AN EXAMINATION OF SEX DIFFERENCES IN COMPUTING BEHAVIOUR AND INTENTIONS TO ENROL IN A COMPUTER STUDIES COURSE USING THE FISHBEIN-AJZEN AND SELF-EFFICACY MODELS

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ABSTRACT

This study aimed to investigate sex differences in secondary school students' intentions to enrol in a computer studies course, and in the relative contributions of the attitudinal and normative components of the Fishbein-Ajzen model and self-efficacy expectations, to explaining variance in these intentions. Sex differences in other dimensions of computing behaviour were also examined. The study also provided the opportunity to test both the Fishbein-Ajzen and Self-Efficacy models per se. Participants were 363 Form 5 students attending seven schools (two single-sex male, two single-sex female, three co-educational) in the lower half of the North Island. The high school students were administered two questionnaires during the two separate phases of the study, measuring Fishbein-Ajzen (1980) model constructs, self-efficacy expectations, past computing behaviour, demographic variables and an estimate of ability. Results unexpectedly revealed that girls' behavioural intentions to enrol in a computer studies course were not significantly lower. In fact, girls were slightly more likely than boys to express intentions to enrol in computer studies courses when assessed at Phase 2. No significant sex differences emerged in the relative contributions of the attitudinal and normative components of the Fishbein-Ajzen model and self-efficacy expectations to intentions. In contrast, strong sex differences in the expected direction were found in access to computers in general including access to home computers. Boys also used computers more frequently, had more past computing experience and higher levels of computing self-efficacy expectations. The results of the present study provided empirical support for both the Fishbein-Ajzen model as well as for self-efficacy theory. However the independent contributions of two variables external to the Fishbein-

Ajzen model to explaining the variance in behavioural intentions, were inconsistent with the Fishbein-Ajzen model. The failure to find predicted sex differences in behavioural intentions was discussed in light of a number of possible explanations. The importance of intervention efforts based on countering traditional views about women's occupational role was highlighted. Results were also discussed in terms of their relationship to previous studies and the adequacy of some of the measures used. Finally some suggestions for future research were offered.

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CHAPTER 1

INTRODUCTION

COMPUTER EDUCATION IN SECONDARY SCHOOLS

Currently an important issue in education is the need to develop a comprehensive policy of computer education in secondary schools. The opportunity to learn about the uses and implications of computers and computer technology should be available to all students, to prepare them for participation in a society in which computer technology is becoming increasingly pervasive. An important corollary of this general aim is that students have 'hands-on' experience of using a computer, either through interaction with prepared programs, through analysis of a data base or through programming.

Sanders (1984) quotes the United States Department of Labour as estimating that in the near future 50-75 percent of jobs will involve computers to some extent (e.g. operation, repair, hardware and software designs, use of packages, sales, programming and service delivery). A similar job situation is likely to exist in New Zealand in the near future. Therefore those individuals who lack the requisite computer skills could be greatly disadvantaged in such a job market.

In 1982, in reviewing the New Zealand situation, the Consultative Committee on Computers in Schools made recommendations for the implementation of a computer awareness course in the junior secondary school and a computer studies course at the sixth form level. It was proposed that a 12 hour computer awareness course be placed within Form 4 Social Studies. The suggested content of the course included 'The Computer - What It Is', 'Applications of the Computer' and 'The Computer and People'. Thus the

course would provide a general introduction to the capabilities, limitations and applications of computers, the social implications of computer technology and an overview of the structure and operation of the computer. Hands-on experience with a computer was considered to be an integral part of the course.

It was recommended that this course be the minimum contact with computers experienced by all students before leaving school. To date, a large number of schools have instituted a computer awareness course at the Form 3 and/or 4 levels. In many schools however, the course is not compulsory and therefore some students are likely to be leaving school with virtually no computer education. Schools also differ in the subject context of the course. In some schools the material is taught within Social Studies, as proposed by the Consultative Committee on Computers in Schools, whereas in others it is placed within Mathematics or spread across a combination of subjects.

The suggested content of the year-long Form 6 computer studies course proposed by the Consultative Committee on Computers in Schools (1982) was computer programming, an overview of the different components and functions of a typical computer system, the history and development of computers, and the uses and applications of computers. It was recommended that the course be incorporated into the Sixth Form Certificate structure. In 1984, 21 percent (12 percent males, 9 percent females) of Form 6 students in New Zealand were enrolled in a Sixth Form Certificate Computer Studies course (Department of Education, 1985).

The current distinction between University Entrance and Sixth Form Certificate at Form 6 level, may be contributing to the relatively small proportion of students enrolled in the course, with the students intending to pursue tertiary education being restricted to the subjects qualifying

for the University Entrance examination. With the removal of the University Entrance examination from the Sixth Form, the range of subjects for all students will be broadened and thus it is likely more students will opt to take the Computer Studies course in the future. Another factor contributing to the low proportion of students taking Computer Studies in the Sixth Form is that not all schools currently offer such a course.

Computing is also incorporated into the Seventh Form curriculum, having been an option in Form 7 Applied Mathematics since 1974. The main emphasis in the course is on programming and on data bases within the computer. (See Appendix A for descriptions of the computer education syllabuses of the seven schools which participated in the present study.)

GENDER EQUITY ISSUES IN COMPUTER EDUCATION

An important issue in the area of computer education is the apparent inequity between boys and girls with regard to computer access and application (see discussion below). It can be argued that if this discrepancy leads to a similar gap in competence and confidence, the girls of today may be severely disadvantaged in the technologically advanced workplace of the near future. This would be particularly unfortunate as the field of computing is still in rapid growth and therefore should be especially promising in offering careers for women.

In recent years, much research has implicated sex differences in mathematics background in restricting women's career options and reinforcing traditional female roles. Many possible job options are cut off for those people who lack an adequate educational background in mathematics. Sells (1980), for example, concluded that mathematics was

the "critical filter" in the pursuit of scientific and technical careers.

In New Zealand sex differences in the number of secondary school students taking mathematics have been gradually decreasing. This is particularly evident at the junior secondary school level (see Table 1). In the period from 1970 to 1983 the total numbers of students taking mathematics has increased for all form levels, particularly amongst girls. For example, the number of Fifth Form girls taking mathematics has increased from 46 percent in 1970 to 92 percent in 1983. However, despite the increases that have occurred, girls are still less likely than boys to take mathematics in the sixth and seventh forms.

TABLE 1

Percentage of male and female secondary school students taking mathematics in 1970 and 1983

Form	1970		1983	
	male	female	male	female
3	85	70	99	99
4	86	63	99	99
5 (1st year)	82	46	96	92
5 (other)	68	20	88	71
6	77	41	88	70
7	81	52	73	52

Source: Department of Education (1971, 1984).

Many articles have reviewed sex differences in mathematics achievement and documented sex differences in mathematics background (see Maccoby and Jacklin, 1974; Fennema and Sherman, 1977; Sherman and Fennema, 1977; Fennema and Sherman, 1978; Betz and Hackett, 1983). In attempting to understand and explain the persistent sex differences in mathematics achievement, variables such as spatial visualisation, negative attitudes, maths anxiety, motive to avoid success and self-

efficacy expectations have been investigated.

In the near future, it is possible that sex differences in computing background and achievement may, like mathematics, contribute to restricting women's career choices and reinforcing traditional female roles. Therefore the sex discrepancy in computer access and application may result in an occupational and economic discrepancy when today's girls and boys become working adults.

For example, at present in the United States, Sanders (1984) cites that more women are computer operators at $12,064 a year (63 percent) than are systems analysts at $26,728 a year (25 percent). In Australia, a recent study (in Aubin, 1985) notes that although "30 percent of computer science graduates are women, they are largely concentrated in the fast-waning data-processing and computer-operating areas." (p. 40) The study found that in hardware and systems analysis, women comprise only 1 percent of the workforce whereas in software engineering they comprise 12 percent. Women comprise 15 percent of senior programmers, but in the highly paid sales representing area, women comprise only 10 percent. Similarly in New Zealand, women comprise only 16 percent of systems analysts and 33 percent of computer programmers. However in the lower paid area of computer operating, they comprise 74 percent (Department of Statistics, 1981).

It is therefore of great importance to not only document the presence of sex differences in computer access and application amongst high school students, but also to attempt to *explain* these differences using relevant theoretical frameworks which are able to generate empirically testable research hypotheses.

Lockheed and Frakt (1984) suggest that the reason why boys are

gaining an edge in computer technology is due primarily to sex differences in access to and use of computers, rather than sex differences in attitudes toward computers, understanding of the relevance of computers or self-confidence regarding computers. They base this assertion on a number of surveys conducted on high school students. For example, one survey cited revealed that 80 percent of the girls, as compared with 82 percent of boys taking a compulsory computer science course, agreed that knowing about computers would be important for their own future.

Another survey cited by Lockheed and Frakt (1984) found no sex differences in intermediate school students' self-confidence regarding computers, in the students' perceptions of the utility of computers or in their attitudes toward computers. The major sex difference which emerged was that boys reported having greater access to computers than did girls and used them more frequently. However, as the relative contributions of attitudes and self-confidence regarding computers, and access to and use of computers (past computing experience) to explaining sex differences in computing behaviour have not yet been examined empirically, their influence cannot be discounted.

In discussing the apparent sex differences in computer use, Lockheed and Frakt (1984) posit three possible explanatory factors: these are sex segregation, the social context of computing and the direct and indirect costs of computing.

Firstly, it is suggested that computers can become a male domain as a result of sex segregation. Thus even if girls are interested in using computers, pre-existing habits of sex segregation can inhibit their desires. "By male self-selection and female default, the computer centre becomes defined as 'male turf' - as socially inappropriate to girls as the boy's locker room." (Lockheed and Frakt, 1984, p. 17)

Similarly, Kiesler, Sproull and Eccles (1983) suggest that the video arcade is a "den of teenage male culture". In an informal survey conducted in a suburban Pittsburgh mall, they found the video arcade populated overwhelmingly by boys (145 boys compared with 30 girls). This discrepancy is of significance because it is a widely held view that most children receive their initiation into the world of computers by playing video games in the arcades or at home (Greenfield, 1980; Kiesler, Sproull and Eccles, 1983). The concept of sex segregation however fails to account for why girls even in the absence of the potentially restrictive presence of boys (i.e. in single-sex female schools) still use computers comparatively less than boys.

The social context of computing may be another important factor contributing to sex differences in computer use. It is thought that most of the messages which surround computer use are male oriented (Fisher, 1984; Lockheed and Frakt, 1984). Advertising, for example, predominantly depicts males as the users of computers. Similarly a large proportion of computer software is targetted at males. This bias is reflected particularly in game packages, the majority of which revolve around the themes of space and land wars, violence, and popular competitive male sports such as football. The aggressive themes may serve to alienate girls from the games. Because it appears that most children's interest in computers begins with games, alienating girls at this initial stage may have the effect of turning girls away from computers in general.

The issue is highlighted by one study which compares the software preferences of girls and boys. Malone (1981) analysed the appeal of Darts, a game designed to teach fractions to primary school children. In this game, the child is required to guess the position of balloons on a number line by typing in a mixed number (whole number and fraction).

If the answer is correct an arrow shoots across the screen and pops the balloon. The game thus has a mildly aggressive fantasy theme. Malone created several variations of the game. The 'aggressive' version with the darts and balloons was popular with the boys but not with the girls. But when the darts and popping balloons were replaced by a voice which said 'correct' when the right line was drawn, its appeal increased amongst girls. This study supports the view that girls may be alienated from aggressive and violent themes which are so prevalent in game packages and other software. Greenfield (1980) refers to a number of games to make the point that nothing intrinsic to video games requires one theme rather than another, and that the same formal features can be embodied in a diversity of themes other than aggressive and violent ones.

Lockheed and Frakt (1984) posit that the direct and indirect costs of computing may also contribute to the disparity between boys and girls regarding computer access and use. It is suggested that parents are more willing to invest in a home computer and computer training for their sons than for their daughters. For example, Lockheed and Frakt cite a survey of California students which revealed that even in affluent districts twice as many boys (15 percent) as girls (7.5 percent) reported having computers at home. Similarly, Fisher (1984) cites a state-wide test of sixth grade students in California which found that 21 percent of the boys, but only 15 percent of the girls had access to a computer at home. Another survey of enrolments in a computer camp found 74 percent boys and 26 percent girls (Fisher, 1984).

One of the indirect costs of computing is opportunity costs (i.e. what the person would have to give up in order to participate in computer related activities). According to time/use studies of high school students, girls spend more of their free time socialising with friends than do boys

(in Lockheed and Frakt, 1984). Thus it could be suggested that girls may perceive greater opportunity costs from investing large amounts of time with computers, than boys.

To summarise, many studies have documented sex differences in computer access and use, and several factors have been postulated to account for these differences. However there is a dearth of empirical studies based on sound theoretical frameworks to explain the apparent sex differences in computing behaviour, and provide guidelines for intervention efforts. Literature relevant to women's career development will be examined in order to establish which theoretical frameworks can be used in investigating sex differences in computing behaviour.

WOMEN'S CAREER DEVELOPMENT: THE ROLE OF SELF-EFFICACY EXPECTATIONS

Early studies of the effects of socialisation on the career choice process and achievements of women primarily concentrated on the barriers faced by women. For example, Horner (1968) postulated the concept of motive to avoid success to explain the unresolved sex differences that existed in the need for achievement. Horner defined motive to avoid success as the anxiety that is associated with success and its implications in competitive achievement situations.

Esposito (1977) examined the relationship between motive to avoid success and vocational choice on a sample of black and white, male and female college students. The study found that a high motive to avoid success in white females predicted well-defined sex-role stereotyped and low occupational aspirations. It should be noted, however, that numerous studies highlighting the methodological difficulties in the measurement

of motive to avoid success have led to growing criticism of the construct (Levine and Crumrine, 1975; Lockheed, 1975; Shaver, 1976; Olsen and Willemsen, 1978).

Farmer (1976) in a review of the literature on achievement and career motivation in women suggested that career motivation in women differs from that of men as a result of the following factors: reduction in academic self-confidence, fear of success, vicarious achievement motivation, home-career conflict, myths about women in the workforce, lower risk-taking in females and finally sex-role orientation.

McLure, Thomas and Piel (1978) investigated female students' perceptions of barriers and facilitating factors in relation to the consideration of careers in science and technology. The results of the study suggested that relatively few girls choose non-traditional careers in science and technology because they have doubts about combining family life with a science career, they lack information about steps in preparing for a science career, and they have little access to examples of the important role women play in science. The results relating to the students' perceptions of facilitating factors suggested that encouragement from family and science teachers, access to role models, and information about careers in science may be influential in changing perceptions of barriers to careers in science and technology.

Hackett and Betz (1981) point out that while the delineation of barriers contribute to an understanding of why women's choices and achievements have been limited, what is needed is the explication of the specific mechanisms by which social beliefs and expectations become manifested in women's vocational behaviour. Such research would be able to direct intervention efforts aiming to increase women's potential for achievement in the workforce.

Hackett and Betz (1981) apply Bandura's (1977) self-efficacy theory in explaining women's career development. It is proposed that differential expectations of self-efficacy among women, as compared with men, may partly account for the disadvantaged position of women in the workforce and the limited career options for women. Low or weak expectations of self-efficacy are seen as a major class of internal barriers to women's career development. External barriers to women such as discrimination, sexual harassment and lack of support systems, are viewed as obstacles which require strong self-efficacy expectations to overcome. Hackett and Betz (1981) thus consider self-efficacy theory as being relevant to the conceptualisation and modification of internal barriers and to the management of external barriers.

Bandura's (1977, 1982) self-efficacy theory postulates that self-efficacy expectations (i.e. a person's beliefs about his/her ability to successfully perform a given task or behaviour) are the most important mediators of behaviour and behaviour change. The model posits that efficacy expectations have a directive influence on whether or not behaviour will be initiated, how much effort will be expended and how long behaviour will be maintained in the face of obstacles and aversive experiences.

According to self-efficacy theory, efficacy expectations vary on three dimensions. They differ in the dimension of level, which refers to the degree of difficulty of tasks the individual feels capable of performing. They also vary in generality, which refers to the extent to which an individual's efficacy expectations generalise to different behavioural domains. Finally efficacy expectations differ in strength

which involves the degree to which efficacy expectations are maintained when the individual has disconfirming experiences (Bandura, 1977).

Bandura (1977) postulates four sources of information through which self-efficacy expectations are learned and by which they can be modified. These are: performance accomplishments (i.e. successful performances of the particular behaviour); vicarious learning or modelling; emotional arousal; and finally verbal persuasion, such as the support and encouragement of others. It is likely that these factors operate in the development of computing self-efficacy. In discussing the assertion that career-related self-efficacy expectations are lower, weaker and less generalised among women than among men, Hackett and Betz (1981) review these four sources of information in respect of possible sex differences in access and exposure to such information.

They posit that sex differences in both access to and interpretation of successful task accomplishments may result in lower and weaker expectations of self-efficacy among women. Self-efficacy theory suggests that the successful performance of a task or behaviour provides information that may increase efficacy expectations in relation to that task or behaviour. The performance of a behaviour requires instrumental action in relationship to the environment. Studies relating to sex role socialisation suggest that the characteristics typifying the stereotypic masculine role are primarily instrumental qualities such as assertiveness, competitiveness and dominance (e.g. Bem, 1974). As a result of these qualities, behaviour is likely to be facilitated and the probability of its success is increased.

On the other hand, the stereotypic female role is characterised by emotionally expressive characteristics, such as nurturance and sensitivity, and passive-submissive qualities (e.g. Bem, 1974). Hackett and Betz (1981)

argue that these qualities do not facilitate successful task accomplishments or, more generally, the development of competence. Maccoby and Jacklin (1974) note that boys are more likely to acquire experience in a diversity of domains beyond the home, such as sports and mechanical skills, than are girls, whose experiences may centre to a greater extent around activities in the home. Hackett and Betz (1981) assert that such differences in access to task accomplishments may influence sex differences in perceptions of self-efficacy in relationship to task performance.

In a similar line of research conducted on a sample of female business students and business alumnae, Stake (1979) found that self-estimates of competence may relate to women's vocational behaviour in at least two respects. Firstly, Stake, posited that women with little confidence in their abilities may avoid career involvement. Secondly, self-estimates may also moderate the relationship between correlates of women's vocational choice (e.g. marriage, sex role attitudes) and career involvement. Stake's (1979) study supports the position that men and women have differential self-evaluations of performance and abilities. Similarly, Maccoby and Jacklin (1974) conclude that among females, self confidence defined in terms of self-evaluations of abilities and completed performances, is lower than among males.

The development of efficacy expectations may be influenced by attributions concerning the causes of success and failure experiences. Bandura (1977) suggests that cognitive appraisals of the causes of one's behaviour (i.e. whether the behaviour is attributed to internal factors such as ability or effort, or to external factors such as luck) may influence whether successful task performance will increase efficacy expectations. Sex differences in attributions concerning the causes of success and failure experiences have been widely documented (e.g. Feather,

1969; Simon and Feather, 1973; Bar-Tal and Frieze, 1977). These studies suggest that sex differences do exist in attributions.

A second important source of information for increasing efficacy expectations derives from vicarious experiences. Observing others perform threatening activities without deleterious consequences can enhance expectations in observers. Bandura (1977) points out that vicarious experience being reliant on inferences from social comparison is a less dependable source of information about one's capabilities than direct evidence of personal accomplishments. Hackett and Betz (1981) postulate that males are exposed to vicarious learning experiences more relevant to career-related efficacy expectations. It has been widely recognised that women are underrepresented and stereotypically depicted in occupational information. For example, Lauver, Gastellum and Sheehy (1975) found that women were underrepresented and disproportionately portrayed in traditional occupations in the 1974-75 edition of the Occupational Outlook Handbook. Furthermore there are less women than men actually engaging in non-traditional pursuits and therefore a lesser availability of successful role models (Douvan, 1976; cited in Hackett and Betz, 1981).

A third source of information influencing efficacy expectations is the physiological arousal from which people gauge their level of anxiety and vulnerability to stress. Both performance and efficacy expectations are usually adversely affected by high levels of anxiety. Hackett and Betz (1981) cite a number of studies (e.g. Sarason, Davidson, Lighthall and Waite, 1958; Sarason, 1963), which indicated that females score higher than males on anxiety measures, and thus have a greater likelihood of experiencing states of physiological arousal which decrease their perceptions of self-efficacy.

It is important to note that Bandura (1977) views anxiety responses and low self-efficacy expectations as being inter-related. When an individual has low efficacy expectations in relation to specific behaviour, anxiety is often a concomitant outcome. However the presence of anxiety results in further decreases to both self-efficacy and the probability that the requisite behaviours will be performed. Therefore, Hackett and Betz (1981) conclude that the greater likelihood of anxiety responses among females adversely affects the development of facilitative efficacy expectations.

The final source of information influencing efficacy expectations is that from the verbal suggestions of others. Increases in efficacy expectations may be induced by encouragement and persuasion toward a given behaviour, while lack of encouragement or active discouragement toward a given behaviour may serve to decrease efficacy expectations. Fitzgerald and Crites (1980) reviewed several studies documenting the lack of encouragement or overt expressions of discouragement women receive from career counsellors. For example, Rohfeld (1977, cited in Fitzgerald and Crites, 1980), found that 13 percent of a sample of female high school students reported that counsellors had discouraged them from a non-traditional goal and 25 percent reported that their teachers and counsellors implied certain jobs were for men and others for women. The research reviewed by Fitzgerald and Crites (1980) suggests that counsellors have probably contributed to sex differences in the acquisition of information which is relevant to the development of strong efficacy expectations.

Houser and Garvey (1983) examined whether support, encouragement and discouragement from important others significantly differentiates those women who enter a non-traditional course of study from those who

remain in female dominated fields. The sample thus consisted of 'Non-traditionals', 'Traditionals' and 'Considereds' (i.e. those women who had considered taking a non-traditional career but never did). Results showed that the Non-traditionals consistently received more support and encouragement than did the Traditionals. In comparing the Non-traditionals with the Considereds, results revealed that the Considereds expected less support and encouragement from the males in their lives than the Non-traditionals indicated they had actually received. Houser and Garvey thus concluded from the results that the amount of support expected by the student by the important others in her life clearly differentiates those who enrol in a non-traditional course from those who do not. This issue will be discussed again when examining the normative component of the Fishbein-Ajzen model which deals with the influence of significant others.

A number of studies have examined the significance of self-efficacy expectations to career-related behaviour. Hackett and Betz' (1981) application of Bandura's (1977) self-efficacy theory has been used to investigate the relationship of career-related self-efficacy expectations to perceived career options in college males and females (Betz and Hackett, 1981). Results revealed that males reported equivalent self-efficacy expectations, for both traditional (for females) and non-traditional (for females) occupations; while females reported significantly lower levels of self-efficacy with regard to non-traditional (for females) occupations and higher levels of self-efficacy with regard to traditionally female occupations. In addition it was found that career-related efficacy expectations were related to the nature and range of career alternatives considered by students. For example, students with greater self-efficacy regarding non-traditional (for females) occupations were likely to have considered more non-traditional careers and fewer traditional

careers than those students who reported lower levels of non-traditional (for females) self-efficacy.

Betz and Hackett (1983) investigated the relationship of mathematics self-efficacy expectations to male and female college students' selection of science-based majors. It was expected that the mathematics self-efficacy expectations of college males would be stronger than those of college females; and that these expectations would be strongly related to the extent to which students selected science-based majors. Both hypotheses were supported.

To conclude, there is considerable empirical evidence to support Betz and Hackett's application of self-efficacy theory to women's career development. In the present study, sex differences in the computing self-efficacy expectations of high school students, and the relationship between self-efficacy expectations and intentions to enrol in a computer studies course, will be investigated.

Bandura (1977) notes, however, that self-efficacy alone is not the sole determinant of behaviour. An individual's expectations of self-efficacy will not produce the behaviour, if the individual does not possess the requisite skills (competence) and adequate incentives for performance. Bandura thus underscores that *given* the appropriate skills and adequate incentives, efficacy expectations are the major cognitive determinants of behaviour. The relationship of self-efficacy to these additional constructs raises a conceptual issue (Kazdin, 1978). Kazdin argues that self-efficacy theory needs to develop more precisely a means of specifying empirically when competence and incentives are at "appropriate levels". The issue of incentives relates to outcome expectations which Bandura argues should be distinguished from efficacy expectations.

An outcome expectation, which is a central concept in the expectancy-value approach (Mitchell and Beach, 1976) is defined as the individual's beliefs that once a given behaviour is performed, certain outcomes will ensue. Efficacy expectations, on the other hand, are defined as the individual's appraisal of whether s/he can perform the behaviours required to produce the outcomes. Bandura (1977) points out that the distinction is made because an individual can believe that performance of a particular action will result in desired outcomes but if that individual has low self-efficacy expectations regarding the action, such information does not influence his/her behaviour (i.e. the task will not be attempted).

Bandura notes that most theorising about expectancies has dealt with outcome expectations. "In most studies the measures of expectations are mainly concerned with people's hopes for favourable outcomes rather than with their sense of personal mastery" (Bandura, 1977, p. 194). Whether Bandura's conceptualisation of self-efficacy expectations is new, however, remains in doubt. Feather (1982) points out that Bandura does not mention Heider's (1958) "naive" analysis of action in which the personal components involved in a person's concept of "can" bear some similarity to the concept of perceived self-efficacy (see Heider, 1958, Chapter 4).

Kazdin (1978) contends that the concepts of self-efficacy and outcome expectations are closely related, and that both are likely to be important and perhaps differentially important as a function of the specific behaviour. Furthermore, Kazdin suggests that it is necessary to integrate these concepts because of their reciprocal nature. It is likely that increases in self-efficacy will demonstrate to individuals that negative consequences do not in fact occur, and alternatively, demonstrations that outcomes are not negative may increase appraisals

of self-efficacy (Kazdin, 1978).

For this reason, in addition to examining the relevance of self-efficacy expectations to computing behaviour, it is necessary to examine models such as those of Vroom (1964), and Ajzen and Fishbein (1980), which incorporate the concept of outcome expectations.

CAREER DEVELOPMENT AND OUTCOME EXPECTATIONS

It is likely that both outcome and self-efficacy expectancies are important in influencing career decision-making and hence intentions to enrol in computer studies courses. The expectancy-value approach which posits the concept of outcome expectations has had a longer history of application to the study of career decision-making than the more recent self-efficacy approach (see Mitchell and Beach, 1976).

Expectancy-value models relate behaviour to the subjective attractiveness or aversiveness of expected consequences. In other words, a person's behaviour is related to the expectations that the person holds and the subjective value of the consequences that might occur following the action. Feather (1982) notes that a feature of expectancy-value models is that:

> people are assumed to possess cognitive structures that concern the implications of their actions, both now and in the future. These implication structures may not always be well defined. They may be in error, and one would expect them to vary in their details from person to person. But they are assumed to exist and along with subjective values, valences or utilities, to be important determinants of goal directed behaviour. (p. 2)

Vroom (1964) explicated the first expectancy-value formulations applied to industrial and organisational psychology. Vroom postulated

that occupational choice depends on the extent to which a given alternative is perceived as more likely than others to lead to valued outcomes. The two components in Vroom's model (i.e. outcome expectations and valences) are seen as combining multiplicatively.

Ajzen and Fishbein (1980) also provide a theoretical model for the prediction of behaviour, which is based on an expectancy-value approach. On the premise that social behaviour is under volitional control, Ajzen and Fishbein propose that a person's intention to perform or not to perform a behaviour is the immediate determinant of the action. The behavioural intention is in turn a function of two major factors: a personal or attitudinal factor and a social or normative factor. This theoretical formulation was derived from a modification of Dulany's (1968) theory of propositional control, dealing mainly with verbal conditioning. Fishbein (1967) reinterpreted the theory's constructs in an attempt to relate them to more familiar social psychological concepts (Fishbein and Ajzen, 1975). The first component of Dulany's theory was identified as resembling an expectancy-value formulation, and the second component as involving the concept of social norms.

Ajzen and Fishbein (1980) argue that making the distinction between a personal attitudinal component and a social normative component stresses the importance of both concepts, and creates a link between the psychological and sociological approaches to studying behaviour. The inclusion of the social component in the Fishbein-Ajzen model makes it a more appropriate basis for explaining career-related decisions than the earlier expectancy-value formulations, which have been criticised for failing to acknowledge the existence of perceived social influence upon the individual. The issue is highlighted in one study (Herriot and Ecob, 1979), which found that although Vroom's (1964) model successfully

predicted the occupational intentions of engineering students, in some cases prediction was enhanced when the subjective norms (as defined in the Fishbein-Ajzen model) were also taken into account.

The Fishbein-Ajzen model can be expressed as the following equation:

$$B \sim BI = (A_B)w_1 + (SN)w_2$$

where B is the behaviour; BI is the behavioural intention to perform the behaviour; A_B is the attitude toward performing behaviour B; SN is the subjective norm; and w_1 and w_2 are empirically determined weights.

The attitudinal component (A_B) is defined in expectancy-value terms as the person's beliefs about the consequences of the behaviour and his/her evaluation of these consequences:

$$A_B = \sum_{i=1}^{n} b_i e_i$$

where b is the belief that performing behaviour B will lead to consequence or outcome i; e is the person's evaluation of outcome i; and n is the number of beliefs.

The normative component (SN) is the person's perceptions or beliefs regarding whether those referents who are important to him/her think that the person should or should not perform a given behaviour, and the person's motivation to comply with these referents:

$$SN = \sum_{i=1}^{n} NB_i MC_i$$

where NB stands for normative belief (i.e. the person's belief that referent i thinks s/he should or should not perform the behaviour); MC is the person's general motivation to comply with referent i, and n is the number of relevant referents (see Fishbein and Ajzen, 1975, pp. 301-302).

Standardised regression weights, obtained by multiple regression analysis, serve as estimates of the component weights. Figure 1 provides a diagrammatic representation of the model, applied to intentions to enrol in a computer studies course.

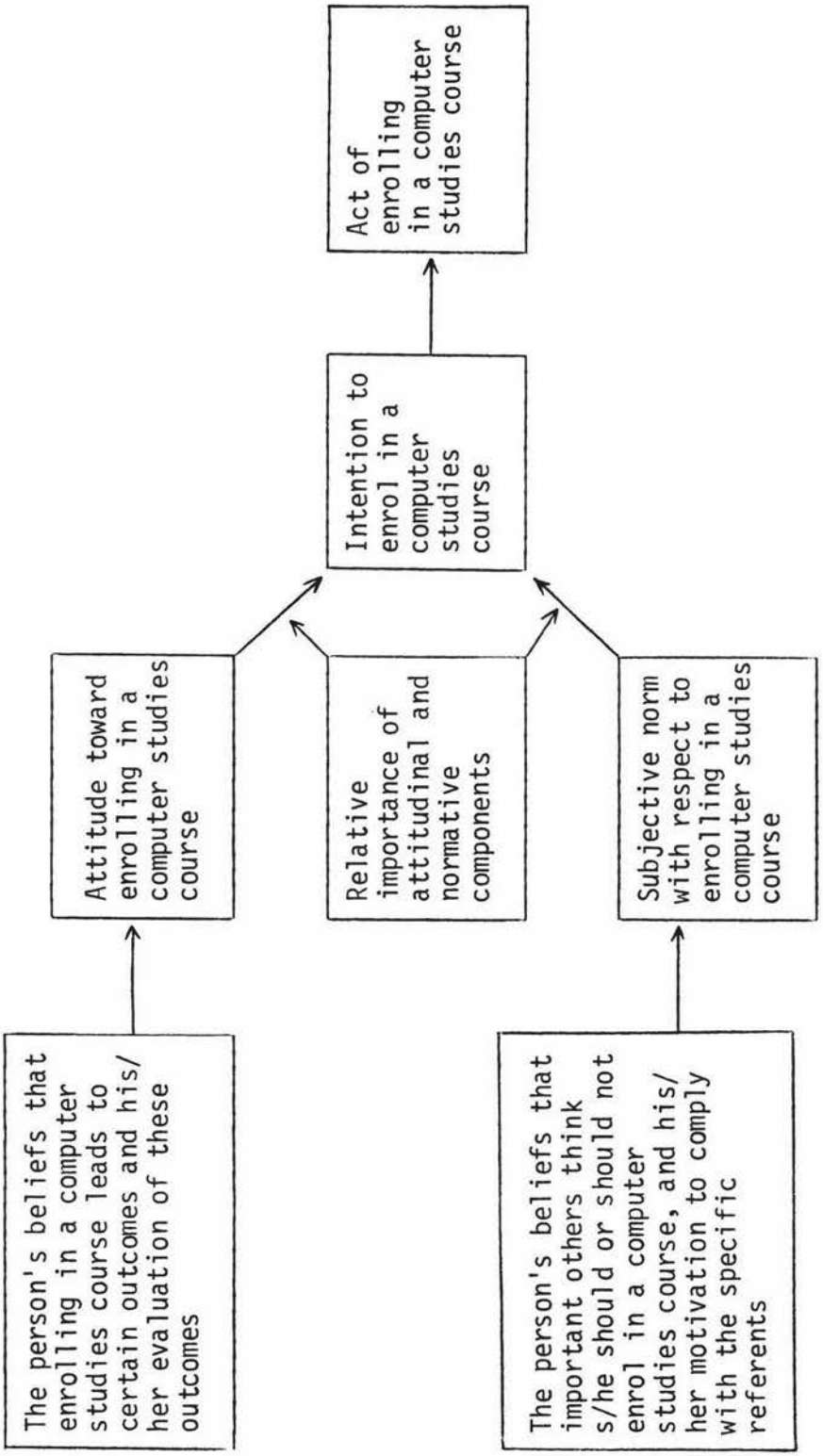

FIGURE 1. DIAGRAMMATIC REPRESENTATION OF THE FISHBEIN-AJZEN MODEL FOR PREDICTING WHETHER OR NOT A PERSON ENROLS FOR A COMPUTER STUDIES COURSE.

The Fishbein-Ajzen model has been applied to the empirical investigation of a diversity of behavioural domains. In reviewing tests of the model, Fishbein and Ajzen (1975) reported high multiple correlations between behavioural intentions and the attitudinal and normative components of the model. (The average multiple correlation of the studies cited was .75.) A similar trend is evident in more recent studies, examining a wide range of behavioural domains such as contraceptive and family planning behaviour (Davidson and Jaccard, 1975; Fishbein, Jaccard, Davidson, Ajzen and Loken, 1980; Fisher, 1984), voting behaviour (Fishbein, Ajzen and Hinkle, 1980; Fishbein, Bowman, Thomas, Jaccard and Ajzen, 1980), signing up for alcoholic treatment (Fishbein, Ajzen and McArdle, 1980), cigarette smoking behaviour (Fishbein, 1982; Eiser and Van der Pligt, 1984), drug-using behaviour (Lacy, 1981), infant-feeding behaviour (Manstead, Profitt and Smart, 1983), and weight losing behaviour (Sejwacz, Ajzen and Fishbein, 1980; Saltzer, 1981).

The Fishbein-Ajzen model has also been applied to vocational behaviour. Sperber, Fishbein and Ajzen (1980) used the model to predict and understand women's occupational choices. The study investigated young women's intentions to pursue a career lifestyle or to become a homemaker. Results revealed that the attitude towards career-making and home-making was more important in influencing the intention, than the normative component.

Ajzen and Fishbein (1980) note that the relative importance of the two components as determinants of intentions are expected to vary with the behaviour and with differences among individuals. For example, it has been observed that attitudinal factors are more important for competitive behaviours than for cooperative behaviours (Ajzen and Fishbein, 1980). Demographic variables (e.g. sex, age, socio-economic

status), personality traits (e.g. extraversion-introversion, authoritarianism) and other individual differences can influence the relative importance of the two components. For example, individuals high in authoritarianism may place more emphasis on normative factors than those low in this trait (Ajzen and Fishbein, 1980). Similarly for certain behaviours, the importance of the two components may differ for males and females. In the present study, sex differences in the relative importance of the two components in determining intentions to enrol in a computer studies course will be examined.

The central premise of the Fishbein-Ajzen model is that behaviour is ultimately determined by beliefs. Ajzen and Fishbein (1980) stress, however, that this does not imply a direct link between beliefs and behaviour. The model posits that beliefs influence attitudes and subjective norms, these two components influence intentions, and intentions, in turn, influence behaviour. Therefore the theory consists essentially of a series of hypotheses linking beliefs to behaviour, with each hypothesis requiring empirical verification. Although these relations are expected to hold, in practice this is not always the case.

Ajzen and Fishbein (1980) propose several factors which can moderate the relationships delineated in the model. For example the observed relation between intention and behaviour is dependent on two factors: (1) The degree of correspondence between the measure of intention and the measure of behaviour. Both behaviours and intentions can be viewed as consisting of action, target, context, and time elements. Intention and behaviour correspond to the extent that their elements are the same. (2) The time interval between measurement of intention and the behaviour's occurrence. The strength of the relationship between intention and behaviour depends on the degree to which the intention remains stable over time.

In support of this, Davidson and Jaccard (1979) found that the relationship between behavioural intentions and behaviour was indeed moderated by the time interval between the assessment of intentions and behaviour and the degree of correspondence.

In the present study, in order to assess the stability of behavioural intentions over time, and hence if intentions are likely to predict behaviour, two measures of intention were obtained four months apart.

Ajzen and Fishbein (1980) argue that variables outside the model (termed 'external variables') such as personality characteristics and demographic variables affect behavioural intentions and therefore behaviour only indirectly by influencing the attitudinal and normative components, or the relative importance of the two components.

Ajzen and Fishbein (1980) argue that relying on external variables to explain behaviour is problematic in that different types of variables have to be referred to for different behavioural domains. They suggest that most research has assumed different causes for different behaviours, resulting in an ever-increasing number of theories linking external variables to behaviour. Furthermore, Ajzen and Fishbein (1980) assert that:

> such a multitude of theories is not only unnecessary, but it actually impedes scientific progress. We believe that the theory of reasoned action...may provide a solution to the problem. It identifies a small set of concepts which are assumed to account for the relations (or lack of relations) between any external variable and any kind of behaviour that is under volitional control. (p. 9)

Recently, however, studies finding direct links between various external variables and behavioural intentions and/or behaviour have called into question the sufficiency of the Fishbein-Ajzen model.

For example, Kantola, Syme and Campbell (1982) in testing the

sufficiency of the Fishbein-Ajzen model, found that age made a significant contribution to explaining the variance in behavioural intentions to conserve water. Kantola et al. concluded that while the contribution of age does not warrant its incorporation into the Fishbein-Ajzen model as an additional component, future discussions should describe the attitudinal and normative components as mediating most but not necessarily all of the variation in behavioural intention.

Saltzer (1981) found that the cognitive variables of locus of control expectancies and value of reinforcement, directly influenced weight losing behaviour, without the mediating effects of the Fishbein-Ajzen model constructs. Similarly, Fisher (1984) found that an emotional variable, erotophobia-erotophilia, contributed independently of the Fishbein-Ajzen model constructs to the prediction of contraceptive behaviour.

Recently several authors (Bentler and Speckart, 1979; Bagozzi, 1981; Lacy, 1981; Manstead, Profitt and Smart, 1983; Granrose, 1984) have found in a variety of behavioural domains, that one particular external variable (self-reported past behaviour) directly influences behaviour. Fishbein and Ajzen (1975) have argued that a model of behavioural intentions does not need to include a measure of past behaviour or experience, because experience is incorporated into a person's perception of consequences, and therefore would be included in their attitudes.

In contrast with Fishbein and Ajzen behavioural theorists postulate that past behaviour is the best predictor of future behaviour (e.g. Mischel, 1968), and would challenge the presupposition that the effects of past behaviour are mediated only through constructs such as attitudes. In support of this view, Bentler and Speckart (1979) suggest that it is likely that a behavioural viewpoint may be required to complement the Fishbein-Ajzen model in predicting behavioural intentions and behaviour.

Granrose (1984) used the Bentler-Speckart (1979) modification of the Fishbein-Ajzen model to examine women's intentions to work following childbirth. Results indicated that the previous work experience of the women was not related to their perception of consequences, i.e. attitudes (as was suggested by Fishbein and Ajzen, 1975), but it did have a significant effect on their intentions, thus supporting the position of Bentler and Speckart (1979). Granrose concluded from these findings that models of intention do need to include a separate measure of the effect of previous behaviour on intentions if they are to be complete.

Lacy (1981) found that the components of the Fishbein-Ajzen model were not sufficient predictors of behavioural intentions for future drug use. Instead the effect of past behaviour on behavioural intentions was found to be direct (i.e. not mediated by the components of the model) and moderately enhanced the model's effectiveness in explaining the variance in behavioural intentions.

Manstead, Profitt and Smart (1983) applied the Fishbein-Ajzen model to the prediction and understanding of mothers' infant-feeding intentions and behaviour. It was found that past behaviour (i.e. whether previous children had been breast-fed or bottle-fed) contributed significantly to the prediction of the mothers' intentions over and above what was accounted for by the attitudinal and normative components of the Fishbein-Ajzen model.

In conclusion, Fishbein and Ajzen have proposed that variables other than those postulated in their model only indirectly influence behavioural intentions. This issue will be investigated in the present study in relation to the contributions of three external variables (self-efficacy expectations, past behaviour and 'ability') to explaining the variance in high school students' intentions to enrol in a computer studies course.

A COMPARISON OF SELF-EFFICACY AND EXPECTANCY MODELS OF OCCUPATIONAL PREFERENCE

Both self-efficacy and outcome expectations are likely to be influential in career decision-making. The present study incorporates both types of expectancies in examining male and female high school students' intentions to enrol in a computer studies course.

Wheeler (1983) was the first study to examine both the expectancy and self-efficacy models of occupational preference in the same study. It was expected that both occupational valence and self-efficacy expectations would explain unique variance in occupational preference; and that efficacy expectations would be more highly correlated with occupational preference than would occupational valence. Both occupational valence and self-efficacy expectations related independently to occupational preference, providing empirical support for both an expectancy model and a self-efficacy model.

One of the methodological problems in this study arose from the measurement of self-efficacy expectations. Two measures of self-efficacy were used: firstly, a perceived 'match of abilities' for each occupation and, secondly, a perceived 'ease of success' in each occupation. Ease of success was found not to make a significant independent contribution to explaining the variance in occupational preference. The hypothesis that self-efficacy expectations would be more highly related than occupational valence to occupational preference was supported when ability-match was the measure of self-efficacy but not when ease of success was the measure of self-efficacy.

Wheeler (1983) concludes that a more complete model of occupational preference would need to incorporate elements of both occupational

valence and self-efficacy expectations. Following along the lines of Wheeler (1983) the present study aims to investigate the relative contributions of the components of the Fishbein-Ajzen model and self-efficacy expectations to explaining the variance in high school students' intentions to enrol in a computer studies course.

OBJECTIVES AND HYPOTHESES

In comparison with men, women's career choices and achievements have been restricted. For example, many professions have a disproportionately low number of females, e.g. medicine, science, engineering, management, administration and systems analysis.

In recent years a growing body of research has implicated sex differences in mathematics background and achievement in restricting women's career choices (e.g. Fennema and Sherman, 1977; Sherman and Fennema, 1977; Fennema and Sherman, 1978; Betz and Hackett, 1983; Hackett, 1985). In the near future, it is possible that, like mathematics, sex differences in computing background and achievement may contribute to restricting women's career choices.

In view of this, the present study aimed to assess whether sex differences in intentions to enrol in computer studies courses and in computing behaviour do exist and if so, whether self-efficacy and the Fishbein-Ajzen models help to explain these differences. The study also aimed to investigate if sex differences existed in computing self-efficacy expectations, and past computing experience.

In addition, the study provided the opportunity to test both self-

efficacy and the Fishbein-Ajzen models and to demonstrate that each of these models have independent relationships to intentions to enrol in a computer studies course.

Hypothesis I: In the light of research reviewed in the introduction, demonstrating sex differences in career-related behaviour, it is hypothesised that sex differences will exist in behavioural intentions to enrol in a computer studies course. Such sex differences will also affect the relative contributions of attitude toward the behaviour, subjective norm and self-efficacy expectations to behavioural intentions.

Hypothesis II: Research reviewed in the introduction provides strong support for Fishbein and Ajzen's contention that behavioural intention is a function of attitude toward the behaviour and subjective norm. It is expected that similar support will be found in relation to behavioural intentions to enrol in computer studies courses.

Hypothesis III: Based on Wheeler's (1983) study it is expected that the determinants of intentions in the Fishbein-Ajzen model (i.e. attitude toward the behaviour and subjective norm) and self-efficacy expectations will each explain unique variance in intentions to enrol in a computer studies course.

Hypothesis IV: Along the lines of recent research finding direct links between various variables external to the Fishbein-Ajzen model

and behavioural intentions (e.g. Lacy, 1981; Kantola, Syme and Campbell, 1982; Manstead, Profitt and Smart, 1983), it is predicted that past behaviour and 'ability' will affect behavioural intentions directly and will not only be mediated by the attitudinal and normative components in the Fishbein-Ajzen model.

Hypothesis V: Based on the research of Betz and Hackett (1983) it is hypothesised that the computing self-efficacy expectations of high school males will be stronger than those of high school females. This will remain even after partialling out the impact of past behaviour and 'ability'.

Hypothesis VI: The literature reviewed (e.g. Lockheed and Frakt, 1984) suggests clearly that high school males will have had a greater range and number of past computing experiences than will have high school females.

CHAPTER 2

METHOD

SUBJECTS

A total of 363 Form 5 students (198 males and 165 females) participated in the main phase of the study. The sample at phase two of the study consisted of 306 subjects (179 males and 127 females), which is 84 percent of the original sample. Subjects were drawn from Form 5 students attending seven single-sex and co-educational high schools (3 co-educational, 2 single-sex female schools, 2 single-sex male schools), in the lower half of the North Island. The average age of the students was 15 for both samples.

The first questionnaire was administered to two non-streamed or 'mixed ability' classes in each school during May/June 1985. A brief follow-up questionnaire was administered to the same subjects in September 1985.

Seven of the questionnaires in the first phase of the study were incorrectly completed. The final sample, therefore, comprised 356 subjects (192 males and 164 females). One hundred and forty-six (41 percent) of this sample attended co-educational schools, 108 (30 percent) attended single-sex female schools, and 102 (29 percent) attended single-sex male schools. One hundred and twenty-two (40 percent) of sample two attended co-educational schools, 86 (28 percent) attended single-sex female schools, and 98 (32 percent) attended single-sex male schools. Table 2 presents a breakdown by type of school of the sex and number of subjects in both phases of the study.

TABLE 2

Number and Sex of Subjects by Type of School

School	Type of School	Phase 1			Phase 2		
		males	females	Total	males	females	Total
1	Single-sex female	-	58	58	-	39	39
2	Co-educational	25	24	49	20	14	34
3	Single-sex female	-	50	50	-	47	47
4	Co-educational	32	19	51	29	16	45
5	Co-educational	33	13	46	32	11	43
6	Single-sex male	50	-	50	48	-	48
7	Single-sex male	52	-	52	50	-	50
		192	164	356	179	127	306

Subjects came from a wide range of socio-economic backgrounds. Thirty-eight percent of the fathers' occupations fell into the top two socio-economic levels (Professional and Managerial), 51 percent into the middle two levels (White collar and Skilled) and 11 percent into the lowest two levels (Semi-skilled and Unskilled). (Elley and Irving, 1976.)

Twenty-four percent of the working mothers' occupations fell into the top two socio-economic levels (Professional and Managerial), 56 percent into the middle two levels (White collar and Skilled) and 20 percent into the lowest two levels (Semi-skilled and Unskilled). (Irving and Elley, 1977.)

INSTRUMENTS

A questionnaire (Survey of Attitudes Toward Computer Studies Courses) was constructed to measure self-efficacy expectations, components of the

Fishbein-Ajzen model, past experience in computing as well as various demographic variables. The questionnaire included a combination of structured and open-ended questions. (See Appendix B which identifies the different sections of the instrument in square brackets.)

1. SELF-EFFICACY EXPECTATIONS

This measure followed the same format as the Maths Tasks Subscale of the Mathematics Self Efficacy Scale developed by Betz and Hackett (1983). The present scale consisted of nine items involving computing tasks. A small sample of people who frequently use computers and teach computing courses were consulted to obtain a list of computing tasks and to check that the final list of important computing tasks was sufficiently comprehensive.

To assess the strength of self-efficacy expectations, subjects were asked to rate how confident they were that they would be able to learn how to successfully perform each of the nine tasks. Confidence ratings for each of the tasks were elicited on a 10-point scale, ranging from 'Complete Confidence' to 'No Confidence at all'. This procedure was similar to that used by Betz and Hackett (1983).

A factor analysis was carried out on the data collected from the present sample to examine the factor structure of the scale (see Appendix C). The analysis failed to yield more than one factor with an eigenvalue greater than one. This together with the high internal consistency for the total scale (α = .92) on the present sample supported the addition of ratings on the items to yield a total self-efficacy score.

2. FISHBEIN-AJZEN MODEL

The Fishbein-Ajzen model requires the measurement of three constructs: behavioural intention, attitude toward the behaviour and subjective norm. Each model construct was measured using a 7-point Likert-type scale and anchors equivalent to those proposed by Ajzen and Fishbein (1980). All questions were phrased at identical levels of specifity with respect to time, target and context as stipulated by Ajzen and Fishbein (1980). A description of the measurement of each model construct is given in more detail below.

(a) Behavioural Intention

Behavioural intention was measured by the subjects' probability rating on a 7-point Likert-type scale with anchors ranging from 'Extremely Likely' to 'Extremely Unlikely' to the following question:

> How likely is it that you will enrol in a computer studies course next year?

(A second measure of behavioural intention was obtained during phase two of the study.)

(b) Attitude toward the behaviour (A_B)

The Fishbein-Ajzen model posits that the attitude toward the behaviour be defined in expectancy-value terms as the person's beliefs about the consequences of the behaviour (behavioural beliefs) and his/her evaluation of those consequences (outcome evaluations). Accordingly attitude toward the behaviour was measured by two scales: a behavioural beliefs or expectancy scale and an outcome evaluations or evaluative scale, both of which will be described in greater detail shortly.

Firstly in order to construct the two scales, it was necessary to identify the modal salient set (i.e. the set of beliefs that are salient in the sample being investigated). The modal salient beliefs concerning consequences of enrolling in a computer studies course were identified by eliciting beliefs from a sample of university and high school students, some of whom had no computing experience whereas others did. The following questions were used to elicit beliefs:

(a) What do you see as the advantages of enrolling in a computer studies course?

(b) What do you see as the disadvantages of enrolling in a computer studies course?

(c) Is there anything else you associate with enrolling in a computer studies course?

The questions were asked separately, as suggested by Ajzen and Fishbein (1980), so as to ensure that the respondents listed both positive and negative consequences. A content analysis was made of the consequences listed. The modal salient set of beliefs was composed of the 12 most frequently mentioned consequences.

The Modal Salient Set

Help me to get a job.
Mean keeping up with new technology.
Mean working with things rather than with people.
Mean paying close attention to detail.
Mean spending a lot of time with computers.
Mean using and applying logical skills.
Mean learning new and different skills.
Mean working with complicated equipment.
Mean being part of future developments in New Zealand.
Mean doing passive as opposed to active things.
Mean spending more time indoors.
Mean being able to talk about computers socially.

(i) Outcome Evaluations/Evaluative Scale

Subjects were asked to evaluate each of the 12 outcomes comprising the modal salient set of beliefs, according to how good or bad they felt the outcome was for them personally. Each outcome was rated on a 7-point Likert-type evaluative scale, with anchors ranging from 'Extremely Good' to 'Extremely Bad'.

Following the procedure used by Ajzen and Fishbein (1980) and by other studies using the Fishbein-Ajzen model (e.g. Lacy, 1981; Granrose, 1984), items were treated as a single set. The internal consistency of the scale was checked, yielding an alpha reliability on the present sample of .84.

(ii) Behavioural Beliefs/Expectancy Scale

For each of the 12 outcomes comprising the modal salient set of beliefs, subjects were asked to indicate their subjective probability that enrolling in a computer studies course would result in the outcome. Each outcome was rated on a 7-point Likert-type scale with anchors ranging from 'Extremely Likely' to 'Extremely Unlikely'.

The alpha reliability for the behavioural beliefs scale on the present sample was .86.

The attitude toward the behaviour (A_B) was measured, as stipulated by Ajzen and Fishbein (1980), by multiplying the rating for each outcome evaluation with the rating for the corresponding behavioural belief, and then summing the products for the total set of beliefs.

(c) Subjective Norm (SN)

The Fishbein-Ajzen model posits that the subjective norm is predicted on the basis of normative beliefs (people's beliefs that their important others think they should or should not perform the behaviour in question), and motivations to comply, in general, with the important others. Thus in order to assess a person's subjective norm two measures are required: a measure of normative beliefs and a measure of the general motivation to comply.

Firstly it is necessary to identify a set of salient referents for the behaviour in question. In the present study, two groups of people were selected as being relevant to the behaviour of enrolling in a computer studies course: the subjects' family and the subjects' friends. Normative beliefs were assessed by asking subjects to rate how likely their family and friends each were to approve of their enrolling in a computer studies course next year. Motivations to comply were assessed by asking subjects to rate, in general, how likely they were to do as their family and friends each wished.

Ratings for both normative beliefs and motivations to comply were obtained on 7-point Likert-type scales with anchors ranging from 'Extremely Likely' to 'Extremely Unlikely'. As stipulated by Ajzen and Fishbein (1980) the subjective norm was measured by multiplying the rating for each normative belief with the rating for the corresponding motivation to comply, and then summing the products.

3. PAST BEHAVIOUR

The extent of past computer behaviour was assessed by asking subjects to indicate whether or not they *had performed* each of the nine tasks

comprising the earlier self-efficacy scale. A 'yes' or 'no' response format was used. The 'yes' responses were treated individually and also added together to construct a measure of past computing behaviour.

(a) Home Computer

An additional predictor of past computer experience was whether or not subjects had a computer at home. Subjects who had computers at home, were asked to indicate what make and model it was. The various makes and models were assigned by a 'computer expert' to four categories reflecting different levels of complexity, thus providing an index of the subjects' likely level of computer experience. (See Appendix D.)

(b) Video Games

Three dimensions of video games playing behaviour were assessed. Subjects were asked to indicate how long they had been playing video games, how frequently they play video games and their favourite game. The games were grouped according to the role of the player in relation to the threat that is posed in the game. Differences in game preferences could be used to assess whether certain features of the games are more attractive to one sex or the other. (See Appendix E.)

FOLLOW-UP QUESTIONNAIRE

A follow-up questionnaire was constructed to obtain a second measure of behavioural intention and a measure of 'ability', described below in more detail. (See Appendix F.)

1. BEHAVIOURAL INTENTION [Time 2]

Behavioural intention was measured by asking subjects to respond, using a Yes/No format to the question: "Would you enrol in a computer studies course if it was offered as a subject next year?". The dichotomous format was used at Time 2 to better simulate the real decision of enrolling in a computer studies course or not.

2. 'ABILITY'

An estimate of ability was obtained by asking subjects to give their mid-year examination grades (as percentages) for English, Mathematics and Science. Many attempts had been made earlier to obtain an objective measure of actual computing skills. None of the available measures (e.g. The SRA Computer Programming Aptitude Test) were appropriate for the age of the present sample. The length of time required to administer such tests also precluded them from use in the present study.

The present measure can only be assumed to provide an estimate of ability, as it is in fact a measure of school achievement at a single point in time and the exam grades were not standardised across the schools. In view of this, the measure is referred to in the text as 'ability'.

A Pearson correlation analysis was carried out to examine the intercorrelations between English, Mathematics and Science grades. Results revealed a high correlation $r(265) = .739$, $p < .001$ between science and mathematics grades and only moderate, although significant, correlations between English and mathematics grades $r(286) = .430$, $p < .001$, and English and science grades $r(272) = .569$, $p < .001$. On the basis of these results, analyses were initially undertaken using only mathematics and science

grades, which were added together to provide an indication of general ability. Analyses were repeated using all three grades but as results were no different, only the 'ability' measure based on mathematics and science are reported.

PROCEDURE

1. PILOT TEST OF QUESTIONNAIRE

Initial drafts of the questionnaire were shown to several experts in the area of computer education in secondary schools. Many of their suggestions relating to both the structure and content of the questionnaire were incorporated into the final draft.

A small pilot sample of Form 5 students of varying computing experience were administered the questionnaire to ensure that the instructions were clear. Consequently, several small modifications were made to the instructions and format of the questionnaire.

2. PROCEDURE

The principals/deputy principals of seven high schools in the lower half of the North Island were contacted during April/May 1985 to negotiate access to Form 5 pupils. Each of the schools approached agreed to participate in the study. The first questionnaire was administered during weeks 1 and 2 of the second school term (May/June 1985). Prior to starting, the students were briefly informed of the nature of the study.

Administration of the questionnaire took approximately 30-35 minutes per class. Due to the scheduling of school exams at mid-year, 'ability' data was not available at phase one of the study.

During weeks 1 and 2 of Term 3 all seven schools were contacted once again to obtain follow-up data. The students who participated in phase one of the study were required to complete a second questionnaire. Administration of this questionnaire took approximately 5-10 minutes per class. A fuller measure of the Fishbein-Ajzen model (i.e. measures of attitude toward the behaviour and subjective norm) at Time 2 was not possible, as the schools involved were unable to provide more than the brief time required to administer questionnaire two.

3. ETHICAL ISSUES

The two ethical issues of concern in this study were those of informed consent and confidentiality. In view of this, the students were briefed about the study and given the opportunity to decline to participate in accordance with the principle of informed consent. Confidentiality was ensured by the use of a coding system in which no names appeared on the questionnaire data collected at time one of the study. A card with each student's name and research subject number was kept separate from the actual data. Although names were requested on the follow-up questionnaires (so as to be able to correlate them with the original questionnaires), the data was entered onto computer by the researcher and numbers substituted for names which were then removed. In addition, to further maintain confidentiality the participating schools are not specifically identified.

CHAPTER 3

RESULTS

All analyses in the present study were undertaken using SPSSX (Nie, 1983; Norusis, 1985). All tests involving the Fishbein-Ajzen model were examined using the measure of behavioural intention to enrol in a computer studies course, administered at Time 1 (Behavioural Intention, Time 1) as well as the dichotomous measure obtained at Time 2 (Behavioural Intention, Time 2).

A point biserial (Pearson) correlation analysis revealed a significant correlation between behavioural intention (Time 1) and behavioural intention (Time 2), $r(305) = .459$, $p < .001$, indicating that behavioural intentions remained moderately stable over time. In interpreting a point biserial coefficient, it should be noted that even if the dichotomous variable has an approximately 50:50 distribution, the ceiling for the correlation coefficient is lower than 1.00 (approx. .80). Therefore the correlation coefficient obtained underestimated the actual degree of relationship. Correcting for this, the correlation coefficient would be in the region of .574.

HYPOTHESIS I

Results revealed there were no significant sex differences in behavioural intentions as assessed at Time 1, $F(1,354) = .001$, (Male $\overline{X}$ = 3.947, Female $\overline{X}$ = 3.951). Contrary to what was expected, significantly more girls (50 percent) than boys (37 percent) intended to enrol in a computer studies course as assessed at Time 2, $\chi^2 = (1) = 5.020$, $p < .05$, $N = 306$.

Hierarchical multiple regression was also used to test whether sex had a direct effect on behavioural intention (assessed through the beta weight for sex) and whether it influenced the relative importance of other explanatory variables (regression coefficients). On all regression analyses listwise deletion of missing data was used as the sample size was sufficiently large. Analyses with key variables (attitude, norm and self-efficacy) were also completed using pairwise deletion, with only very small differences.

In testing the difference between the regression coefficients for males and females, the basic issue, as described by Pedhazur (1982) is whether "using separate regression coefficients for each group adds significantly to the regression sum of squares, as compared to the regression sum of squares obtained when a common regression coefficient is used." (p. 438)

To test the hypothesis on behavioural intention (Time 1), the variables entered (forced entry) at step one of the hierarchical multiple regression were sex, attitude toward the behaviour, subjective norm and self-efficacy expectations. At step two, in order to examine the impact of sex on the relationships between behavioural intention (Time 1) and attitude toward the behaviour, subjective norm and self-efficacy expectations, three multiplicative terms were entered, i.e. (Sex × A_B), (Sex × SN) and (Sex × Efficacy). Sex, A_B, SN and Efficacy were standardised prior to creating the multiplicative terms. (See Appendix G for correlations before and after standardising.)

Results showed that the multiplicative terms did not add significantly to the regression equation. The R^2 change (.002) at step two was not significant. The beta weight for sex, entered on step one (.025) was also not significant. (See Table 3.) Therefore sex did not have

TABLE 3

Regression Coefficients and Multiple Correlation of Sex, Attitude toward the behaviour, Subjective Norm, Self-Efficacy Expectations and (Sex × Attitude), (Sex × Norm) and (Sex × Efficacy) on Behavioural Intention (Time 1)

D.V = Behavioural Intention (T_1)	Beta	R	R^2	R^2 change	d.f.
Step one		.514	.264***	.264***	4,334
Sex	.025				
Attitude	.310***				
Norm	.226***				
Efficacy	.134**				
Step two		.516	.266***	.002	7,331
Sex	.027				
Attitude	.305***				
Norm	.229***				
Efficacy	.140**				
(Sex × Norm)	.024				
(Sex × Efficacy)	.039				
(Sex × Attitude)	-.034				

Significance of Beta, R^2 and R^2 change based on F tests.
* $p < .05$, ** $p < .01$, *** $p < .001$ (d.f. for F tests given in Table)

an effect on behavioural intention (Time 1) nor on the relationship between behavioural intention (Time 1) and attitude toward the behaviour, subjective norm and self-efficacy expectations.

An identical regression analysis was carried out using behavioural intention (Time 2) as the dependent variable (see Table 4). Results showed that the multiplicative terms did not contribute significantly to the regression equation. The R^2 change (.018) at step two was not significant. However the beta weight for sex, entered at step one (.148), was significant ($p < .01$). Therefore sex did have an effect on behavioural intention as measured at Time 2, but not on the relationship between behavioural intention (Time 2) and the attitudinal and normative components and self-efficacy expectations. The sex effect as alluded to earlier is

TABLE 4

Regression Coefficients and Multiple Correlation of Sex, Attitude toward the behaviour, Subjective Norm, Self-Efficacy Expectations and (Sex × Attitude), (Sex × Norm) and (Sex × Efficacy) on Behavioural Intention (Time 2)

D.V = Behavioural Intention (T_2)	Beta	R	R^2	R^2 change	d.f.
Step one		.243	.059**	.059**	4,287
Sex	.148**				
Norm	.092				
Efficacy	.106				
Attitude	.075				
Step two		.278	.077**	.018	7,284
Sex	.142**				
Norm	.118				
Efficacy	.109				
Attitude	.035				
(Sex × Norm)	.130				
(Sex × Efficacy)	.004				
(Sex × Attitude)	-.119				

Significance of Beta, R^2 and R^2 change based on F tests.
** $p < .01$ (d.f. for F tests given in Table)

due to significantly more females than males intending to enrol in a computer studies course as measured at Time 2.

In the present study, using separate regression coefficients for males and females (moderated regression) would not have added significantly to the prediction of behavioural intentions. Pedhazur (1982) states "when the increment in the regression sum of squares due to the use of separate b's is not significant, it is concluded that there are no significant differences between the b's. In other words the common b is tenable for all groups." (p. 440) On all analyses, sample residuals were examined, revealing no abnormalities.

Therefore it can be concluded from the results that there are no

significant differences between males and females in the relative importance of the attitudinal and normative components and self-efficacy expectations, and that common beta weights for the three variables apply to both groups.

To conclude results revealed that females did not have significantly lower intentions to enrol in computer studies courses than males and no sex differences existed in the relative importance of the attitudinal and normative components and self-efficacy expectations to behavioural intentions, thus failing to support the hypothesis.

HYPOTHESIS II

The second hypothesis involved a direct test of the Fishbein-Ajzen model which postulates that behavioural intention is a function of attitude toward the behaviour (A_B) and subjective norm (SN). Multiple regression has typically been used to test the model (Ajzen and Fishbein, 1980). Accordingly the attitudinal and normative components of the model were regressed on behavioural intention (Time 1). (See Table 5.) As shown in the table, the multiple correlation of A_B and SN with behavioural intention (Time 1) was moderately high ($R = .504$, d.f. = 2,321) and the beta weights of both explanatory variables were highly significant. Therefore results support the hypothesis that behavioural intentions to enrol in a computer studies course, as assessed at Time 1, are a function of both the attitudinal and normative components of the Fishbein-Ajzen model.

The sample size in the first phase of the present study was sufficiently large to carry out a cross-validation of the Fishbein-Ajzen model.

TABLE 5

Regression Coefficients and Multiple Correlation of Attitude toward the behaviour, Subjective Norm, Self-Efficacy Expectations and Past Behaviour on Behavioural Intention (Time 1)

D.V. = Behavioural Intention (T_1)	Beta	R	R^2	R^2 change	d.f.
Step one		.504	.254***	.254***	2,321
Norm	.246***				
Attitude	.359***				
Step two		.516	.266***	.012*	3,320
Norm	.234***				
Attitude	.311***				
Self-Efficacy	.122*				
Step three		.516	.266***	.000	4,319
Norm	.234***				
Attitude	.311***				
Self-Efficacy	.122*				
Past Behaviour	.000				

Significance of Beta, R^2, and R^2 change based on F tests.
* $p < .05$, ** $p < .01$, *** $p < .001$ (d.f. for F tests given in Table)

Two subsamples were derived involving one co-educational school, one single-sex female school and one single-sex male school in each sample. It should be noted that these subsamples were systematically rather than randomly derived. Multiple regression analyses, regressing the attitudinal and normative components on behavioural intention (Time 1) were carried out on both subsamples, yielding an R^2 of .230 (d.f. = 2,146) for subsample one and an R^2 of .309 (d.f. = 2,132) for subsample two. (See Appendix H for full results.)

The unstandardised regression coefficients obtained from the analysis on subsample one were then cross-validated on subsample two. The regression coefficients derived from subsample one were used to compute a predictor variable in subsample two data $[\text{constant} + (B_{\text{attitude}} \times \text{Attitude}) + (B_{\text{norm}} \times \text{Norm})]$. This new variable was then regressed on behavioural intention (Time 1), on the second subsample. Twenty-seven

percent (R^2 = .272, d.f. = 1,132) of the variance in behavioural intention (Time 1) was explained by the attitudinal and normative components in the cross-validation on subsample two. In comparison, as noted above, 23 percent (R^2 = .230, d.f. = 2,146) of the variance was explained in the regression analysis conducted on subsample one. The similarity in R^2 resulting from cross-validation of the Fishbein-Ajzen model on the two subsamples suggests stability of the coefficients even though the variance explained is only moderate.

The higher variance in behavioural intention (Time 1) in subsample two (3.21) than in subsample one (2.25) may possibly account for the increment in R^2 from subsample one to subsample two, although alternative explanations cannot be ruled out.

The Fishbein-Ajzen model was also tested using behavioural intention (Time 2) as the dependent variable and the attitudinal and normative components of the model as independent variables. The multiple corelation of attitude toward the behaviour and subjective norm with behavioural intention (Time 2) was low (.179, d.f. = 2,290, $p < .01$) but significant, although the beta weights of both explanatory variables failed to reach significance on their own (see Table 6).

TABLE 6

Regression Coefficients and Multiple Correlation of Attitude Toward the Behaviour, Subjective Norm, Self-Efficacy Expectations on Behavioural Intention (Time 2)

D.V. = Behavioural Intention (T_2)	Beta	R	R^2	R^2 change	d.f.
Step one		.179	.032**	.032**	2,290
Norm	.103				
Attitude	.114				
Step two		.196	.038**	.006	3,289
Norm	.097				
Attitude	.076				
Self-Efficacy	.090				

Significance of Beta, R^2 and R^2 change based on F tests.
** $p < .01$ (d.f. for F tests given in Table)

Pedhazur (1982) notes that it is possible to obtain a significant R^2 and yet find that none of the regression coefficients is significant, when each coefficient is tested individually. A possible reason for such a finding in the present study could be multicolinearity among the independent variables, leading to the standard errors of the b's becoming relatively large (Pedhazur, 1982, p. 59). Differences in the results obtained from using behavioural intention measured at Time 1 and Time 2, suggest that the ability of the attitudinal and normative components of the Fishbein-Ajzen model to predict behavioural intentions weakened over time.

In conclusion, results from analyses using both behavioural intention (Time 1) and behavioural intention (Time 2) supported the Fishbein-Ajzen model's premise that behavioural intention is a function of attitude toward the behaviour and subjective norm.

HYPOTHESIS III

In order to assess whether the determinants of intentions in the Fishbein-Ajzen model (i.e. A_B and SN) are self-efficacy expectations explain unique variance in intentions to enrol in a computer studies course, a series of multiple regression analyses were conducted (see Table 5), using behavioural intention (Time 1) as the dependent variable. As shown in the table, when all variables were entered, attitude toward the behaviour, subjective norm and self-efficacy expectations all yielded significant beta weights. However to test whether the two models made significant independent contributions to explaining the variance in behavioural intention (Time 1) required an examination of R^2 change.

As previously indicated, in relation to hypothesis II, the

attitudinal and normative components of the Fishbein-Ajzen model explained 25 percent of the variance in behavioural intention (Time 1) ($R = .504$, $R^2 = .254$). When self-efficacy expectations were included in the equation at step two, 27 percent of the variance in behavioural intention (Time 1) was explained ($R = .516$, $R^2 = .266$). The R^2 change (.012) at step two was small but significant ($p < .05$) indicating that the inclusion of self-efficacy expectations in the regression equation added significantly to the prediction of behavioural intention (Time 1). This finding throws doubt on Ajzen and Fishbein's (1980) contention that variables external to the model will not affect behavioural intentions directly, and supports the hypothesised independent contribution of self-efficacy.

When self-efficacy was entered first, it explained 9 percent of the variance ($R = .312$, $R^2 = .097$, d.f. = 1,322, $p < .001$) and the R^2 change after adding in the attitudinal and normative components of the Fishbein-Ajzen model was .168 (d.f. = 3,320, $p < .001$). These results suggest that the Fishbein-Ajzen model explained more unique variance in behavioural intentions to enrol in a computer studies course, as assessed at Time 1, than did the self-efficacy model.

To test the hypothesis on behavioural intention (Time 2) a similar series of regression analyses were carried out (see Table 6), using behavioural intention (Time 2) as the dependent variable. When all variables were entered, none of the beta weights of the three explanatory variables were significant (see Table 6). As already indicated in relation to hypothesis II, the attitudinal and normative components of the Fishbein-Ajzen model, when entered at step one, explained a small but significant proportion of variance ($R = .179$, $R^2 = .032$, d.f. = 2,290, $p < .01$). When self-efficacy was entered into the equation at step two, 4 percent of the variance was explained ($R = .196$, $R^2 = .038$, d.f. = 3,289). The R^2 change (.006) at step two was not significant, thus indicating that

self-efficacy expectations did not make a significant independent contribution to explaining the variance in behavioural intentions to enrol in a computer studies course, as assessed at Time 2.

When self-efficacy was entered first, it explained a small but significant amount of the variance ($R = .145$, $R^2 = .021$, $p < .01$, d.f. = 1,291). The R^2 change, after entering in the components of the Fishbein-Ajzen model (A_B and SN) at step two, was not significant (R^2 change = .017, d.f. = 3,289) indicating that the Fishbein-Ajzen model also did not explain unique variance in behavioural intention (Time 2). Thus neither self-efficacy nor the Fishbein-Ajzen model (A_B and SN) explained unique variance in behavioural intention (Time 2), despite the significant R^2(.038) when both were entered.

In conclusion, the components of the Fishbein-Ajzen model and self-efficacy expectations each explained unique variance in behavioural intention (Time 1) but not in behavioural intention (Time 2) thus providing mixed support for the hypothesis.

HYPOTHESIS IV

Results from the multiple regression analyses assessing whether past behaviour and 'ability' related to behavioural intention (Time 1), are given in Tables 5 and 7. As can be seen in the tables, past behaviour and 'ability' did not yield significant beta weights. When past behaviour was included in the regression equation, after entering attitude, norm and self-efficacy (see Table 5), no additional variance in behavioural intention (Time 1) was explained. The R^2 change (.000, d.f. = 4,319) at step three was not significant. In examining the inter-correlation matrix (see Table 8), it can be seen that the correlation

TABLE 7

Regression Coefficients and Multiple Correlation of Attitude toward the behaviour, Subjective Norm, and 'Ability' on Behavioural Intention (Time 1)

D.V. = Behavioural Intention (T_1)	Beta	R	R^2	R^2 change	d.f.
Step one		.508	.258***	.258***	2,250
Norm	.253***				
Attitude	.355***				
Step two		.509	.259***	.001	3,249
Norm	.250***				
Attitude	.351***				
'Ability'	.026				

Note 1. Significance of Beta, R^2 and R^2 change based on F tests. *** $p < .001$ (d.f. for F tests given in Table)

Note 2. 'Ability' is based on the addition of mathematics and science school examination grades.

Note 3. In contrast with Table 5, lower degrees of freedom were obtained as a result of the listwise deletion of missing data.

TABLE 8

Intercorrelation Matrix

	Behav. Intention (T_1)	Behav. Intention (T_2)	Attitude	Norm	Efficacy	Past Behav.	'Ability'	Sex
Behavioural Intention (T_1)		.459***	.441***	.367***	.333***	.174***	.157**	.001
Behavioural Intention (T_2)			.156**	.151**	.150**	-.055	-.064	.135**
Attitude				.358***	.448***	.257***	.228***	-.023
Norm					.241***	.181***	.204***	-.063
Efficacy						.456***	.366***	-.120**
Past Behaviour							.149**	-.332***
'Ability'								-.110*
Sex								

*** $p < .001$, ** $p < .01$, * $p < .05$

between past behaviour and self-efficacy is fairly high (.456, $p < .001$). However, entering past behaviour at step two, immediately after the attitudinal and normative components of the Fishbein-Ajzen model also yielded a non-significant R^2 change (.002, d.f. = 3,321). Thus past behaviour did not explain any unique variance in behavioural intentions to enrol in computer studies courses, as assessed at Time 1.

Table 7 presents results for the external variable 'ability'. No additional variance in behavioural intention (Time 1) was explained when 'ability' was included in the regression equation at step two after entering the attitudinal and normative components of the Fishbein-Ajzen model. The R^2 change at step two (.001, d.f. = 3,249) was not significant. This particular finding is consistent with the Fishbein-Ajzen model which proposes that variables external to the model affect behavioural intentions only indirectly, but fails to support the hypothesised independent contribution of external variables.

To test the hypothesis relating to external variables on behavioural intention, as assessed at Time 2, a similar series of multiple regression analyses were carried out, using behavioural intention (Time 2) as the dependent variable (see Tables 9 and 10). As shown in the tables, past behaviour did not yield a significant beta weight (see Table 9), while 'ability' did (see Table 10).

When past behaviour was entered in the regression equation at step two, after entering the attitudinal and normative components of the Fishbein-Ajzen model (see Table 9), no additional variance in behavioural intention (Time 2) was explained. The R^2 change (.011, d.f. = 3,276) at step two was not significant, thus indicating that past behaviour did not explain any unique variance in behavioural intention (Time 2). This particular finding too fails to support the hypothesised role of external

TABLE 9

Regression Coefficients and Multiple Correlation of Attitude toward the behaviour, Subjective Norm and Past Behaviour on Behavioural Intention (Time 2)

D.V. = Behavioural Intention (T_2)	Beta	R	R^2	R^2 change	d.f.
Step one		.184	.034**	.034**	2,277
Norm	.120				
Attitude	.103				
Step two		.213	.045**	.011	3,276
Norm	.129*				
Attitude	.135*				
Past Behaviour	-.113				

Significance of Beta, R^2 and R^2 change based on F tests.
* $p < .05$ (d.f. for F tests given in Table)

TABLE 10

Regression Coefficients and Multiple Correlation of Attitude toward the behaviour, Subjective Norm and 'Ability' on Behavioural Intention (Time 2)

D.V. = Behavioural Intention (T_2)	Beta	R	R^2	R^2 change	d.f.
Step one		.177	.031*	.031*	2,250
Norm	.112				
Attitude	.101				
Step two		.224	.050**	.019*	3,249
Norm	.132				
Attitude	.124				
'Ability'	-.141*				

Significance of Beta, R^2 and R^2 change based on F tests.
* $p < .05$, ** $p < .01$ (d.f. for F tests given in Table)

variables but instead supports Ajzen and Fishbein's (1980) contention that variables external to their model affect behavioural intentions only indirectly.

However, the R^2 change when 'ability' was entered into the regression

equation at step two, after the entry of attitude toward the behaviour and subjective norm, was significant. (R^2 change = .019, d.f. = 3,249, $p < .05$.) (See Table 10.) Thus 'ability' contributed significantly to the variance explained in behavioural intentions to enrol in a computer studies course, as assessed at Time 2. This finding is consistent with the hypothesised role of external variables but not with the Fishbein-Ajzen model. The negative beta weight for 'ability' indicates that students with lower 'ability' estimates were more likely to express intentions to enrol in a computer studies course at Time 2. This result will be discussed more fully later.

To conclude, results provided only limited support for the hypothesised direct links between two variables external to the Fishbein-Ajzen model and behavioural intentions. Past behaviour did not explain any unique variance in behavioural intentions (Times 1 and 2). Although 'ability' did not contribute significantly to the variance explained in behavioural intention (Time 1) it did explain a small but significant amount of variance in behavioural intention (Time 2).

HYPOTHESIS V

Table 11 provides results relating to sex differences in computing self-efficacy. Mean scores for male and female high school students on the items comprising the computing self-efficacy scale are given. The items are arranged according to overall confidence ratings, from items toward which subjects reported least to those toward which they reported greatest confidence.

As can be seen in Table 11, males reported significantly stronger self-efficacy expectations for 4 of the 9 items. Of the remaining 5

TABLE 11

Sex Differences in Computing Self-Efficacy

Tasks	Total (N=355)		Females (N=163)		Males (N=192)		Test of Signif-icance
	M	SD	M	SD	M	SD	F
Express problems in a logical form	4.8	2.3	4.7	2.1	5.0	2.4	1.7
Copy files and keep backups	5.1	2.5	5.0	2.1	5.2	2.8	0.5
Learn and use a computer language	5.7	2.4	5.4	2.0	5.9	2.1	4.2*
Organise and use disk files	5.7	2.5	5.6	2.3	5.8	2.6	0.8
Use a menu driven program	5.8	2.7	5.6	2.5	6.0	2.9	1.4
Use manuals	6.1	2.0	5.8	1.7	6.3	2.1	6.9**
Connect power cords and cables	6.3	2.5	5.6	2.4	6.8	2.4	21.1***
Use a computer keyboard	6.9	1.9	7.0	5.4	6.7	2.1	3.1
Switch on and start the system	7.1	2.2	6.5	2.3	7.5	2.0	19.2***

Note 1 Responses were obtained on a 10-point scale ranging from "No confidence at all" (0) to "Complete confidence" (9).

Note 2 Tasks are arranged by mean overall confidence rating, i.e. from least to most reported confidence.

* $p < .05$ ** $p < .01$ *** $p < .001$

items, males reported greater confidence on 4 of the 5. The only item in which females reported slightly stronger self-efficacy expectations, although it was not statistically significant, was "Use a Computer Keyboard". It is interesting to note that this item involves a traditionally female activity, i.e. typing. Females reported greatest confidence for this item, while males reported greatest confidence for the item "Switch on and Start the System".

To examine whether sex had an effect on self-efficacy expectations,

even after partialling out the impact of past behaviour and 'ability', a multiple regression analysis was carried out using self-efficacy expectations as the dependent variable (see Table 12).

TABLE 12

Regression Coefficients and Multiple Correlation of Past Behaviour, 'Ability' and Sex on Self-Efficacy Expectations

D.V. = Self-Efficacy	Beta	R	R^2	R^2 change	d.f.
Step one		.585	.342***	.342***	2,251
Past behaviour	.461***				
Ability	.293***				
Step two		.599	.358***	.016**	3,250
Past behaviour	.511***				
'Ability'	.301***				
Sex	.139**				

Significance of Beta, R^2 and R^2 change based on F tests.
*** $p < .001$ * $p < .05$ (d.f. for F tests given in Table)

Past behaviour and ability were entered at step one. The beta weights for both variables were significant. Sex was entered into the regression equation at step two, to examine whether sex explained any unique variance in self-efficacy expectations over and above that explained by past behaviour and 'ability'. The R^2 change at step two was significant (.016, d.f. = 3,250, $p < .01$), indicating that sex did explain unique variance in self-efficacy expectations.

Thus as hypothesised males were found to have stronger computing self-efficacy expectations than females. Furthermore, sex was found to effect self-efficacy expectations even after partialling out the impact of past behaviour and 'ability'.

HYPOTHESIS VI

Table 13 presents data relating to male and female high school students past computing experience, in terms of the performance of nine computing tasks. For each task, the percentage of males and females who reported that they had performed the task and the results of chi-square analyses are given.

TABLE 13

Sex Differences in Past Computing Behaviour

Tasks	Total (N=355)		Females (N=163)		Males (N=192)		Test of Signif-icance
	n	(%)	n	(%)	n	(%)	χ^2
Copied files and kept backups	74	(21)	15	(9)	59	(31)	24.50***
Organised and used disk files	122	(35)	36	(22)	86	(45)	19.50***
Expressed problems in a logical form	135	(38)	48	(29)	87	(46)	9.24**
Used a computer language	172	(49)	57	(35)	115	(60)	21.43***
Connected power cords and cables	177	(50)	60	(37)	117	(62)	21.01***
Used a menu driven program	215	(62)	93	(58)	122	(65)	1.25*
Used manuals	228	(64)	81	(49)	147	(77)	28.01***
Switched on and started the system	273	(77)	105	(64)	168	(89)	29.60***
Used a computer keyboard	344	(97)	159	(97)	185	(97)	.00

Note 1 Responses were obtained using a Yes/No format to the question: "Have you done any of the following tasks associated with computers?".

Note 2 Tasks are arranged according to overall degree of performance, i.e. from least to most reported performance.

* $p < .05$ ** $p < .01$ *** $p < .001$

As shown in the table, significantly more boys than girls reported that they had performed 8 of the 9 tasks, clearly supporting the hypothesised sex difference in range and number of past computing experiences. For the remaining task ("Used a Computer Keyboard"), equal proportions of both boys and girls reported having performed it. Interestingly, this task involves a traditionally female activity (i.e. typing).

SUPPLEMENTARY RESULTS

As the major focus of the study was on sex differences in computing behaviour, a series of post-hoc analyses were completed. The purpose of these analyses was descriptive rather than being aimed at testing specific hypotheses.

1. Access to Home Computers

Data relating to male and female high school students' access to a computer at home is presented in Table 14.

TABLE 14

Sex Differences in Access to a Computer at Home

	Females		Males		Total	
	n	%	n	%	n	%
'Home Computer'	28	17	78	41	106	30
'No Home Computer'	135	83	113	59	248	70

$\chi^2(1) = 22.35, \quad p < .001, \quad \phi' = .25$

The numbers and percentages of males and females reporting both

access and no access to a home computer, and the results of a chi-square analysis are given. (Yates' correction for continuity was applied in all analyses with one degree of freedom, see Hayes, 1973.) An indice of association (Cramer's statistic, ϕ') is also reported to provide a measure of the relationship between the two sets of variables. This index lies between 0, reflecting complete independence, and 1, indicating complete dependence, of the variables. (Hayes, 1973, p. 745.) This statistic will be provided in all subsequent tables.

As shown in the table significantly more males (41 percent) than females (17 percent) reported having a computer at home.

The number and percentage of students in each socio-economic level who reported both access and no access to a home computer, and the results of a chi-square analysis are given in Table 15.

TABLE 15

Differences by Socio-Economic Status in Access to a Home Computer

	Profess-ional		Manag-erial		White Collar		Skilled		Semi-Skilled		Un-Skilled	
	n	%	n	%	n	%	n	%	n	%	n	%
'Home Computer'	21	23	15	16	26	28	23	25	6	7	2	2
'No Home Computer'	33	16	45	22	43	21	57	28	16	8	8	4

$\chi^2(5) = 4.84$, $p > .05$, $\phi' = .12$

As shown in the table, no significant differences were found.

Information, from those respondents who reported having computers at home, about the makes and models of their home computers, is presented in Table 16. The number and percentage of males and females in each category and the results of a chi-square analysis are given.

TABLE 16

Sex Differences in Make and Model of Home Computers

Category	Females		Males		Total	
	n	%	n	%	n	%
IBM-PC lookalike	0	0	2	3	2	2
Apple	3	13	10	14	13	13
BBC type - using TV as screen	15	65	45	61	60	62
Smaller systems	5	22	17	23	22	23

$\chi^2(3) = 0.69, \quad p > .05, \quad \phi' = .05$

Note 1 Responses were obtained by asking subjects who had computers at home to indicate what make and model it was. The various makes and models were then assigned to the four categories reflecting different levels of complexity. (See Appendix D.)

Note 2 Categories are presented in order of level of complexity, i.e. from the most complex category of systems to the least complex category of systems.

The majority of subjects reported having less sophisticated computer systems (i.e. computers assigned to categories 3 and 4). No significant differences were found between males and females in the types of computers they reported having access to.

2. Differences by Sex and School-type in Access to Computers

The inclusion of two single-sex male, two single-sex female and three co-educational schools permitted the examination of the relationship between sex, school-type and access to computers.

Table 17 provides results relating to male and female high school students' reported access to computers. As shown in the table, males reported having significantly greater access to computers than did females. For example, 51 percent of males reported having daily computer access, compared with 27 percent of females. The large majority of males

TABLE 17

Sex Differences in Access to Computers

Access	Females		Males		Total	
	n	%	n	%	n	%
Daily	44	27	98	51	142	40
Weekly	37	23	55	29	92	26
Monthly	25	15	10	5	35	10
A few times a year	32	20	16	8	48	14
Never	24	15	13	7	37	11

$\chi^2(4) = 36.81, \quad p < .001, \quad \phi' = .32$

(80 percent) reported having either daily or weekly computer access compared with 50 percent of females.

Data relating to high school students' perception of sex differences in computer access is presented in Table 18.

TABLE 18

Perception of Sex Differences in Access to Computers

"Do you think boys and girls have equal access to computers?"	Females		Males		Total	
	n	%	n	%	n	%
Yes	135	84	163	88	298	86
No	25	16	22	12	47	14

$\chi^2(1) = 0.72, \quad p > .05, \quad \phi' = .05$

The large majority of both males and females believed that boys and girls have equal access to computers. No significant differences between males and females were found.

Table 19 presents data pertaining to differences in computer access by type of school. Percentages for each type of school and the results of a chi-square analysis are provided.

TABLE 19

Differences by Type of School, in Access to Computers

Access	Co-Educational Schools		Single-Sex Girls' Schools		Single-Sex Boys' Schools	
	n	%	n	%	n	%
Daily	69	48	26	24	47	46
Weekly	38	26	20	19	34	33
Monthly	6	4	20	19	9	9
A Few Times a Year	14	10	26	24	8	8
Never	18	12	15	14	4	4

$\chi^2(8) = 46.45, \quad p < .001, \quad \phi' = .26$

As can be seen in the table, significantly more students attending co-educational and single-sex boys' schools reported having greater computer access than students attending single-sex girls' schools. For example, 48 percent of students attending co-educational schools, and 46 percent of those attending single-sex boys' schools, compared with only 24 percent of those attending single-sex girls' schools reported having daily access. However, no significant difference in computer access was found between girls attending co-educational schools and girls attending single-sex girls' schools. (See Table 20.) Thus suggesting that the difference between co-educational and single-sex boys' schools on the one hand and single-sex girls' schools on the other, reflects a sex difference.

TABLE 20

Differences between Girls Attending Co-Educational Schools and Girls Attending Single-Sex Girls' Schools, in Access to Computers

Access	Girls attending Co-ed. schools		Girls attending Single-Sex Girls' Schools	
	n	%	n	%
Daily	18	33	26	24
Weekly	17	31	20	19
Monthly	5	9	20	19
A Few Times a Year	6	11	26	24
Never	9	16	15	14

$\chi^2(4) = 8.93, \quad p > .05, \quad \phi' = .23$

3. Differences by Sex and School-Type in Frequency of Computer Use

The inclusion of two single-sex male, two single-sex female and three co-educational schools made it possible to examine the relationship between school-type, sex and frequency of computer use.

Data relating to male and female high school students' reported frequency of computer use is presented in Table 21.

TABLE 21

Sex Differences in Frequency of Computer Use

Frequency	Females		Males		Total	
	n	%	n	%	n	%
Daily	4	3	37	19	41	12
Weekly	11	7	39	20	50	14
Monthly	29	18	32	17	61	17
A few times a year	81	50	68	35	149	42
Never	38	23	16	8	54	15

$\chi^2(4) = 50.45, \quad p < .001, \quad \phi' = .38$

As can be seen in the table, males reported that they used computers significantly more frequently than did females. For example, 19 percent of males reported using computers daily compared with only 3 percent of females; 20 percent of males reported using computers weekly compared with only 7 percent of females.

Table 22 presents data pertaining to differences in frequency of computer use by type of school. Percentages for each type of school and the result of a chi-square analysis is given.

Students attending co-educational and single-sex boys' schools reported using computers more frequently than students attending single-sex girls' schools. For example, 32 percent and 35 percent of students attending co-educational and single-sex boys' schools respectively,

TABLE 22

Differences by Type of School in Frequency of Computer Use

Frequency	Co-ed. Schools		Single-sex Girls' Schools		Single-sex Boys' Schools	
	n	%	n	%	n	%
Daily	28	19	3	3	10	10
Weekly	19	13	6	6	25	25
Monthly	21	14	20	20	20	20
A few times a year	50	34	59	59	40	39
Never	28	19	19	18	7	7

$\chi^2(8) = 42.64$, $p < .001$, $\phi' = .25$

reported using computers either daily or weekly, compared with only 9 percent of students attending single-sex girls' schools. In order to determine if this difference was merely reflecting a difference based on sex rather than on type of school, differences between girls attending co-educational schools and girls attending single-sex girls' schools were examined (see Table 23).

TABLE 23

Differences between Girls Attending Co-educational Schools and Girls Attending Single-Sex Girls' Schools, in Frequency of Computer Use

Frequency	Girls attending Co-ed. Schools		Girls attending Single-Sex Schools	
	n	%	n	%
Daily	1	2	3	3
Weekly	5	9	6	6
Monthly	9	16	20	20
A few times a year	22	39	59	59
Never	19	34	18	19

$\chi^2(4) = 6.88$, $p > .05$, $\phi' = .21$

A chi-square analysis revealed no significant difference in frequency of computer use between the two groups. Girls attending both types of schools reported using computers less frequently. For example, only 11 percent of girls attending co-educational schools and 9 percent of

girls attending single-sex girls' schools reported using computers either daily or weekly.

Therefore, results suggest that the difference between co-educational and single-sex boys' schools on the one hand and single-sex girls' schools on the other reflects a sex difference per se rather than attendance at a single sex school.

4. Sex Differences in Video Games Playing Behaviour

Table 24 presents data relating to male and female high school students' frequency of playing video games. Percentages and the results of a chi-square analysis are given.

TABLE 24

Sex Differences in Frequency of Playing Video Games

Frequency	Females		Males		Total	
	n	%	n	%	n	%
Daily	1	1	14	7	15	4
Weekly	22	13	61	32	83	23
Monthly	46	28	53	28	99	28
A few times a year	81	49	53	28	134	38
Never	14	9	11	6	25	7

$\chi^2(4) = 34.31$, $p < .001$, $\phi' = .31$

As shown in the table, males reported playing video games more frequently than females. For example, 39 percent of males, compared with only 14 percent of females reported playing video games either daily or weekly.

Table 25 presents data pertaining to sex differences in video game preferences amongst male and female high school students.

TABLE 25

Sex Differences in Game Preferences

	Females		Males		Total	
	n	%	n	%	n	%
Non-Projectile Defensive	11	12	16	14	27	13
Non-Projectile Aggressive	14	16	3	3	17	8
Projectile Defensive	27	30	23	21	50	25
Projectile Aggressive	17	19	35	31	52	26
Sports Simulation	21	23	35	31	56	28

$\chi^2(4) = 15.89$, $p < .01$, $\phi' = .28$

Note: Responses were obtained by asking subjects to name their favourite video game. The various games were then assigned to five categories reflecting the role of the player in the game and the type of game involved. See Appendix E.

There were significant differences between males and females in game preferences. The two most preferred types of games amongst males were sports simulation games and projectile aggressive games. For females the two most preferred types of games were projectile defensive games and sports simulation games. The least preferred type of games amongst males were non-projectile aggressive games, while amongst females the least preferred games were those in the non-projectile defensive category. Projectile games appeared to be more favoured by both sexes than non-projectile games. No sex difference in preferences for aggressive games was revealed. Both males and females favoured aggressive and defensive games equally.

It should be noted, however, that only a small proportion of the females played video games, a group whose interests may have differed from other girls.

5. Sex Differences in Type of Computer Language Used

Data relating to the types of computer languages used by male and female high school students is presented in Table 26.

TABLE 26

Sex Differences in Type of Computer Language Used

Language	Females		Males		Total	
	n	%	n	%	n	%
Basic	24	75	79	78	103	77
Logo	7	22	15	15	22	17
Pascal	1	3	6	6	7	5
Fortran	0	0	1	1	1	1

$\chi^2(3) = 1.44$, $p > .05$, $\phi' = .10$

The large majority of both male and female high school students, who had used a computer language, reported using Basic (75 percent females, 78 percent males).

A chi-square analysis revealed no significant sex differences in the types of computer languages used, even though more males than females had used a language, $\chi^2(1) = 21.43$, $p < .001$.

6. Perception of Link between Ability at Maths and Ability at Computing

Table 27 presents data relating to male and female high school students' perception of a link between ability at maths and successful performance in a computer studies course. The large majority of both males and females (63 percent and 70 percent respectively) did not believe that one has to be good at maths to succeed in a computer studies course. A chi-square analysis revealed no significant sex difference in this belief.

TABLE 27

Perception of Link between Ability at Maths and Ability at Computing

"Do you think that you have to be good at maths to succeed in a computer studies course?"	Females		Males		Total	
	n	%	n	%	n	%
Yes	46	30	66	37	112	33
No	110	70	113	63	223	67

$\chi^2(1) = 1.72, \quad p > .05, \quad \phi' = .07$

To summarise, results from the supplementary analyses revealed significant sex differences in access to computers in general and more specifically to home computers, and in frequency of computer use and playing video games. Results also revealed differences by type of school in computer access and frequency of use, but on closer examination these were found to reflect a sex difference rather than a difference by school-type.

CHAPTER 4

DISCUSSION

SEX DIFFERENCES

The results of this study did not find that girls' behavioural intentions to enrol in a computer studies course were significantly lower than those of boys. There were no significant sex differences in the relative contributions of attitude toward the behaviour, subjective norm and self-efficacy expectations to intentions. Hypothesis I was therefore not supported. Girls were in fact slightly more likely to enrol in a computer studies course than boys as assessed at Time 2. However, despite this unexpected finding, the supplementary results section demonstrated strong sex differences in the expected direction, in computer access and use, past computing experience and computing self-efficacy expectations. Males reported having greater access to computers as well as using computers more frequently than females.

Interestingly, although females reported having less access to computers in general, and more specifically, to computers at home, than males, the large majority of both sexes believed that males and females have equal access to computers. This lack of awareness of the actual differences in access is difficult to explain on a post hoc basis although it may reflect a situation where each sex feels they have as much access as they want.

As predicted males reported having greater past computing experience, in terms of the performance of nine computing tasks. Significantly more males than females reported that they had performed 8 of the 9 tasks. For the remaining task, which involved a traditionally female activity

(typing), equal proportions of males and females reported having performed it.

One of the factors posited by Lockheed and Frakt (1984) to account for sex differences in computer access and use is sex segregation. In some respects this was not supported in the present study, in that no differences in reported access to computers and frequency of computer use emerged between girls attending co-educational schools and girls attending single-sex female schools. However it is possible that sex segregation may have been operating in areas other than at school, e.g. at home and in video arcades.

The costs of computing have also been implicated in contributing to sex differences in computer access and use, in that parents may be more willing to invest in a home computer for their sons than for their daughters. (Fisher, 1984; Lockheed and Frakt, 1984.) In line with previous research the results of the current study revealed that more than twice as many males as females reported having access to a computer at home. A survey of parental attitudes toward the purchase of computers for their sons and daughters might provide more insight into this particular sex difference.

Much research has suggested the social context of computing is biased towards males (e.g. in advertising, and in the themes of video games and other software), and that this contributes to sex differences in computer use. (Greenfield, 1980; Fisher, 1984; Lockheed and Frakt, 1984.) In examining video game preferences in the present study, no sex differences in preferences for video games with aggressive themes emerged. This finding was in contrast with Malone (1981) who found that aggressive themes were more appealing to boys than to girls. However it should be noted that a smaller proportion of the female sample relative

to the male sample in the present study, played games regularly. It could perhaps be suggested that more girls might play video games, if video games were designed to be more appealing to girls.

Lockheed and Frakt (1984) suggest that the reason why boys are gaining an edge in computer technology is due primarily to sex differences in access to and use of computers, rather than sex differences in factors such as self-confidence regarding computers. In the present study self-efficacy expectations (conceptually similar to self-confidence) were examined and in contrast to Lockheed and Frakt's contention, sex differences emerged. A multiple regression analysis revealed that sex explained unique variance in computing self-efficacy indicating that sex was significantly related to computing self-efficacy even with the effects of past behaviour and ability partialled out.

At the individual item level, males reported significantly stronger computing self-efficacy expectations than did females on 4 of the 9 items. Of the remaining items the means of males were higher than those of females on 4 of the 5 items. On only one item, which involved a stereotypically female activity (typing) was the mean of females higher than those of males. Thus it can be suggested that low computing self-efficacy expectations are more prevalent among females. These findings are similar to those of Betz and Harkett (1980) who examined sex differences in mathematics self-efficacy.

The crucial question however, is whether lower levels of computing self-efficacy will result in women avoiding computers and in limiting women's career choices. In the area of mathematics, Betz and Hackett (1983) linked lower levels of mathematics self-efficacy among females, to avoidance of mathematics-related course work and consequently majors and careers in the sciences. As mentioned earlier, in the present study

no evidence was found of the lower computing self-efficacy expectations among females, translating into avoidance of computing courses. In other words, although females were clearly less confident than males regarding computing, this did not influence their intentions to enrol in a computer studies course. Interestingly, contrary to expectations, slightly more females than males reported intending to enrol in a computer studies course as assessed during phase two of the study.

On the other hand, the results of this study clearly show that males, generally, have more involvement with computers, in respect of greater computing experience, more access to computers and higher frequency of computer use. These sex differences in computer access and use may provide an explanation for the absence of sex differences in intentions to enrol in computer studies courses, in that males may perceive less need to enrol in a formal computing course having already acquired computer expertise informally (e.g. through using home computers, joining computer clubs etc.). This is obviously a post hoc interpretation and such a possibility requires further investigation.

Although it is heartening to observe no sex differences in intentions to enrol in computer studies courses, further research would be required to determine whether females' selection of subjects at high school become manifest in their actual career-choice behaviour. Many studies (e.g. Horner, 1968; Farmer, 1977) have explicated various barriers (e.g. home-career conflict) which may act to moderate the relationship between subject choice and manifest career choice.

The Fishbein-Ajzen model of behavioural intentions was also examined to assess its utility in explaining sex differences in computing behaviour. In particular, sex differences in the attitudinal and normative components of the model and in the relative contributions of the two

components to behavioural intentions were examined. Multiple regression analyses revealed that sex did not have an effect on the relationship between behavioural intention (as assessed at both Times 1 and 2), and attitude toward the behaviour and subjective norm. (See Tables 3 and 4 where the interaction terms involving sex failed to contribute unique variance in behavioural intentions at either Time 1 or Time 2.) No significant differences between males and females existed in the relative importance of the attitudinal and normative components of the model in influencing intentions. It should be noted that limited theoretical bases exist for the postulation of sex differences in the relative importance of the two components in influencing intentions. Also in light of the absence of the predicted sex differences in intentions, it is not surprising to find that no differences existed in the contributions of the two components to intentions.

FISHBEIN-AJZEN MODEL

The present study also afforded the opportunity to test the sufficiency of the Fishbein-Ajzen model per se. Ajzen and Fishbein (1980) posit that the two variables predicting behavioural intention are attitude toward the behaviour and subjective norm. In this study the two explanatory variables together were significantly correlated with behavioural intentions to enrol in a computer studies course as assessed at both Times 1 and 2, thus supporting the model. Support was however much lower at Time 2. Fishbein and Ajzen (1975) in reviewing tests of their model reported high multiple correlations between behavioural intentions and the attitudinal and normative components of the model. The average multiple correlation of the studies cited was .75. Lower multiple R's were obtained in the present study, particularly when using the second

measure of behavioural intention as the dependent variable.

While it cannot be established from lower correlations that the attitudinal and normative components are not mediating all of the 'explainable' variance in intentions, they do suggest that there is unaccounted for variance which may be explained if additional explanatory variables were incorporated into the regression equation. Ajzen and Fishbein (1980), however, contend that variables external to their model will affect behavioural intentions only indirectly. This was examined in the present study using three external variables: Self-efficacy expectations, past behaviour and 'ability'.

It was found that the addition of self-efficacy expectations to the Fishbein-Ajzen model contributed a small but significant increment to the variance explained in behavioural intention (Time 1). Self-efficacy expectations, however, did not explain any unique variance in behavioural intention (Time 2), although when entered into the regression equation on its own, it did explain a small but significant amount of variance.

The effect of a second external variable, past computing behaviour, on intentions to enrol in a computer studies course was different. After entering the attitudinal and normative components of the Fishbein-Ajzen model, past behaviour did not explain any unique variance in behavioural intentions as assessed at either Time 1 or Time 2. This finding supports the Fishbein-Ajzen model, but is not consistent with other studies (e.g. Bentler and Speckart, 1979; Lacy, 1981; Granrose, 1984) which found direct links between past behaviour and intentions.

The finding that past behaviour did not influence intentions to enrol in a computer studies course appears to contradict the interpretation made earlier, that girls in view of their lesser past computing experience

could be intending to enrol in computer studies courses as a catch-up measure to boys, whose greater past computing experience may have been acquired through alternative sources (e.g. home computers, computer clubs, etc.). This issue will be raised again below.

The effect of a third external variable 'ability', on intentions to enrol in a computer studies course, was also examined. 'Ability' (estimated in terms of school achievement) did not contribute significantly to explaining the variance in behavioural intention (Time 1), over and above what was accounted for by the attitudinal and normative components of the Fishbein-Ajzen model. However, it did explain a small but significant amount of unique variance in behavioural intention (Time 2). Although this finding appears to be inconsistent with the Fishbein-Ajzen model it can be argued, in support of the model, that the information from the school exam. grades may have been incorporated into a measure of attitude toward the behaviour, had such a measure been obtained along with behavioural intention (Time 2) during the follow-up study.

It should also be noted that the respondents did not have access to their exam. grades when responding to Questionnaire 1 which assessed behavioural intentions (Time 1) and the model constructs "attitude" and "norm". This would also partly explain why contradictory results were obtained for 'ability' on behavioural intention (Time 1) and behavioural intention (Time 2) in that 'ability' (measured at Time 2) would not have influenced respondents at Time 1.

Interestingly, results revealed that students with lower 'ability' estimates were more likely to express intentions to enrol in a computer studies course at Time 2. This finding could perhaps be explained in view of the fact that 'Computer Studies' was introduced into the Sixth Form as a Sixth Form Certificate rather than as a University Entrance

option. Consequently students with higher academic achievement who intend to pursue tertiary education (for which U.E. is a prerequisite) are restricted to subjects qualifying for U.E. Although U.E. is to be removed from the Sixth Form in 1986, and the present sample would no doubt have been aware of this, when expressing their intentions to enrol in a computer studies course (Time 2), they still may have perceived 'Computer Studies' as being a 'non-academic' subject.

In conclusion, the results of the present study provided mixed support for the hypothesised role of external variables. In contrast with the Fishbein-Ajzen model it was found that self-efficacy expectations explained unique variance in behavioural intentions (Time 1) and 'ability' made a small but significant contribution to explaining the variance in behavioural intentions (Time 2). The external variable of past behaviour, however, did not influence behavioural intentions as assessed at either Time 1 or Time 2. The small contributions made by the external variables, self-efficacy expectations and 'ability', to explaining the variance in behavioural intentions, do not warrant their inclusion into the model; however, they suggest that the attitudinal and normative components of the Fishbein-Ajzen model are able to explain *some* but not *all* of the variance in behavioural intentions.

A full test of the Fishbein-Ajzen model would require a validation of the criterion variable, behavioural intention. In the current study it was not possible to obtain a behavioural validation of intentions to enrol in a computer studies course. However during follow-up a dichotomous measure of behavioural intentions was used which more closely simulated the real decision of enrolling in a computer studies course or not, than did the earlier 7-point measure. The option of returning to the schools to check the actual behaviour in order to provide a validation of the measure of intentions has been kept open.

Ajzen and Fishbein (1980) note that if there is a time interval between the formation and expression of intentions, and the behaviour, events may intervene which prevent the original intention from being enacted. Thus the strength of the relationship between intention and behaviour depends on the degree to which intentions remain stable over time. Results from the present study revealed a moderately high correlation between behavioural intention (Time 1) and behavioural intention (Time 2), indicating that intentions remained relatively stable over time. From this it can be suggested that intentions to enrol in a computer studies course could well be predictive of the actual behaviour.

The substantial difference in the multiple R's obtained when using behavioural intentions, measured at Time 1 and Time 2, indicate that the ability of the attitudinal and normative components of the Fishbein-Ajzen model to predict behavioural intentions weakened over time. Furthermore, neither of the beta weights for the explanatory variables (A_B and SN) were significant although the two together yielded a significant multiple correlation (R) with behavioural intention (Time 2). The beta weights for both variables were significant when using behavioural intentions (Time 1).

From these results it can be suggested that the Fishbein-Ajzen model runs the risk of artificiality and being method-bound, in that the model constructs are able to predict behavioural intentions successfully only when the attitudinal and normative components and behavioural intentions are assessed concurrently. Also implicit in the model is that behavioural intentions are a single one-off decision rather than an ongoing process.

SELF-EFFICACY THEORY

Results revealed that self-efficacy expectations influence intentions to enrol in a computer studies course, although the relationship is not strong. As would be expected sex, past behaviour and 'ability' were each found to be significantly related to self-efficacy expectations. Thus the results of the present study provided empirical support for self-efficacy theory (Bandura, 1977) as well as for Betz and Hackett's (1981) application of the model to women's career development.

In accordance with Wheeler (1983), the results of the present study provide empirical support for both the Fishbein-Ajzen model (and hence the concept of outcome expectations) as well as self-efficacy theory, when behavioural intention (Time 1) is used as the criterion. It can therefore be concluded that both outcome and self-efficacy expectations are important in influencing intentions to enrol in a computer studies course. In the present study, the Fishbein-Ajzen model explained more unique variance in behavioural intentions than did the self-efficacy model. This finding is not surprising in view of the fact that behavioural intention is a Fishbein-Ajzen model construct, and the attitudinal and normative components were postulated specifically to predict intentions. Self-efficacy theory, on the other hand, does not posit behavioural intention as the criterion variable, although in the present study self-efficacy expectations made a small but significant independent contribution to explaining the variance in behavioural intentions as assessed at Time 1.

METHODOLOGICAL ISSUES

A number of possible methodological flaws in the measurement of the variables in the present study should be highlighted. Ajzen and Fishbein (1980) stress that it is necessary to ensure that the researcher elicits salient beliefs from the sample under investigation, and that all the important referent groups are included in the analysis. In this study, the modal salient set of beliefs was obtained from a separate but similar sample and the referent groups were intuitively derived. It is possible that certain referents (e.g. teachers) not included in the study, may have been influential. Similarly, it is possible that certain salient beliefs may have been omitted. However, it must be noted that the questionnaire did include an open-ended question requesting respondents to list any beliefs which were not included in the modal salient set. Only a very small proportion of the sample responded to this question. It could possibly be assumed from the low response that the modal salient set of beliefs was adequately comprehensive.

A problem was encountered in operationalising the expectancy and evaluative scales used to derive the attitudinal component in the Fishbein-Ajzen model. It appeared that some subjects found it conceptually difficult to differentiate between the two scales, and therefore responded identically to both. Distinguishing between expectancy and evaluative dimensions may require abstract levels of thinking not possessed by all Form 5 students. Further research is needed to develop ways of distinguishing between these two components more clearly.

There is also a possibility that the measure of past behaviour and self-efficacy expectations involved too much 'computer jargon'. The instrument was however pilot tested on a sample of individuals both familiar and unfamiliar to computers, so as to ensure understanding.

Those students whose understanding was deficient would probably have responded with low self-efficacy estimates and less past computing experience; responses appropriate to their situation. To the extent that they did not respond in this way "jargon" may have caused a problem. Unfortunately there is no way of knowing on a post hoc basis whether this was so.

Another problem encountered was in obtaining an objective measure of computing ability which was appropriate for Form 5 students. The unavailability of such a measure necessitated using school exam. grades which only provided an estimate of ability. Despite possible flaws, the methodological problems highlighted above are relatively minor and should not detract in any major way from the conclusions drawn in this study.

GENERAL DISCUSSION

Results suggested that although strong sex differences exist in computer access, frequency of computer use, past computing experience and self-confidence regarding computing, this has not resulted in girls avoiding computer courses. Although no definitive reason can be offered for the failure to find predicted sex differences in behavioural intentions, a number of possibilities exist. The post hoc suggestion that girls intended enrolling to "catch up" on the boys whose past behaviour included more computing was not supported as there was no significant relationship between past behaviour and behavioural intention. A more likely explanation lies in the perception of computer studies as being "non-academic" because of its previous Sixth Form Certificate status. Also it is possible that remedial efforts such as the Labour Department's "Girls Can Do Anything" campaign may be having an impact on girls' career

decision-making, by presenting a broader and non-traditional range of career options for girls. Such campaigns may help to counter traditional views about women's occupational role. Verbal persuasion is one of the ways in which self-efficacy expectations can be influenced (Bandura, 1977). Self-efficacy does influence intentions to enrol in computer studies courses although the relationship is not strong.

Many studies (e.g. Kiesler, Sproull and Eccles, 1983; Fisher, 1984; Sanders, 1984) have reported that females may be more negative towards computers than males, because computers are perceived as being basically masculine objects and part of the male domain of electronics, machinery and mathematics. In contrast, in the present study the large majority of both males and females perceived no link between ability at mathematics and performance in a computer studies course and hence maths anxiety may not transfer to computing. This is increasingly accurate as the new wave of "user friendly" software becomes available together with an increasingly popular view of computers simply as tools to be used for English, History, Geography etc., as well as in the traditional subject areas such as Maths.

The issue of sex differences in computing is of growing interest to vocational psychologists as evidenced by a current study in the *Journal of Vocational Behaviour* (Dambrot, Watkins-Malek, Silling, Marshall and Garver, 1985), which explored sex differences in computer attitude and aptitude and how these variables along with mathematics aptitude, maths anxiety and school achievement, related to computer involvement. One of the limitations of the Dambrot et al. (1985) study was that it was conducted on a sample of university, first-year psychology students. Such respondents are hardly representative of young men and women generally. Dambrot et al. found that females had more negative attitudes

toward computers, lower computer aptitude and less prerequisite math aptitude and experience. It was also found that more males than females had completed a computer course.

The difference between these findings and the results of the present study may be due to the present study's sample being younger than the sample used in the Dambrot et al. (1985) study. It is possible that sex differences in enrolments in computing courses are more marked at the tertiary education level. Differences in the results may also be attributable to the positive effect of existing remedial campaigns in New Zealand.

Many changes are occurring or are imminent in the New Zealand education system which may influence computer education in secondary schools. An important issue under debate is whether separate computing courses should be offered or whether computing should be integrated with other courses thereby involving more students with computing. As noted earlier, 'Computer Studies' was introduced into the Sixth Form as a Sixth Form Certificate rather than as a U.E. option. With the removal of the University Entrance Exam. from the Sixth Form in 1986, the range of subjects for all students will be broadened and it is likely that more students will opt to take 'Computer Studies' in the future. Students intending to pursue tertiary education will also be able to enrol for 'Computer Studies' having been previously restricted to subjects qualifying for University Entrance.

The present study provides a good basis for future replications, which will be able to monitor the effects of changes in the education system on sex differences in computing behaviour. Hopefully an improvement for future studies will be the availability of a more objective measure of computing ability suitable for use in New Zealand. Future

research would also be able to provide a clearer understanding of the relationship between intentions and behaviour. As noted earlier, a full test of the sufficiency of the Fishbein-Ajzen model would require a behavioural validation of intentions. Future studies may also be able to clarify if in fact the Fishbein-Ajzen model constructs are able to predict behavioural intentions successfully only when the attitudinal and normative components and behavioural intentions are assessed at the same time. The construction of the attitudinal and normative components which are straight product terms, is an area which also requires further investigation. For example, the present data or data similar to it could be used to explore the effect of transforming data (e.g. standardising outcome expectations, behavioural beliefs, normative beliefs and motivations to comply) prior to calculating attitude toward the behaviour and subjective norm.

SUMMARY AND CONCLUSIONS

The results of the present study did not reveal sex differences, in the expected direction, in intentions to enrol in a computer studies course, nor in the relative contributions of the attitudinal and normative components of the Fishbein-Ajzen model and self-efficacy expectations to explaining the variance in these intentions. However as predicted strong sex differences emerged in computer access and use, past computing behaviour and computing self-efficacy expectations. Therefore although girls reported less involvement with computing, less access to computers including home compu'ers, and less confidence regarding computing, this did not result in an intention to avoid computing courses.

Empirical support was obtained for the independent contribution of the Fishbein-Ajzen model constructs and self-efficacy expectations to explaining the variance in behavioural intentions to enrol in a computer studies course. Both the Fishbein-Ajzen and self-efficacy models were supported in the present study. Mixed results, however, were obtained in support of the Fishbein-Ajzen model. The reduction in the multiple R from Time 1 to Time 2 suggests that the ability of the attitudinal and normative components to predict behavioural intentions weakened considerably over time.

The independent influence of self-efficacy expectations on behavioural intentions is inconsistent with that aspect of Ajzen and Fishbein's (1980) theory which proposes that variables external to their model influence intentions only indirectly. Also in contrast to their view, it was found that 'ability' directly influenced intentions (Time 2). However, in support of the model but contrary to the hypothesis past behaviour was found not to explain any unique variance in behavioural intentions. It can thus be concluded that the attitudinal and normative components explain *some* but not *all* of the 'explainable' variance in behavioural intentions, and that the inclusion of some external variables into the model can increase the amount of variance explained in behavioural intentions.

The absence of the predicted sex differences in intentions to enrol in computer studies may be due to a number of factors. For example the "non-academic" perception of computer studies may have been of significance. It is also possible that existing remedial efforts such as the "Girls Can Do Anything" campaign may be having a positive effect. In view of this, it is important that such campaigns are continued, particularly within the education system. Ongoing research is needed

to monitor the impact of such campaigns and changes in the education system on sex differences in computing behaviour. Results revealing sex differences in self-confidence regarding computing indicate that intervention efforts based on increasing girls' computing self-efficacy expectations may also be required to ensure that women will be able to participate in and contribute to future technology.

REFERENCES

AJZEN, I. and Fishbein, M. (1980)
Understanding attitudes and predicting social behaviour. Englewood Cliffs, New Jersey: Prentice-Hall Inc.

AUBIN, T. (1985, June 29)
Chauvinism and the computer. *The Sydney Morning Herald*, 40.

BAGOZZI, R.P. (1981)
Attitudes, intentions and behaviour: A test of some key hypotheses. *Journal of Personality and Social Psychology, 41*, 607-611.

BANDURA, A. (1977)
Self-efficacy: Toward a unifying theory of behavioural change. *Psychological Review, 84(2)*, 191-215.

BANDURA, A. (1982)
Self-efficacy mechanism in human agency. *American Psychologist, 37(2)*, 122-147.

BAR-TAL, D. and Frieze, I.H. (1977)
Achievement motivation for males and females as a determinant of attributions for success and failure. *Sex Roles, 3*, 301-313.

BEM, S.L. (1974)
The measurement of psychological androgyny. *Journal of Consulting and Clinical Psychology, 42*, 155-162.

BENTLER, P.M. and Speckart, G. (1979)
Models of attitude-behaviour relations. *Psychological Review, 86(5)*, 452-464.

BETZ, N.E. and Hackett, G. (1981)
The relationship of career-related self-efficacy expectations to perceived career options in college women and men. *Journal of Counselling Psychology, 28(5)*, 399-410.

BETZ, N.E. and Hackett, G. (1983)
The relationship of mathematics self-efficacy expectations to the selection of science-based college majors. *Journal of Vocational Behaviour, 23*, 329-345.

CONSULTATIVE Committee on Computers in Schools. (1982)
Computers in School. Department of Education, Wellington.

DAMBROT, F.H., Watkins-Malek, M.A., Silling, S.A., Marshall, R.S. and Garver, J. (1985)
Correlates of sex differences in attitudes toward and involvement with computers. *Journal of Vocational Behaviour, 27*, 71-86.

DAVIDSON, A.R. and Jaccard, J.J. (1975)
Population psychology: A new look at an old problem. *Journal of Personality and Social Psychology, 31*, 1073-1082.

DAVIDSON, A.R. and Jaccard, J.J. (1979)
Variables that moderate the attitude-behaviour relation: Results of a longitudinal survey. *Journal of Personality and Social Psychology, 37*, 1364-1376.

DEPARTMENT of Education. (1971)
Education Statistics of New Zealand. Wellington: Department of Education.

DEPARTMENT of Education. (1984)
Education Statistics of New Zealand. Wellington: Department of Education.

DEPARTMENT of Education. (1985)
Education Statistics of New Zealand. Wellington: Department of Education.

DEPARTMENT of Statistics. (1981)
New Zealand Census. Wellington: Department of Statistics.

DULANY, D.E. (1968)
Awareness, rules, and propositional control: A confrontation with S-R behaviour theory. In D. Horton and T. Dixon (eds), *Verbal behaviour and S-R behaviour theory.* Englewood Cliffs, New Jersey: Prentice Hall.

ELLEY, W.B. and Irving, J.C. (1976)
Revised socio-economic index for New Zealand. *New Zealand Journal of Educational Studies, 11(1)*, 25-36.

EISER, J.R. and Van der Pligt, J. (1984)
Attitudinal and social factors in adolescent smoking: In search of peer group influence. *Journal of Applied Social Psychology, 14(4)*, 348-363.

ESPOSITO, R.P. (1977)
The relationship between the motive to avoid success and vocational choice. *Journal of Vocational Behaviour, 10*, 347-357.

FARMER, H.S. (1976)
What inhibits achievement and career motivation in women? *The Counselling Psychologist, 6*, 12-14.

FEATHER, N.T. (1969)
Attributions of responsibility and valence of success and failure in relation to initial confidence and task performance. *Journal of Personality and Social Psychology, 13*, 129-144.

FEATHER, N.T. (1982)
Expectations and Actions: Expectancy-value models in psychology. Hillsdale, New Jersey: Lawrence Erlbaum Associates.

FENNEMA, E. and Sherman, J.A. (1977)
Sex-related differences in mathematics achievement, spatial visualisation, and affective factors. *American Educational Research Journal, 14*, 51-71.

FENNEMA, E. and Sherman, J.A. (1978)
Sex-related differences in mathematics achievement and related factors: A further study. *Journal for Research in Mathematics Education, 9*, 189-203.

FISHBEIN, M. (1967)
Readings in attitude theory and measurement. New York: John Wiley.

FISHBEIN, M. (1982)
Social psychological analysis of smoking behaviour. In J.R. Eiser (ed.), *Social psychology and behavioural medicine*, 179-197, Chichester, England: Wiley.

FISHBEIN, M. and Ajzen, I. (1975)
Belief, attitude, intention and behaviour: An introduction to theory and research. Reading, Mass: Addison-Wesley.

FISHBEIN, M., Ajzen, I. and Hinkle, R. (1980)
Predicting and understanding voting in American elections: Effects of external variables. In I. Ajzen and M. Fishbein, *Understanding attitudes and predicting social behaviour.* Englewood Cliffs, New Jersey: Prentice-Hall.

FISHBEIN, M., Ajzen, I. and McArdle, J. (1980)
Changing the behaviour of alcoholics: Effects of persuasive communication. In I. Ajzen and M. Fishbein, *Understanding attitudes and predicting social behaviour.* Englewood Cliffs, New Jersey: Prentice Hall.

FISHBEIN, M., Bowman, C.H., Thomas, K., Jaccard, J.J. and Ajzen, I. (1980)
Predicting and understanding voting in British elections and American referenda: Illustrations of the theory's generality. In I. Ajzen and M. Fishbein, *Understanding attitudes and predicting social behaviour.* Englewood Cliffs, New Jersey: Prentice-Hall.

FISHBEIN, M., Jaccard, J.J., Davidson, A.B., Ajzen, I. and Loken, B. (1980)
Predicting and understanding family planning behaviour: Beliefs, attitudes and intentions. In I. Ajzen and M. Fishbein, *Understanding attitudes and predicting social behaviour.* Englewood Cliffs, New Jersey: Prentice-Hall.

FISHER, G. (1984)
Access to computers. *The Computing Teacher, April*, 24-26.

FISHER, W.A. (1984)
Predicting contraceptive behaviour among university men: The role of emotions and behavioural intentions. *Journal of Applied Social Psychology,14(2)*, 104-123.

FITZGERALD, L.F. and Crites, J.O. (1980)
Toward a career psychology of women: What do we know? What do we need to know? *Journal of Counselling Psychology, 27*, 44-62.

GRANROSE, C.S. (1984)
A Fishbein-Ajzen model of intention to work following childbirth. *Journal of Vocational Behaviour, 25*, 359-372.

GREENFIELD, P.M. (1984)
Mind and Media. Cambridge, Mass: Harvard University Press.

HACKETT, G. (1985)
Role of mathematics self-efficacy in the choice of math-related majors of college women and men: a path analysis. *Journal of Counselling Psychology, 32(1)*, 47-56.

HACKETT, G. and Betz, N.E. (1981)
A self-efficacy approach to the career development of women. *Journal of Vocational Behaviour, 18*, 326-339.

HAYES, W.L. (1973)
Statistics for the social sciences. New York: Holt, Rinehart and Winston, Inc.

HEIDER, F. (1958)
The Psychology of Interpersonal Relations. New York: John Wiley and Sons, Inc.

HERRIOT, P. and Ecob, R. (1979)
Occupational choice and expectancy-value theory: testing some modifications. *Journal of Occupational Psychology, 52*, 311-324.

HORNER, M.S. (1968)
Sex differences in achievement motivation and performance in competitive and non-competitive situations. Unpublished doctoral dissertation, University of Michigan.

HOUSER, B.B. and Garvey, C. (1983)
The impact of family, peers and educational personnel upon career decision-making. *Journal of Vocational Behaviour, 23*, 35-44.

IRVING, J.C. and Elley, W.B. (1977)
A socio-economic index for the female labour force in New Zealand. *New Zealand Journal of Educational Studies, 12(2)*, 154-163.

KANTOLA, S.J., Syme, G.J. and Campbell, N.A. (1982).
The role of individual differences and external variables in a test of the sufficiency of Fishbein's model to explain behavioural intentions to conserve water. *Journal of Applied Social Psychology, 12(1)*, 70-83.

KAZDIN, A.E. (1978)
Conceptual and assessment issues raised by self-efficacy theory. *Advances in Behaviour Research and Therapy, 1*, 177-185.

KIESLER, S., Sproull, L. and Eccles, J.S. (1983, March)
Second-class citizens? *Psychology Today*, 41-48.

LACY, W.B. (1981)
The influence of attitudes and current friends on drug-use intentions. *The Journal of Social Psychology, 113*, 65-76.

LAUVER, P.J., Gastellum, R.M. and Sheehy, M. (1975)
Bias in OOH illustrations? *Vocational Guidance Quarterly, 23*, 335-340.

LEVINE, A. and Crumrine, J. (1975)
Women and the fear of success: A problem in replication. *American Journal of Sociology, 80*, 964-974.

LOCKHEED, M. (1975)
Female motive to avoid success: A psychological barrier or a response to deviancy. *Sex Roles, 1*, 41-50.

LOCKHEED, M.E. and Frakt, S.B. (1984)
Sex equity: Increasing girls' use of computers. *The Computing Teacher, April*, 16-18.

LOWTHER, J. (1984)
Video games: Art, business, community. *And/2*, 83-89.

MACCOBY, E.E. and Jacklin, C.N. (1974)
The psychology of sex differences. Stanford, California: Stanford University Press.

MALONE, T.W. (1982)
Toward a theory of intrinsically motivating instruction. *Cognitive Science, 5*, 333-370.

MANSTEAD, A.S.R., Profitt, C. and Smart, J.L. (1983)
Predicting and understanding mothers' infant-feeding intentions and behaviour: Testing the theory of reasoned action. *Journal of Personality and Social Psychology, 44(4)*, 657-671.

McLURE, G.T. and Piel, E. (1978)
College-bound girls and science careers: Perceptions of barriers and facilitating factors. *Journal of Vocational Behaviour, 12*, 172-183.

MISCHEL, W. (1968)
Personality assessment. New York: Wiley.

MITCHELL, T.R. and Beach, L.R. (1976)
A review of occupational preference and choice research using expectancy theory and decision theory. *Journal of Occupational Psychology, 49*, 231-248.

NIE, R. (1983)
SPSSX users' guide. New York: McGraw-Hill.

NORUSIS, M.J. (1985)
Advanced statistics guide: SPSSX. New York: McGraw-Hill.

OLSEN, N.J. and Willemson, E.W. (1978)
Fear of success - fact or artifact? *Journal of Psychology, 98(1)*, 65-70.

PEDHAZUR, E.J. (1982)
Multiple regression in behavioural research (2nd edition). New York: Holt, Rinehart and Winston.

SALTZER, E.B. (1981)
Cognitive moderators of the relationship between behavioural intentions and behaviour. *Journal of Personality and Social Psychology, 41(2)*, 260-271.

SANDERS, J.S. (1984)
The computer: Male, female or androgynous? *The Computing Teacher, April*, 31-34.

SEJWACZ, D., Ajzen, I. and Fishbein, M. (1980)
Predicting and understanding weight loss: Intentions, behaviours and outcomes. In I. Ajzen and M. Fishbein, *Understanding attitudes and predicting social behaviour.* Englewood Cliffs, New Jersey: Prentice-Hall.

SELLS, L.W. (1980)
The mathematics filter and the education of women and minorities. In L.H. Fox, L. Brody and D. Tobin (eds), *Women and the mathematics mystique*. Baltimore: Johns Hopkins.

SHAVER, P. (1976)
Questions concerning fear of success and its conceptual relatives. *Sex Roles, 2*, 305-320.

SHERMAN, J.J. and Fennema, E. (1977)
The study of mathematics by high school girls and boys: Related variables. *American Educational Research Journal, 14*, 159-168.

SIMON, J.G. and Feather, N.T. (1973)
Causal attributions for success and failure at university examinations. *Journal of Educational Psychology, 64*, 46-56.

SPERBER, B.M., Fishbein, M. and Ajzen, I. (1980)
Predicting and understanding women's occupational orientations: Factors underlying choice intentions. In I. Ajzen and M. Fishbein, *Understanding attitudes and predicting social behaviour*. Englewood Cliffs, New Jersey: Prentice-Hall.

STAKE, J.E. (1979)
Women's self-estimates of competence and the resolution of the career/home conflict. *Journal of Vocational Behaviour, 14*, 33-42.

VROOM, V.H. (1964)
Work and motivation. New York: Wiley.

WHEELER, K.G. (1983)
Comparisons of self-efficacy and expectancy models of occupational preferences for college males and females. *Journal of Occupational Psychology, 56(1)*, 73-77.

APPENDIX A

COMPUTER EDUCATION IN THE 7 SCHOOLS PARTICIPATING IN THE PRESENT STUDY

Computer Education Syllabus: School 1

Form 3 - 'Keyboarding Skills' (approximately 3 hours per student).

Form 4 - 'Computer Awareness' (4 hours per student in Social Studies, 4 hours per student in Science and 2 hours per student in English).
Content: 1. Keyboard Orientation. 2. Elementary Programming. 3. Models and Applications. 4. Computer Structure.

Form 5 - No formal course available.

Form 6 - 'Computer Studies', offered for credit to 6th Form Certificate. In 1985, approximately 75 students (3 classes) were enrolled.
Content: 1. Programming. 2. Uses and Applications of Computers. 3. History and Development of Computers.

Form 7 - Applied Mathematics - 30 hours devoted to computer education (approximately $\frac{1}{5}$ of course). In 1985, 25 students were enrolled.

Computer Education Syllabus: School 2

Form 3 - 'Computer Studies' (compulsory 1 hour per week for every student).
Content: 1. The Computer - What it is. 2. Applications. 3. Programming.

Form 4 - 'Computer Studies' (2 optional courses offered, with 3 hours per week in each option). In 1985, 28-30 students were enrolled in each option.

Form 5 - 'Computer Studies' (2 optional courses offered). In 1985, 27 students were enrolled.

Form 6 - 'Computer Studies' (1 optional course offered for credit to 6th Form Certificate). In 1985, 21 students were enrolled.
Content: 1. Programming. 2. Uses and Applications of Computers.

Form 7 - Applied Mathematics - a large proportion of course devoted to computing.

Computer Education Syllabus: School 3

Form 3 - No course offered.

Form 4 - 'Computer Awareness' (Compulsory 1 hour per week for all students, for one term, taught by maths teachers).
Content: 1. Keyboarding Skills. 2. The Computer - What it is. 3. Applications of the Computer. 4. Social Issues. 5. Programming.

Form 5 - No course offered.

Form 6 - 'Computer Studies' - an optional course for credit to 6th Form Certificate. In 1985 2 small classes were enrolled.
Content: 1. Programming. 2. Uses and Applications of Computers.

Form 7 - Applied Mathematics - a substantial proportion of course devoted to computer education.

Computer Education Syllabus: School 4

Form 3 - 'Computer Studies' (optional course involving 2 hours per week). In 1985, 4 classes were enrolled.
Content: 1. The History of Computing. 2. Uses of Computers. 3. Social Implications. 4. Computer Systems. 5. Problem Analysis. 6. Programming. 7. Computer Operation. 8. Information and Its Handling.

Form 4 - 'Computer Studies' (optional course involving 3 hours per week). In 1985, 2 classes were enrolled.
Content: Involves studying the previous year's work to a greater depth.

Form 5 - 'Computer Studies' (optional course involving 5 hours per week). In 1985, 1 class was enrolled.
Content: Involves studying the previous year's work to a greater depth.

Form 6 - 'Computer Studies' (optional class). In 1985, 1 class was enrolled.
Content: 1. Programming. 2. History of Computing. 3. Uses and Applications of Computers.

Form 7 - Applied Mathematics.

Computer Education Syllabus: School 5

Forms 3 and 4 - 'Computer Awareness' (6 hour block per student in maths). A basic course with less emphasis on programming. The aim of the course is to teach students how to use computers. (Approximately 60-75% of students would be exposed to some computer education in Forms 3 and 4.)

Form 5 - No course offered.

Form 6 - 'Computer Awareness' - option for credit to 6th Form Certificate. In 1985, 2 classes (25-30 students) were enrolled.
Content: 1. Programming. 2. The Computer System. 3. History and Development. 4. Social Implications. 5. Visits to Installations.

Form 7 - Applied Mathematics.

Computer Education Syllabus: School 6

Forms 3 and 4 - Compulsory 6 (1 hour) sessions per student, taken by Maths teachers.
Content: No set guidelines for content, although the emphasis is on hands-on interactive experience.

Form 5 - No course offered.

Form 6 - 'Computer Studies' - option for credit to 6th Form Certificate.
Content: 1. Programming. 2. Uses and Applications of Computers. 3. History and Development of Computers. 4. The Computer System. 5. Social Implications (the future of computers).

Compulsory 1 hour per week of computer education for all students not enrolled in 'Computer Studies'.

Form 7 - Applied Mathematics - 15% of course devoted to computer education.

Computer Education Syllabus: School 7

Form 3 - Compulsory 9 'Keyboard Contact' hours per student.
Content: 1. Programming.
Taught by Maths teachers.

Form 4 - (a) Compulsory 9 hours per student, taught by science teachers.
Content: 1. Programming.
(b) 'Computer Awareness' (3-4 week optional block in Social Studies).
Content: 1. History and Development. 2. Social Implications.

Form 5 - No course offered.

Form 6 - In 1985, 100 students taking a 1 hour per week course.
Content: 1. Programming.

Form 7 - Applied Mathematics - 2 hours per week of computing. In 1985, 60 students were enrolled.

APPENDIX B

Survey of Attitudes towards computer studies course

[col 1]

Subject number _____

1. Sex: Male _____
Female _____

2. What is your age? Years _____

Months _____

3. How many years have you been at secondary school? _____

4. What is your father's occupation?

_____ _____

5. What is your mother's occupation?

_____ _____

The following questions ask about your attitudes to a course which would teach you the basics of how to use and program computers. The course would illustrate how computer packages can be used to help in a wide range of areas. You would also learn how to program a computer.

6. How likely is it that you will enrol in a computer studies course next year?

Circle the number next to the response which represents how you feel

EXTREMELY LIKELY	7
VERY LIKELY	6
LIKELY	5
I'M NOT SURE	4
UNLIKELY	3
VERY UNLIKELY	2
EXTREMELY UNLIKELY	1

[BEHAVIOURAL INTENTION (TIME 1)] [col 12]

continue on next page/-

7. The next few questions look at specific skills used in computer studies courses. Using the scale below please rate how confident you are that you would be able to learn how to successfully perform each of the tasks.

COMPLETE CONFIDENCE	9	8	7	6	5	4	3	2	1	0	NO CONFIDENCE AT ALL

[col 14]

(Please circle the appropriate number)

a.	Use a computer keyboard	9 8 7 6 5 4 3 2 1 0
b.	Use manuals (instruction books)	9 8 7 6 5 4 3 2 1 0
c.	Connect power cords and cables	9 8 7 6 5 4 3 2 1 0
d.	Switch on and start (boot) the system	9 8 7 6 5 4 3 2 1 0
e.	Organise and use disk files	9 8 7 6 5 4 3 2 1 0
f.	Copy files and keep backups	9 8 7 6 5 4 3 2 1 0
g.	Express problems in a logical form	9 8 7 6 5 4 3 2 1 0
h.	Use a menu driven program	9 8 7 6 5 4 3 2 1 0
i.	Learn and use a computer language	9 8 7 6 5 4 3 2 1 0

[col 22]

[SELF-EFFICACY EXPECTATIONS]

Continue on next page/-

8. Enrolling in a computer course could lead to some positive and some negative things for you. Listed below are a number of possible outcomes from enrolling in such a course. Use the scale below to show how good or bad you feel the outcome is for you personally.

7 EXTREMELY GOOD
6 VERY GOOD
5 GOOD
4 I'M NOT SURE
3 BAD
2 VERY BAD
1 EXTREMELY BAD

	EXTREMELY GOOD						EXTREMELY BAD	
a) Help me to get a job	7	6	5	4	3	2	1	[col 24]
b) Mean keeping up with new technology	7	6	5	4	3	2	1	
c) Mean working with things rather than with people	7	6	5	4	3	2	1	
d) Mean paying close attention to detail	7	6	5	4	3	2	1	
e) Mean spending a lot of time with computers	7	6	5	4	3	2	1	
f) Mean using and applying logical skills	7	6	5	4	3	2	1	
g) Mean learning new and different skills	7	6	5	4	3	2	1	
h) Mean working with complicated equipment	7	6	5	4	3	2	1	
i) Mean being part of future developments in N.Z.	7	6	5	4	3	2	1	
j) Mean doing passive as opposed to active things	7	6	5	4	3	2	1	
k) Mean spending more time indoors	7	6	5	4	3	2	1	
l) Mean being able to talk about computers socially	7	6	5	4	3	2	1	

9. Are there any other bad things about doing a computer course? Please list them and then rate them using the above scale

[OUTCOME EVALUATIONS SCALE]

_____	7	6	5	4	3	2	1
_____	7	6	5	4	3	2	1
_____	7	6	5	4	3	2	1

10. Are there any other good things about doing a computer course? Please list then rate them using the same scale.

_____	7	6	5	4	3	2	1
_____	7	6	5	4	3	2	1
_____	7	6	5	4	3	2	1 [col 41]

11. For the next set of questions the following scale will be used.

7 EXTREMELY LIKELY
6 VERY LIKELY
5 LIKELY
4 I'M NOT SURE
3 UNLIKELY
2 VERY UNLIKELY
1 EXTREMELY UNLIKELY

For each statement ask yourself, "How likely is it that enrolling in a computer studies course next year will":

[BEHAVIOURAL BELIEFS SCALE]

	EXTREMELY LIKELY						EXTREMELY UNLIKELY	
a) Help me to get a job	7	6	5	4	3	2	1	[col 43]
b) Mean keeping up with new technology	7	6	5	4	3	2	1	
c) Mean working with things rather than with people	7	6	5	4	3	2	1	
d) Mean paying close attention to detail	7	6	5	4	3	2	1	
e) Mean spending a lot of time with computers	7	6	5	4	3	2	1	
f) Mean using and applying logical skills	7	6	5	4	3	2	1	
g) Mean learning new and different skills	7	6	5	4	3	2	1	
h) Mean working with complicated equipment	7	6	5	4	3	2	1	
i) Mean being part of future developments in N.Z.	7	6	5	4	3	2	1	
j) Mean doing passive as opposed to active things	7	6	5	4	3	2	1	
k) Mean spending more time indoors	7	6	5	4	3	2	1	
l) Mean being able to talk about computers socially	7	6	5	4	3	2	1	

Using the same scale, answer the following questions

12. How likely is your family to approve of your enrolling in a computer studies course next year?	7	6	5	4	3	2	1	
13. How likely are your friends to approve of your enrolling in a computer studies course next year?	7	6	5	4	3	2	1	
14. In general, how likely are you to do as your family wishes?	7	6	5	4	3	2	1	
15. In general, how likely are you to do as your friends wish?	7	6	5	4	3	2	1	[col 58]

[SUBJECTIVE NORM]

The last set of questions are about your previous experience with computers.

16. Do you have a computer at home? Yes/No (col 60)

    If Yes, what make and model?

    _____

17. Do any of your friends have computers at home? Yes/No

18. Do you know anyone who does own a computer? Yes/No
    What is their relationship to you?

    _____

19. Have you ever used a computer to play games? Yes/No

20. How frequently do you play video games?

DAILY	5
WEEKLY	4
MONTHLY	3
A FEW TIMES A YEAR	2
NEVER	1

21 For how many years have you been playing video games? _____

22. What is your favourite video game?

    _____

23. How frequently could you have access to a computer if you wished?

DAILY	5
WEEKLY	4
MONTHLY	3
A FEW TIMES A YEAR	2
NEVER	1

24. How frequently do you actually use a computer?

DAILY	5
WEEKLY	4
MONTHLY	3
A FEW TIMES A YEAR	2
NEVER	1

25. Do you think that girls and boys have equal access to computers? Yes or No _____ (col 74)

Continued on next page

[col2/1]

26. Have you done any of the following tasks associated with computers? (Answer yes or no)

	Yes/No	[PAST BEHAVIOUR]
a. Used a computer keyboard	_____	
b. Used manuals (instruction books)	_____	
c. Connected power cords and cables	_____	
d. Switched on and started (booted) the system	_____	
e. Organised and used disk files	_____	
f. Copied files and kept backups	_____	
g. Expressed problems in a logical form e.g. flowcharting	_____	
h. Used a menu driven program	_____	
i. Used a computer language	_____	

If yes, what types of programs have you written and in what language?

_____

27. Have you done any other tasks associated with computers? If so, please list them.

_____

_____

_____

28. Do you think that you have to be good at Maths to succeed in a computer studies course? Yes/No

[col 2/14]

APPENDIX C

FACTOR ANALYSIS OF SELF-EFFICACY SCALE

Results revealed only one factor with an eigenvalue greater than one. The factor accounted for 62 percent of the variance, with all nine items loading on it.

Factor Analysis of Self-Efficacy Scale

Items	Factor 1 Loadings	Percent of Variance
Use a computer keyboard	.682	62.4
Use manuals	.803	
Connect power cords and cables	.722	
Switch on and start the system	.779	
Organise and use disk files	.847	
Copy files and keep backups	.852	
Express problems in a logical form	.790	
Use a menu driven program	.822	
Learn and use a computer language	.798	

APPENDIX D

COMPUTER MAKES AND MODELS

IBM PC lookalike

Apple III
Sanyo MBC-550

CP/M Z/80: Apple

CAT
Apple IIe
Commodore C16
Spring Circle 100
Apple II europlus
Apple Datamini

BBC-type: using TV as screen

Atari 400
Commodore VIC 20
Commodore 64
Spectrum +
Commodore Pet
BBC Micro
Sinclair ZX Spectrum
ZX Spectrum 48K
BBC B
TRS-80 I
Atari 2600
Acorn, Electron

Smaller Systems

SC 3000 Sega
Brother
Pencil 2
ZX 81 Sinclair
VZ 200
Micro Professor II
Colour Genie
Sharp MZ 700
Casio FP 200
Challenger 4P/old

APPENDIX E

CATEGORIES OF VIDEO GAMES

Games were grouped according to the role the 'player' takes in relation to the threat posed in the game. The 'player' is usually depicted on screen as a moveable object or 'sprite'. Distinctions can be made between games on the basis of projectile or non-projectile forms, and divided further in terms of the basically aggressive or defensive orientation of the games (Lowther, 1984). A further category, reflecting an orientation towards sporting activities (e.g. Olympic events, karate matches etc.) was used.

Projectile Defensive Games

Galaga
Space Invaders
Moon Patrol
Stargate
Galaxia
Tube Panic
Tutankamen
Astro Belt
Mooncresta
Aqualung
Centipede
Spider's Web

Non-Projective Defensive Games

Donkey Kong
Elevator Action
Congo Bongo
Crazy Kong
Frogger
Bank Panic
Dragon's Lair
The Hobbit
Zork
Robot Attack
Lode Runner
Egg
Pirates
Adventure

Projectile Aggressive Games

Defender
Phoenix
Firefox
Gyrus
Space Raiders
Vulgus
1942
Star Wars
Time Pilot
Ghostbusters
Robotron
Deadly Disc
(Tron)
Zaxxon
Beach Head
Buck Rogers
Omega Race
Mister Viking
Espial
Juno First
Raid Over Moscow

Sports Simulation Games

Tennis vs Tennis
Pole Position
Hyper-Olympics
Karate Champ
Pontoon
Black Jack
Summer Games
Target Shooting Analyzer
Grand Prix Racing
Turbo Racer
Rally X
Safari Race
Joust
Ski
Golf
Poker
Boxing

Non-Projectile Aggressive Games

Pac Man
Lady Bug
Snac Man

APPENDIX F

Name: _____

1. Would you enrol in a computer studies course if it was offered as a subject next year?

   Yes or No _____

   [BEHAVIOURAL INTENTION (TIME 2)]

2. What were your marks in the mid-year examinations you sat this year?

Subject	Marks
English	_____
Mathematics	_____
Science	_____

['ABILITY']

APPENDIX G

CORRELATIONS BEFORE AND AFTER STANDARDISING SEX, ATTITUDE TOWARD THE BEHAVIOUR, SUBJECTIVE NORM AND SELF-EFFICACY EXPECTATIONS

The correlations indicate that multicollinearity between the product term and attitude, norm, and efficacy was reduced through standardising prior to creating the product term. Signs should be ignored in interpreting size of relationship in the product terms.

	Attitude
Sex × Attitude (unstandardised)	.597
Sex × Attitude (standardised)	-.300
	Norm
Sex × Norm (unstandardised)	.743
Sex × Norm (standardised)	-.140
	Efficacy
Sex × Efficacy (unstandardised)	.573
Sex × Efficacy (standardised)	-.276

APPENDIX H

TABLES FOR CROSS-VALIDATION OF FISHBEIN-AJZEN MODEL

TABLE 28

Regression Coefficients and Multiple Correlation of Attitude Toward the Behaviour and Subjective Norm on Behavioural Intention (Time 1) for Subsample one

D.V. = Behavioural Intention (T_1)	Beta	R	R^2	Adj R^2	R^2 change	d.f.
Step one		.480	.230***	.219	.230***	2,146
Attitude	.269***					
Norm	.322***					

Significance of Beta, R^2 and R^2 change based on F tests.
*** $p < .001$

TABLE 29

Regression Coefficients and Multiple Correlation of Attitude Toward the Behaviour and Subjective Norm on Behavioural Intention (Time 1) for Subsample two

D.V. = Behavioural Intention (T_1)	Beta	R	R^2	Adj R^2	R^2 change	d.f.
Step one		.556	.309***	.298	.309***	2.131
Attitude	.451***					
Norm	.187*					

Significance of Beta, R^2 and R^2 change based on F tests.
* $p < .05$, *** $p < .001$

TABLE 30

Regression Coefficients and Multiple Correlation of Predictor Variable on Behavioural Intention (Time 1) for Subsample two

D.V. = Behavioural Intention (T_1)	Beta	R	R^2	Adj R^2	R^2 change	d.f.
Step one		.522	.272***	.267	.272***	1,132
Predictor Variable	.522***					

Significance of Beta, R^2 and R^2 change based on F tests.
*** $p < .001$