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Longitudinal Surveys of Australian Youth

Research Report 41

Attitudes, Intentions and Participation

Siek Toon Khoo
John Ainley

July 2005

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a research program jointly managed by ACER and the
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EXECUTIVE SUMMARY

From previous research, based on a variety of methods and approaches, there is evidence that student attitudes to school and the intentions formed by students by the time they are in the early years of secondary school are related to subsequent participation in education and training. However, there is less research literature that provides an indication of how attitudes influence decisions to continue with school and education beyond school. The analyses in this report are based on propositions from the Ajzen (2001) theory of planned behaviour that intentions act as a mediating influence on actions, and that attitudes to school as well as other factors operate through their influence on intentions.

The analyses are based on data from the 13,600 young people who were sampled when they were in Year 9 of school in 1995 and whose educational and occupational activities were followed annually from that time onwards. For these young people, there are data concerning their participation in Year 12, in higher education and in tertiary (higher plus other post-school) education. There are also data on their educational intentions (Year 12, higher education or tertiary education), attitudes to school, achievements in literacy and numeracy, and background. Student background was reflected in indicators of socioeconomic status, parental education, language background, home location and gender.

The strength of the relationship between intentions at Year 9 to complete Year 12 and participation in Year 12 can be seen in the following results:

- 87 per cent of those who indicated that they planned to proceed to Year 12 did in fact do Year 12.
- 79 per cent of those who indicated that they planned to leave school before Year 12 did leave school before Year 12.
- The correlation between intention to proceed to Year 12 and actual participation is very high ($r = 0.80$).

Overall, 33 per cent of those who were in Year 9 in 1995 participated in university study. The strength of the relationship between intentions and university participation is evident in the following results:

- 52 per cent of those who intended to enter university did in fact participate in university.
- Only 14 per cent of those who indicated that they did not intend to proceed to university eventually participated in university.
- The correlation between intention and entry to higher education is moderately strong ($r = 0.59$).

The results of the analyses of these longitudinal data indicate that intentions for continuing with education as expressed in junior secondary school are important indications of actually continuing in education. A range of factors, including attitudes to school, influences those intentions. The importance of attitudes to school is evident in the observations that:

- The associations between attitudes to school and educational intentions are moderately strong ($r = 0.37$ for Year 12 and $r = 0.33$ for university).
- Attitudes to school are more strongly related to educational intentions than any aspects of student background included in the analysis, including socioeconomic background.

Other things being equal, students who are positively oriented to their schools and are actively engaged in its academic work and other activities are more likely to develop an intention to continue through school and beyond. Results in this report also show that attitudes to school are relatively independent of both proficiency in literacy and numeracy and student background. In other words, attention to what happens in the middle and early secondary years of school including nurturing of favourable attitudes to school can influence educational intentions and subsequent participation.

Most of the aspects of student background that are associated with participation in Year 12 and education beyond school also operate by influencing intentions that later become manifest as participation. Educational intentions are influenced not only by attitudes to school but also by achievements in the foundation areas of literacy and numeracy and various aspects of student background.

Attitudes, Intentions and Participation

1. INTRODUCTION

Past research from several countries suggests that young people's educational intentions are related to their subsequent participation in education and training. Students' attitudes to school and learning potentially influence both educational intentions and continuation in formal learning through school and beyond. It is important to understand the connections between attitudes, intentions and subsequent educational participation. If those connections are strong, it can be inferred that actions intended to increase participation in postcompulsory education need to include attention to what happens in the formative school years. Student attitudes can be regarded as malleable influences on participation, because they are formed in response to curriculum, teaching practices and organisational arrangements. Increased participation in postcompulsory education will be supported by attending to those aspects of earlier school experiences.

This report examines the relationship between students' attitudes to school and intentions to participate in education and training, and the influence of these attitudes and intentions on participation in Year 12 and in further education and training. Students' attitudes to school, educational intentions and attainments are considered in the context of earlier school achievement, social background, geographic location, language background and gender. These factors are related to attitudes, intentions and participation.

Research Questions

In broad terms, the research questions that shape this investigation concern the strength and significance of the pathways that link attitudes to school to subsequent participation in education. In investigating these questions, this research investigates whether that relationship involves a direct influence or whether the influence is apparent because it operates through an intention to participate as an intermediary.

Participation in postcompulsory education, attitudes to school and educational intentions are all potentially influenced by personal and family background and by earlier achievements in the foundation areas of literacy and numeracy. Any investigation of the relationships between attitudes, intentions and participation must allow for the influence of these other factors. However, in addition to making an allowance for these factors, this investigation considers whether those influences act directly on participation or through the influence they have on attitudes and intentions.

The research questions can be expressed more specifically in the following terms. Over and above the influence of personal and family background and achievement in literacy and numeracy:

- What are the effects of attitudes to school on intention to complete school and on participation in Year 12?
- To what extent does the influence of attitudes to school on participation in Year 12 operate directly and to what extent does it operate through its influence on an intention to complete school?
- What are the effects of attitudes to school on intention to participate in tertiary education (defined as either university or post-school TAFE) and subsequent participation in tertiary education?

- To what extent does the influence of attitudes to school on participation in tertiary education operate directly and to what extent does it operate through its influence on an intention to continue to tertiary education?
- What are the effects of attitudes to school on intention to participate in university education and subsequent participation in university education?
- To what extent does the influence of attitudes to school on university participation operate directly and to what extent does it operate through its influence on an intention to continue to university?
- To what extent do the influences on educational participation differ between males and females and among other groups of students (for example, those defined by socioeconomic levels, language backgrounds and geographical locations), after taking into account influences of attitudes, achievement and intentions?

Research Literature

Reasons for leaving school

Although work-related reasons—such as the desire to get a job and earn money—are the most frequently cited reasons for leaving school before reaching the final year, factors related to experiences at and attitudes to school are among the reasons frequently cited by young people for leaving school. In the *Education and Training Experience Survey* conducted by the Australian Bureau of Statistics, about 15 per cent of early school leavers said they left school because they did not like school or teachers, and 14 per cent said that they had lost interest and motivation (ABS, 1998, p. 63). Similar results have been reported in several LSAY research reports, with one report in that series concluding that not liking school was a very important reason for 21 per cent of early school leavers (Long *et al*, 1999, pp. 19-20). Long *et al* (1999) note that ‘not liking school’ was more often an important reason for leaving school for males than for females. Teese and Polesel (2003) also reported that male early school leavers, to a greater extent than female early school leavers, report that their classes are ‘boring’ and describe their schools as ‘restrictive’. A number of focussed, localised studies of early school leavers have reported that a prominent reason for leaving was dissatisfaction with school, either in terms of getting on with teachers or finding activities interesting or motivational (Hattam & Smyth, 2003; Holden & Dwyer, 1992). In some studies, a distinction is made between attitudes to school and attitudes to teachers and teaching, but in most studies there is a high level of association between the two groups of attitudes.

Relationships between attitudes to school and leaving school

In addition to perspectives derived from data on stated reasons for leaving school, there is evidence from studies that have examined the associations between leaving school before completing the final year and independent measures of factors such as engagement, motivation and attitudes. Previous LSAY research has examined patterns of attitudes to school life and has related those patterns to students leaving school before Year 12 (Marks, 1998). Marks *et al* (2000) studied both educational intentions and attitudes to school in studies of influences on participation in Year 12 but not of participation in post-school education. Finn (1989) argued that alienation or feelings of estrangement contribute to the likelihood that a student will leave before Year 12. According to Finn’s ‘participation-identification’ model, disengagement in the early secondary years has a long-term effect on identification with school, as well as on behaviour and achievement in the later years. A number of research studies have linked poor school performance to declining motivation to learn, disengagement from school and early leaving (Astone & McLanahan, 1991; Kaplan *et al*, 1997). Eskrom *et al* (1986) showed that, other things being equal, students who were less engaged with school were more likely to leave school before completing the final year. Rumberger (1987) reported similar findings. Newmann *et al* (1992) and Wehlage *et al* (1989) argued that the decision to leave secondary school before completion is

influenced by attitudes concerned with social relationships in school, commitment to the institution and beliefs in the value of schooling. Vallerand and Fortier (1997) analysed influences on school completion and concluded that affective factors such as intrinsic motivation and a sense of autonomy reduced the likelihood that students would leave school before completion. Ethnographic studies have supported these claims by suggesting that an emotional connection to school is a protective factor that keeps 'at-risk' students in school (Mehan et al, 1996). Overall, there is evidence in previous research that favourable attitudes to school are associated with remaining at school to the final year, but the ways in which that relationship operates are less clear.

Attitudes, engagement and participation

There is a complex set of links between engagement, attitudes and motivation in terms of their influence on intentions to complete school or enter higher education. Distinctions made between behavioural, emotional and cognitive forms of engagement help provide a perspective on these links (Fredericks et al, 2004). Behavioural engagement refers to participation in schoolwork-related and co-curricular activities, and has been measured in previous LSAY research (Fullarton, 2002). Emotional engagement refers to identification with or attachment to school. Emotional engagement would be manifest in attitudes to school and to learning. Cognitive engagement refers to a personal investment of effort in learning that results in a person pursuing an issue with the intention of achieving mastery. The first two of these forms of engagement have been related to school completion and participation in university (Fredericks et al, 2004). Fredericks et al (2004, p. 72) concluded, 'Longitudinal research that explores the mediating processes between behavioural and emotional disengagement and dropping out is critical for intervention efforts.'

Intentions

Most of the research studies concerned with students' educational plans have focused on intentions to complete secondary school, rather than intentions for study beyond secondary school. Ainley and Sheret (1992) reported that students' stated intentions to remain at school provided a good predictor of actual completion. In that study, conducted in New South Wales between 1987 and 1991, 70 per cent of those who indicated that they would leave school at the end of Year 10 did so. Correspondingly, 72 per cent of those who said that they would complete Year 12 did so. LSAY data indicate an even higher correspondence between intentions and reality (Lamb et al 2004; Marks et al, 2000). On the basis of a logistic regression analysis, Marks et al (2000) calculated that Year 12 participation (relative to non-participation) was seven times as likely for those students who intended to proceed to Year 12 than for those students who did not intend to proceed to Year 12. They concluded that the magnitude of the effect of intentions is greater than the effect of earlier achievement, although it should be noted that achievement is strongly associated with intentions. Ainley et al (1991) indicated that plans to continue through secondary school are influenced by factors such as achievement and attitudes to school, as well as a number of background characteristics such as gender, socioeconomic background and ethnicity.

Differences among socioeconomic groups in participation in university education have endured over many years and have persisted despite overall expansion of the system and changes in a range of policies for funding, organisation and student support (James, 2002). As part of a study of students in Years 10, 11 and 12 in three States, James (2002) attributed these differences in participation to the opinions and attitudes to post-school education formed during the school years. A higher percentage (53%) of students from higher socioeconomic backgrounds expressed an intention to proceed to university after finishing school than did students from lower socioeconomic backgrounds (31%).

Summary

The preceding review indicates that there is previous research that links attitudes to school with continued participation in education. Some of this research makes allowance for concomitant influences on participation, so that it is possible to conclude that there is a relationship between attitudes and intentions with participation in an integrated framework that allows the strengths of the different influences to be tested. This investigation sets out to provide an integrated perspective on the ways attitudes and intentions interact to influence subsequent participation. It makes use of longitudinal data to conduct analyses of causal influences that are not possible with cross-sectional data. Analyses of longitudinal data make a distinctive and significant contribution to knowledge about influences on educational attainments. Because longitudinal data are collected in a temporal sequence, it is not necessary to rely on concurrent or retrospective information about attitudes and intentions. In the *Longitudinal Surveys of Australian Youth* (LSAY) program, data on attitudes and intentions are collected when students are in the middle years of secondary school and then related to attainments some years after that. Those data are based on individual records that contain information about background, achievement, intentions and attainments¹.

Outline of the Report

Following the present chapter that outlines the issues being investigated, there is in Chapter 2 a discussion of the theories that guide the investigation, the models that are derived from those theories and the data that are analysed to estimate those models. Chapter 3 reports the results of the analyses as well as outlining the multivariate methods that are used for those analyses. Chapter 4 provides a conclusion that most of the effects of attitudes to school operate through shaping educational intentions.

¹ Attainment refers to the highest level of education reached. For example, if a person participated in Year 12 but undertook no further education, their attainment would be Year 12.

2. THEORY, MODELS AND DATA

The formulation of research questions and the interpretation of the research literature in Chapter 1 invoke a conceptualisation of attitudes to school influencing educational intentions and each then influencing educational participation. Moreover, this chain of influences is set within a context of other influences from personal and social background and school achievement. This conceptualisation of the influences of attitudes on participation is similar to an established but more general theory of human behaviour that is used to guide the analysis. That theory and the associated conceptualisation of how those influences operate are outlined in this chapter. The chapter also describes data from the *Longitudinal Surveys of Australian Youth* (LSAY) that are used to investigate the strength of the relationships involving attitudes and intentions that are part of the theory.

Theory of Planned Behaviour

A theory that links attitudes to behaviours through intentions is the theory of planned behaviour (Ajzen & Fishbein, 2000; Ajzen, 2001). The theory of planned behaviour assumes that attitudes influence actions through reasoned processes (that are manifested as intentions). It recognises that there may be alternative links between attitudes and behaviour that bypass intentions, but the major pathway is through intentions. Figure 1 provides a representation of this theory. In this figure, the variables are shown in boxes and the paths of influence are represented by the arrows. According to this theory, relevant attitudes are shaped by beliefs, norms and people's perceptions of their capacity to attain the intended outcome.

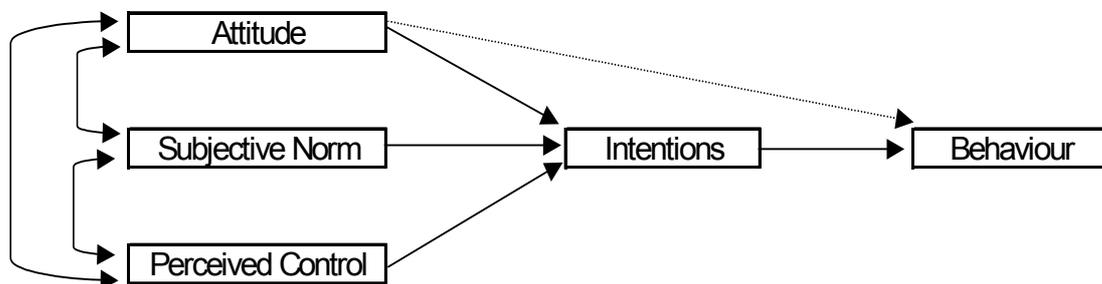


Figure 1 Representation of the theory of planned behaviour

In the present study, the behaviour of interest is continued participation in education, the intentions are plans to continue in education, and the relevant attitudes are attitudes to school. In addition, this investigation allows a direct assessment of 'capacity' (as reflected in school achievement) and incorporates information about social contexts that reflect norms. Thus the present investigation examines the extent to which attitudes influence participation through intentions as well as directly. In addition, the strength of the relationship and its interaction with other influences such as achievement, background and location are investigated. Although the present study does not include information about 'subjective norms' or 'perceived control', it does contain extensive information about background characteristics (including social characteristics) and achievement.

Mediation Models

Outcomes such as educational participation are influenced by a number of factors that interact with each other. For that reason, it is necessary to use multivariate methods of analysis so that the influence of each variable can be examined net of the other associated influences. Within this network of influences, some factors will have an impact on educational participation directly, and others will appear to have an impact only because they influence another factor that in turn influences educational participation. In the present study, both attitudes to school and educational intentions are investigated as influences on educational participation. Attitudes to school can directly influence educational participation and they can indirectly influence participation by influencing educational intentions. In this sense, educational intention mediates the influence of attitudes on educational participation.

In a more general sense, the relationship between a predictor and an outcome variable is said to be mediated through an intermediary or a mediator when differences in the level of the predictor lead to differences in the mediator which in turn affects the level of the outcome. The theory of planned behaviour (Ajzen, 2001) illustrates a mediation model. A simple mediation model is shown in Figure 2.

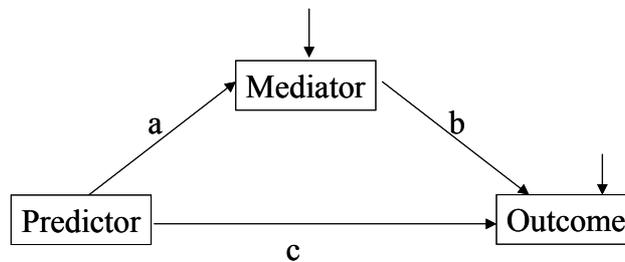


Figure 2 A simple mediation model

The path labelled *c* represents the direct influence of the predictor and the outcome. The path through the combination of *a* and *b* represents the mediated pathway. The strengths of the mediation effect (path *ab*) and the direct effect (path *c*) can be tested statistically. The methods for doing this are described in Appendix B.

A Model Relating Attitudes, Intentions and Participation

According to literature reviewed in Chapter 1, students' intentions can be seen as an influence on educational attainment, defined here as participation in Year 12 or further education. Intentions are, in turn, influenced by attitudes to school, earlier achievement and aspects of personal background such as gender, socioeconomic background, location and ethnicity. Of course, the identification of intentions as a powerful intermediary does not preclude the possibility that achievement and background have direct effects on attainments (and are not transmitted through intentions).

This set of relationships has been summarised in the model shown in Figure 3 for participation in Year 12 and in Figure 4 for participation in higher education.

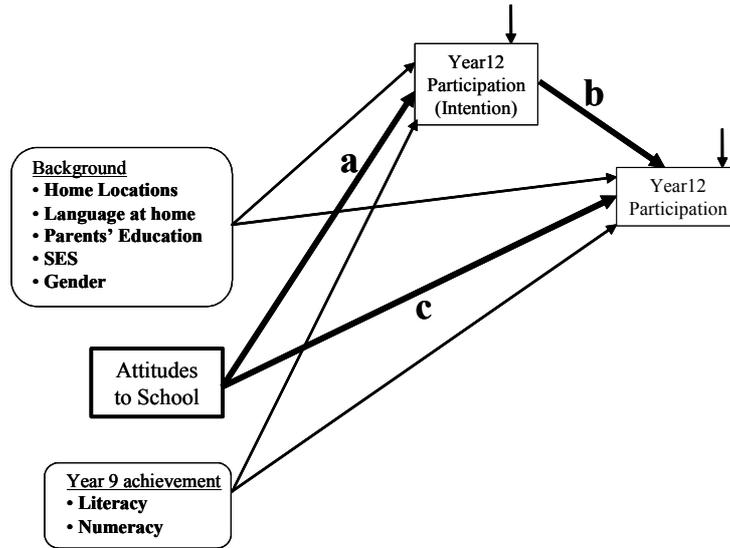


Figure 3 Conceptual mediation model: Influences of background and attitudes on intention and participation in Year 12

The models shown in these two figures embody the major research questions that are the focus of this investigation. In broad terms, the strength and significance of the relations and pathways that link attitudes to school to subsequent participation in education are investigated. Is there a relationship between attitudes to school and subsequent participation in education? If there is a relationship, then is it a direct influence (path c) or does the influence work through the intention for participation as an intermediary (path a then b)? In other words, does the intention for such participation ‘mediate’ the relationship between attitudes to school life and participation?

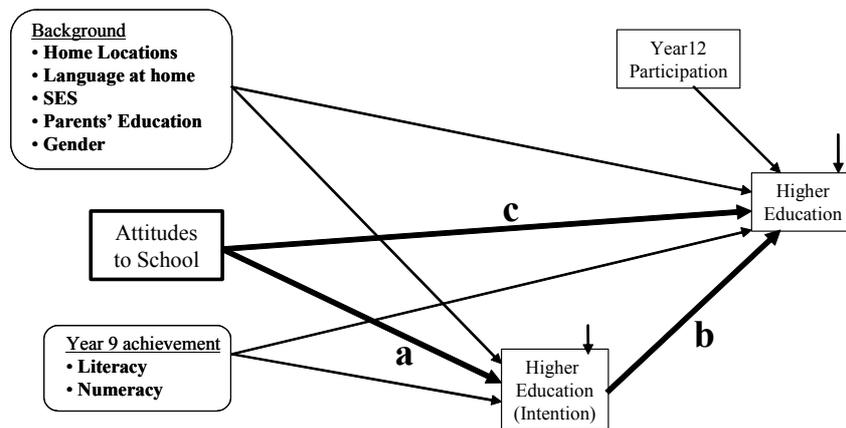


Figure 4 Conceptual mediation model: Influences of background and attitudes on intention and participation in higher education

Data

These analyses of the influence of attitudes and intentions on educational participation are based on data from the *Longitudinal Surveys of Australian Youth* (LSAY) and, in particular, data from the cohort that was in Year 9 in 1995 (designated as Y95)². Data on attitudes and intentions are collected when students are in Year 9 and then related to attainments some years after that. This chapter provides a brief outline of the data elements, with additional detail being provided in Appendix C.

Participation in education and training

Three sets of measures refer to cumulative educational participation (i.e. ever participated in):

- Participation in Year 12;
- Participation in tertiary education (also referred to as further education or post-school education); and
- Participation in higher education (also referred to as university education).

Intentions

- Intentions to complete secondary school are based on student responses to a questionnaire item referring to their intended year of leaving school. The questionnaire was administered when they were in Year 9.
- Intentions to enter tertiary or higher education are based on student responses to a questionnaire item asking about study plans after leaving or completing school. The questionnaire was administered when they were in Year 9.

Intentions are assessed at a point when the full sample is at school and able to provide information about their intentions. For each year after Year 9, successively larger numbers of the sample will have left school and can no longer have an intention to complete Year 12.

Attitudes to school

Attitudes to school scales are based on student responses to a set of 30 items that were contained in a questionnaire administered when the students were in Year 9 (and repeated with a more limited range of items) in later years (Marks, 1998). The five domains of attitudes to school were students' general satisfaction with school, their motivation, their attitudes to their teachers, their views on the opportunities their school provides, and their sense of achievement. The full list of items and a description of the construction of the attitudes to school measure are provided in Appendix B (the reliability coefficient was 0.93).

² The sample from Y95 cohort consists of 13 000 students. Seventy-two per cent of the Y95 sample was retained to 1998 (the year of participating in Year 12) and 51 per cent were retained to 2001. Each survey program begins with tests in reading comprehension and mathematics and a questionnaire about attitudes, intentions and background. Annual surveys are then used to ascertain young people's experiences in school and the labour force, changes in attitudes and aspirations, participation in social and community activities, and some aspects of their personal circumstances. Following the initial data collection in schools and mail surveys in the second wave, subsequent contact with the sample is by a telephone survey.

Educational achievement

Tests undertaken in 1995 measured literacy and numeracy achievement in Year 9. These tests included many items used in previous national studies of literacy and numeracy. The literacy test³ comprised 20 items in which students were asked to read some text and then to answer several questions about what they read. The numeracy test also consisted of 20 questions with three broad types of questions: mathematical operations (mainly computations), practical applications of numerical skills, and the application of abstract mathematical concepts. Each of the tests is reliable (reliability coefficients are approximately 0.80) and item response theory indicated a good fit to the scale (Marks & Ainley, 1997).

Socioeconomic status

Socioeconomic status is based on student reports of parental occupations coded using the ANU3 scale to provide a measure of family socioeconomic status (Jones, 1989). This scale ranges from 0 (low status) to 100 (high status). The occupation of the male parent was taken as the basis for coding, but when information on the occupation of the male parent was not available, the occupation of the female parent was substituted.

Parental education

Parental education is based on the highest level of education completed by each parent. For the analyses in this report, this is coded in two categories: parents with a higher education qualification and parents without a higher education qualification.

Language background

Language background is based on the country of birth of parents coded as either both parents born in Australia or another predominantly English-speaking country versus one or both parents born in a country in which English was not the predominant language.

Location

Location is based on student indication of their home address when they were in Year 9, which was geocoded to a census collection district and assigned a code based on a modified form of the *Accessibility/Remoteness Index of Australia* (ARIA) (ABS, 2001; Jones, 2000). For the present analyses, it was found that geographic location was best used as a dichotomy: metropolitan or non-metropolitan.

Summary

The theory of planned behaviour provides a powerful basis for the investigation of the influence of attitudes on educational participation. It is well-established in research literature addressing a range of phenomena that are concerned with intentions and actual behaviour. The theory provides a model for envisaging the influence of attitudes on educational participation as either a mainly direct influence or an influence that mainly operates because attitudes influence intentions that then influence participation. The data available provide reliable measures of attitudes to school as well as achievement in literacy and numeracy. Those data also contain important aspects of student background such as gender, socioeconomic status, language background and home location. Each of these could be related to educational intentions and participation using the methods outlined in the next chapter.

³ This was strictly a test of reading comprehension rather than broader aspects of literacy.

3. RESULTS FROM THE MODEL ESTIMATIONS

The analyses in this report involve an examination of the relationships among the variables specified in the models shown in Figures 3 and 4. This examination begins with an inspection of the statistical properties of the main variables and the associations between them. It then proceeds to investigate the net effects—the effects of each variable on the outcome variables when allowance is made for the concomitant effects of other variables. This involves multivariate analyses that take account of the fact that the important outcomes are categorical (for example, participate or not) rather than continuous. This chapter outlines the analytic methodology used to investigate the effects of intentions as an intermediary variable and presents the results of the analyses.

Properties of the Main Variables

Table 1 records the means for each of the main variables in the analysis and the correlation coefficients for the associations between those variables.

Table 1 Means for and correlation coefficients between variables

	Means	Correlation Coefficients										
		Uni.	Year 12	Uni. Intent	Yr 12 Intent	Reading	Maths	Attitude	Parent edu.	SES	Location	LBOTE
University	0.33											
Year 12	0.77	0.80										
Uni intent	0.49	0.59	0.58									
Yr 12 intent	0.88	0.64	0.80	0.77								
Reading	-0.02	0.43	0.37	0.41	0.36							
Maths	0.01	0.46	0.40	0.43	0.40	0.55						
Attitudes	0.50	0.24	0.28	0.33	0.37	0.10	0.12					
Parent edu.	0.25	0.29	0.26	0.33	0.25	0.23	0.23	0.09				
SES	3.82	0.24	0.24	0.26	0.25	0.21	0.22	0.07	0.36			
Location	0.34	-0.09	-0.14	-0.15	-0.11	0.03	-0.01	-0.02	-0.10	-0.06		
LBOTE	0.23	0.11	0.15	0.18	0.15	-0.11	-0.03	0.09	0.03	-0.07	-0.28	
Gender	0.51	0.15	0.17	0.19	0.21	0.10	-0.10	0.09	0.01	-0.02	0.01	0.02

Notes:

1. Tetrachoric correlation coefficients are recorded for the outcome variables that are dichotomous.
2. For dichotomous variables the means represent the proportion of the sample in a designated category that was coded as 1 with the reference category being coded as 0.
 University participation is coded as 1 (non-participation is 0) and 33% participated in university.
 Year 12 participation is coded as 1 (non-participation is 0) and 77% participated in Year 12.
 University intention is coded as 1 (non-intention is 0) and 49% intended to study at university.
 For parental education university is coded as 1 (other education is 0). 25% had parents who studied at university.
 For location non-metropolitan is coded as 1 (metropolitan is 0). 34% were IN non-metropolitan locations.
 LBOTE refers to the birthplace of parents with one or both parents born in a predominantly non-English speaking country being coded as 1 (others coded as 0). 23% of the sample were of coded as LBOTE.
 For gender female is coded as 1 (males are coded as 0) and 51% of the sample is female.
3. For continuous variables the mean is shown with standard deviations as follows:
 Reading and mathematics achievement have means close to 0 and standard deviations of 1.
 Attitudes to school has a mean of 0.5 (logits) and a standard deviation of 1.4.
 Socioeconomic status (SES) has a mean of 3.8 and a standard deviation of 2.3. The range is from 0 to 10 (the 100 point ANU3 scale divided by 10).

The data in Table 1 show the associations or correlations⁴ between each of the predictor variables and participation in university or Year 12. In other words, they show the strength of the unadjusted associations with the participation measures before conducting analyses that make allowance for the influence of the relationships among the predictors of participation. In summary:

- Participation in university is strongly associated with participation in Year 12 (because not all of those who complete Year 12 proceed to university the association is not perfect).
- Participation in university and Year 12 are both strongly associated with intentions expressed during Year 9 to continue to those forms of education.
- Participation in university and Year 12 are both associated with developed educational aptitudes: achievement in Year 9 reading and mathematics and positive attitudes to school.
- Participation in university and Year 12 are both associated with aspects of student background: socioeconomic status, parental education, language background (positive for students from language backgrounds other than English) and gender (positive for females compared to males). There is a small negative association for being from a non-metropolitan location. Of these associations, the strongest are for parental education and socioeconomic status.

It can also be noted that attitudes to school are moderately strongly correlated with intentions but are only weakly correlated with achievement in reading and mathematics in Year 9. Attitudes to school are only very weakly correlated with student background characteristics.

The strength of the relationship between intentions and participation can be seen in the observation that 87 per cent of those who indicated that they planned to proceed to Year 12 did in fact continue to Year 12. Seventy-nine per cent of those who indicated that they planned to leave school before Year 12 did leave school before Year 12. Overall, 33 per cent of the cohort participated in university study, comprising 52 per cent of those who intended to enter university and 14 per cent of those who indicated that they did not intend to proceed to university. Attitudes to school are moderately strongly associated with educational intentions ($r = 0.37$ for Year 12 and $r = 0.33$ for university). These associations are stronger than those between intentions and any of the aspects of student background included in the analysis, including socioeconomic background.

⁴ An analysis of the correlation between two variables can be used to investigate the association between them. If there is a significant positive correlation, it does not simply imply that one factor depends on the other or there is a cause-effect relationship between them: it simply means that they occur together. Further analysis and investigation is needed to determine the nature of the association. Correlation values range from -1 (a negative correlation – as one goes up the other goes down) to a +1 (a positive correlation – as one goes up so does the other). Although the most commonly used measure is the Pearson product-moment correlation coefficient, the appropriate measure between two dichotomous variables is the tetrachoric correlation coefficient.

Multivariate Analysis

Because there are potentially several relationships involving attitudes, intentions, background and participation, it is important to use multivariate analysis so that net effects (that is, the effect of one variable on another when other influences are taken into account) can be estimated. A sequence of regression analyses is therefore conducted to build up a final model⁵. Each of the hypothesized models encompasses several regression analyses which are specified in the structural equation modelling (SEM) framework⁶. The important dependent variables under investigation—participation in Year 12, participation in higher/tertiary education and the intention variables—are all dichotomous variables (coded 0 for no and 1 for yes). Therefore probit-based structural equation models for ordinal variables (see Appendix B) are specified for the analyses of these data.

Intentions as an Intermediary between Attitudes and Participation

This section presents the results of the analyses conducted in investigating the effects of intentions as an intermediary variable. The conceptual models presented in Figures 3 and 4 are specified as single models and the relationships in those models are estimated. The results show a close fit to the data⁷. The model was re-estimated for prediction of tertiary (university plus other post-school) education instead of higher (university) education. There was also a close fit to the data⁸. The parameter estimates are shown in Table 2. The results are presented in three parts:

- Influences on intention towards and participation in Year 12,
- Influences on intention towards and participation in university education, and
- Influences on intention towards and participation in tertiary (university plus other post-school) education.

Both indirect effects—those transmitted through influences on intermediary variables—and direct effects are discussed.

The regression coefficients for the four dependent variables are shown in Table 2, with the standard error included in parentheses for each coefficient and the level of significance indicated. These data are presented in path diagrams in the sections that follow.

⁵ Regression analysis is carried out to examine the separate effects of each of the variables on student performance. The regression is based on an equation that has an outcome as the dependent variable and the other variables as predictors. The analysis provides a regression coefficient that allows for a comparison between the dependent variable and the predictor variables in the equation (or analysis), for example. The larger the coefficient, the stronger is the effect of that variable as a predictor on the dependent variable. The analysis also provides a percentage of the variance explained by the dependent variable on performance.

⁶ Structural equation modelling (SEM) allows for the simultaneous estimation of these regression analyses. SEM provides for the incorporation of latent (unmeasured) as well as measured variables in the model. In this application, only measured variables are included and therefore the form of structural equation modelling is path analysis.

⁷ χ^2 (N = 13,142, df = 17) = 940.597, $p < 0.001$; RMSEA = 0.064, CFI = 0.944

⁸ χ^2 (N = 13,142, df = 17) = 935.871, $p < 0.001$; RMSEA = 0.064, CFI = 0.925

Table 2 Influences of attitudes to school and background on intentions and educational participations

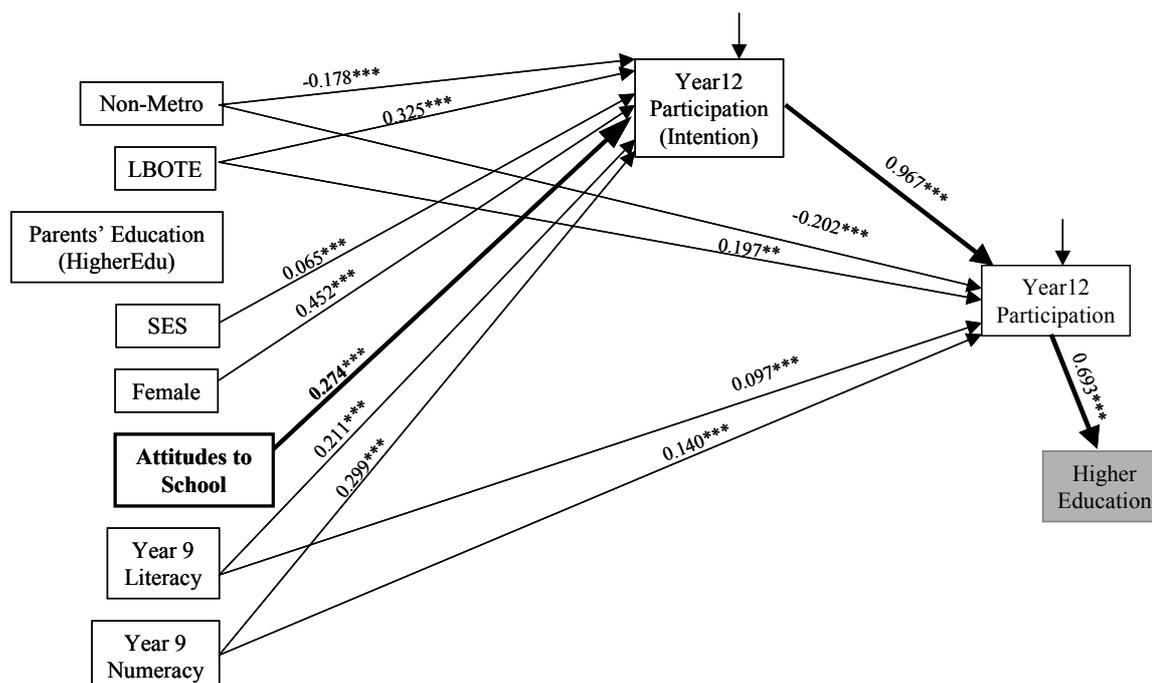
	Year 12 (Intention)#	Year 12 Participation#	University Education (Intention) #	University Education Participation#	Tertiary Education (Intention) #	Tertiary Education Participation#
Thresholds	-0.678	-0.393	0.792	1.642	0.574	0.269
Coefficient estimate (std. error)						
Participation						
Year 12 Participation				0.693 (0.045)***		0.389 (0.022)***
Intentions						
University/Tertiary education				0.184 (0.036)***		0.156 (0.024)***
Year 12		0.967 (0.042)***				
Attitudes						
Attitudes to School	0.274 (0.012)***	0.006 (0.018)	0.234 (0.010)***	-0.005 (0.019)	0.163 (0.010)***	-0.003 (0.013)
Year 9 Achievement						
Literacy	0.211 (0.022)***	0.097 (0.028)***	0.249 (0.017)***	0.157 (0.032)***	0.172 (0.016)***	0.073 (0.022)***
Numeracy	0.299 (0.022)***	0.140 (0.029)***	0.315 (0.017)***	0.167 (0.032)***	0.227 (0.017)***	0.069 (0.022)***
Background and Demographic						
Gender (Female)	0.452 (0.038)***	0.069 (0.051)	0.418 (0.027)***	0.087 (0.051)	0.607 (0.027)***	0.139 (0.036)***
Parental education	0.236 (0.121)	0.260 (0.157)	0.372 (0.074)***	0.087 (0.134)	0.321 (0.076)***	-0.011 (0.096)
Socioeconomic status	0.065 (0.011)**	0.012 (0.014)	0.068 (0.007)***	0.005 (0.013)	0.046 (0.007)***	-0.003 (0.009)
Non-metropolitan	-0.178 (0.039)***	-0.202 (0.052)***	-0.287 (0.030)***	0.040 (0.055)	-0.239 (0.029)***	-0.028 (0.038)
LBO TE	0.325 (0.050)***	0.197 (0.069)**	0.436 (0.033)***	-0.011(0.063)	0.347 (0.033)***	0.001 (0.044)

Notes # Latent response variables. * $p < .05$, ** $p < .01$, *** $p < 0.001$

All coefficients are unstandardised.

Intention Towards and Participation in Year 12

The significant paths from Table 2 in the regressions of intention towards and participation in Year 12 are shown in the path diagram in Figure 5. This diagram shows the relative importance of the various influences on students' intentions to participate in Year 12 and on their actual participation in Year 12. The paths with arrows indicate the links that are statistically significant, with the level of significance shown by the number of asterisks and the strength of the effect indicated by the size of the coefficient on the line. The bolded lines show the relationships of particular interest in this study: between attitudes to school and intention to participate in Year 12, and between intentions to participate in Year 12 and actual participation in Year 12.



Note: All coefficients are unstandardised. * $p < .05$, ** $p < .01$, *** $p < 0.001$

Figure 5 Influences on intention towards and participation in Year 12

After the background and Year 9 literacy and numeracy achievements of the respondents are taken into account, the important conclusions that can be drawn from these results are:

- attitudes to school significantly predict the intention to participate in Year 12;
- intention to participate in Year 12, in turn, significantly predicts actual participation in Year 12;
- the direct effect of attitude to school on actual Year 12 participation is not statistically significant⁹; and
- the mediated effect is significant and accounts for over 95% of the total effects.

⁹ Table 1 showed that there is an overall effect of attitudes on participation in Year 12 (the coefficient is 0.28). This is an indication that almost all the influence of attitudes to school on participation in Year 12 is mediated by the intention to complete school.

In other words, among members of the 1995 Year 9 LSAY cohort, positive attitudes to school influenced intentions to continue at school to Year 12, net of other influences, and intentions had a strong influence on subsequent participation¹⁰. In addition, Table 1 showed that attitudes to school were only weakly associated with student background and achievement¹¹. The formation of positive attitudes to school thus provides a vehicle for influencing educational intentions and subsequent participation through to the final year of school.

There were also factors that had significant residual direct effects on participation in Year 12 after the mediated effect of intention to participate was taken into account. In the prediction of the intention towards participation in Year 12, all the predictor variables except for parental education have significant net effects on the intention to participate in Year 12 after taking the other predictors into account¹².

- Both literacy and numeracy have direct effects on participation as well as effects mediated through the influence on intentions. However, in both cases the mediated effect was more than twice as strong as the direct effect. The presence of the direct effect could be interpreted as reflecting that capable students who do not intend initially to proceed with school eventually may decide or may be persuaded to continue, and students who may intend to continue but are not proficient in school work may decide not to continue with school.
- There was a residual direct effect of language background in that students from a language background other than English were more likely to continue to Year 12 than would have been predicted from their intentions. The direct effect was smaller than the mediated effect that operated through the enhanced intentions to proceed to Year 12 among students of a language background other than English.
- Being from a non-metropolitan location had a negative influence on both intentions (the mediated effect on participation) and a direct residual effect on participation, with the magnitude of the two effects being similar. In other words, students from non-metropolitan locations had lower expectations of proceeding to Year 12 and, after allowing for this, had net lower rates of participation.

As expected, participation in Year 12 significantly predicts participation in higher (university) education.

Intentions Towards and Participation in Higher (University) Education

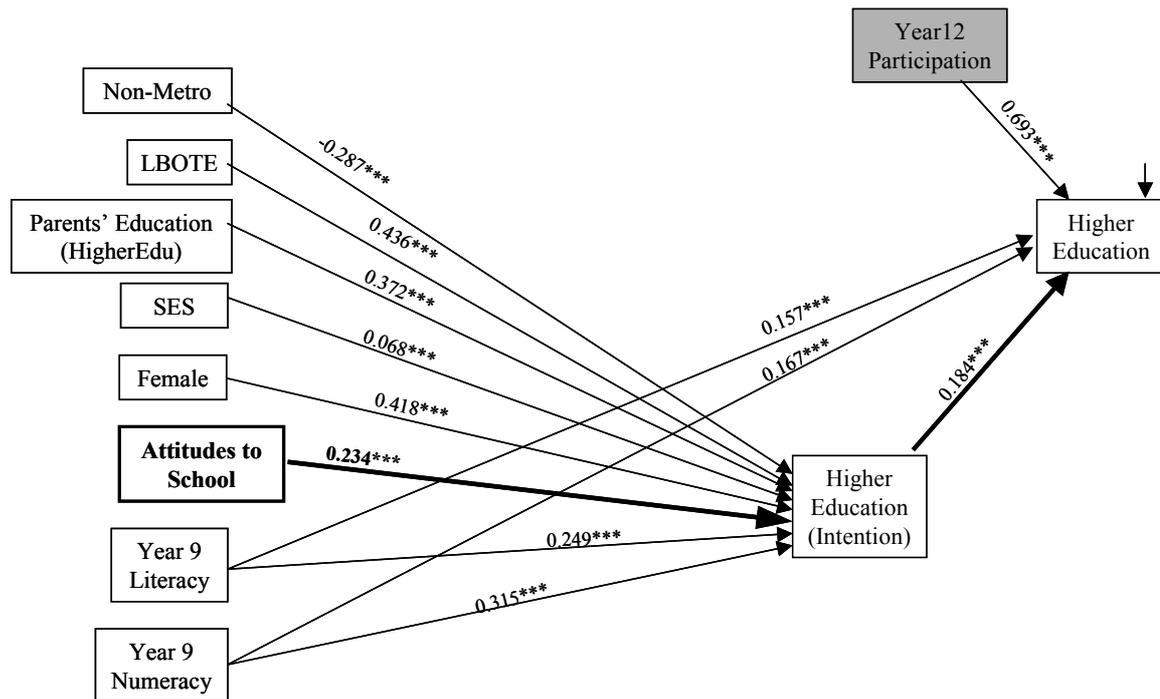
The significant paths from Table 2 in the regressions of intention towards and participation in higher (university) education are shown in the path diagram in Figure 6.

In the prediction of the intention towards participation in Higher Education, all the predictor variables, including parents' education, have significant net effects on the intention towards participating in higher education after taking the other predictors into account.

¹⁰ The path coefficients for the preceding text are as follows: $a = 0.274$ ($se = 0.012$); $b = 0.967$ ($se = 0.042$); $c = 0.006$ ($se = 0.018$); $a \times b = 0.265$ ($se = 0.016$).

¹¹ This has been found in a large number of studies of attitudes to schools (Ainley & Bourke, 1991). The result means that low-achieving students can find school a satisfying experience to a similar extent as high-achieving students.

¹² Table 1 indicated that parents' education was correlated with intention to participate in Year 12. The reason it does not have a net effect is that it is correlated with other variables (mainly socioeconomic status) that in combination have an even stronger association with intentions.



Note: All coefficients are unstandardised. * $p < .05$, ** $p < .01$, *** $p < 0.001$

Figure 6 Influences on intention towards and participation in higher education

The effects of attitudes to school on intention towards and participation in higher education follow the same pattern as those for intention to participate and actual participation in Year 12.

After the background and Year 9 literacy and numeracy achievements of the respondents are taken into account¹³:

- attitudes to school significantly predict the intention to participate in higher education;
- intentions towards higher education, in turn, significantly predict actual participation in higher education; and
- the direct effect of attitude to school on actual participation is not statistically significant, an indication that almost all the influence of attitudes to school on participation in higher education is mediated by the intention to participate.

There are two indirect paths from attitude to school to participation in higher education:

- From attitudes to school to higher education intention to higher education participation; and
- From attitudes to school to Year 12 participation to higher education participation.

The total mediated effect is significant and accounts for almost all of the total effects. Year 9 achievement in literacy and numeracy also has significant direct effects on participation in higher education after the mediated effects of background variables and attitudes to school through intention to participate are taken into account.

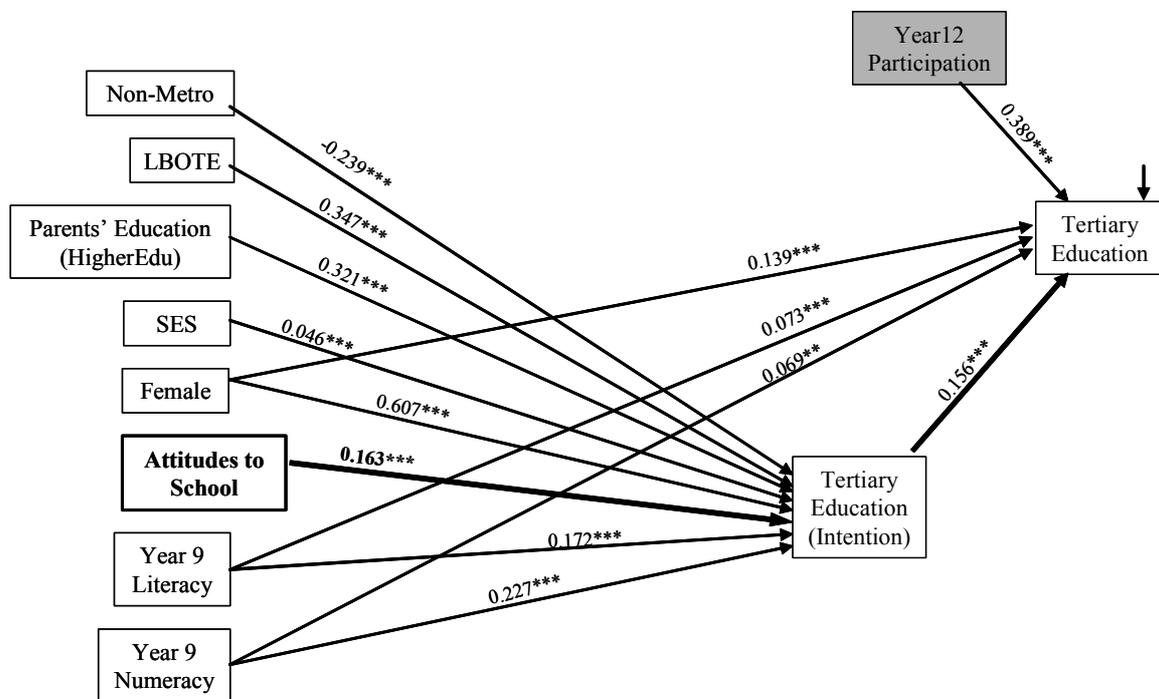
¹³ The path coefficients for these analyses are as follows: $a = 0.234$ ($se = 0.010$); $b = 0.184$ ($se = 0.036$); $c = -0.005$ ($se = 0.019$); $a \times b = 0.227$ ($se = 0.016$)

Intentions Towards and Participation in Tertiary Education (University and TAFE)

The significant paths in the regressions of intention towards and participation in tertiary education (that is, university plus technical and further education) are shown in the path diagram in Figure 7.

The patterns of the coefficients are similar to those for higher education discussed in the previous section. In this analysis, intentions refer to intentions for participation in post-school education more broadly in forms that include but are not limited to universities.

As might be expected, the direct effects of achievement in literacy and numeracy are weaker than is the case for participation in university education, but the effects are still evident. In addition, the influences of achievement on intentions are a little weaker for tertiary than for higher education. The effects of attitudes to school on intentions are also weaker when those intentions refer to broader forms of post-school study than just universities. Beyond these differences and the emergence of a direct effect of gender (that is, female compared to male) on participation in tertiary education, the overall pattern for tertiary education resembles that for higher education.



Note: All coefficients are unstandardised. * $p < .05$, ** $p < .01$, *** $p < 0.001$

Figure 7 Influences on intention towards and participation in tertiary education

Summary

Analysis of longitudinal data from a nationally representative sample of young Australians who were in Year 9 in 1995 indicates that intentions for continuing with education as expressed in junior secondary school are important indications of actually continuing in education. A range of factors including attitudes to school influences those intentions. Other things being equal, students who are positively oriented to their schools and are actively engaged in its academic work and other activities are more likely to develop an intention to continue through school and beyond. In other words, the results of these analyses suggest that attention to what happens in the middle and early secondary years of school can influence educational intentions and subsequent participation. These results are consistent with the theory of planned behaviour.

4. CONCLUSION

The analyses conducted in this study indicate that, after student background and proficiency in literacy and numeracy are taken into account, attitudes to school have a substantial influence on students' intentions to continue to Year 12 and those intentions affect their participation in Year 12. In addition, the analyses show that the effects of attitudes to school on students' intentions towards and participation in higher education (and more broadly, tertiary education) follow a similar pattern. The analyses also show that attitudes to school are relatively independent of both proficiency in literacy and numeracy and student background. Therefore, the nurturing of favourable attitudes to school provides an important avenue for influencing participation through school and into education beyond secondary school.

The results of the study show that intentions formed relatively early in secondary school are powerful predictors of subsequent participation in education. Most of the background factors associated with participation in senior secondary school operate by influencing intentions. Educational intentions are influenced by attitudes to school as well as by achievement in the foundation areas of literacy and numeracy and various aspects of student background. The results of the analyses of the longitudinal data on which this report is based support the proposition from the Ajzen (2001) theory of planned behaviour that intentions act as a mediating influence on actions and that a range of influences operate through their impact on intentions.

One interpretation consistent with but extending beyond these data would be that intentions reflect interest in education—as measured by the attitude to school measure—and a sense of competence to succeed in education—as measured by the achievement measures. On this basis, it could be argued that attention to the extent to which students develop positive attitudes to school and a sense of proficiency in foundation skills will influence their intentions to continue with formal study and become manifest in their actual continued participation in education.

It is also evident that proficiency in literacy and numeracy has a direct influence on participation. This can be interpreted as indicating that capable students who do not intend to proceed with education may decide to continue, and that students who intend to continue but who are not proficient may decide not to continue in education. However, these direct effects are much smaller than the effects that operate through intentions. There are also small direct effects of language background and location: students from a language background other than English are more likely to continue to Year 12 than predicted from their intentions, and being from a non-metropolitan location has a negative influence on both intentions and participation.

Many developments in educational policy and practice have been designed to encourage young people to complete Year 12 and proceed to education beyond school. Many of these developments have focussed on curriculum and organisation in the postcompulsory years of schooling and greater diversity in post-secondary education. Over two decades there have been a diversification of curriculum provision in the senior secondary years of school, substantial reorganisation of university education and a broadening of opportunities in post-school education and training. There have also been initiatives intended to encourage students in the junior years of secondary school to see the benefits of an extended education that builds skills and knowledge, and to provide a foundation that makes successful participation in education and training more feasible. Studies of successive cohorts of young people in LSAY have shown a consistent picture, in that those who have acquired a mastery of literacy and numeracy are more likely to complete Year 12, continue in education and find jobs to earn higher incomes. The results of this study suggest that engagement in school and positive attitudes towards school also contribute to the completion of secondary school and participation in post-school education and training.

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APPENDIX A: THE ATTITUDES TO SCHOOL SCALE

Attitudes to school scales are based on student responses to a set of 30 items. The five domains of attitudes to school were students' general satisfaction with school (P), their motivation (M), their attitudes to their teachers (T), their views on the opportunities their school provides (O), and their sense of achievement (A). The full list of items is provided in Part I below. Part II of this appendix describes the construction of the attitudes to school measure.

I. Attitudes to School Items in LSAY

My school is a place where:

<u>Item #</u>	<u>Domain Id</u>	
01	M1	The work we do is interesting
02	T1	Teachers are fair and just
03	O1	The things I learn are important to me
04	A1	I have learnt to work hard
05	P1	I feel happy
06	T2	Teachers listen to what I say
07	A2	I achieve a standard in my work I consider satisfactory
08	P2	I like learning
09	P3	I get enjoyment from being there
10	O2	The work I do is good preparation for the future
11	M2	I like to ask questions in class
12	T3	Teachers give me the marks I deserve
13	O3	I have acquired skills that will be of use to me when I leave school
14	A3	I always achieve a satisfactory standard in my work
15	M3	I like to do extra work
16	T4	Teachers take a personal interest in helping me with my school work
17	P4	I really like to go each day
18	M4	I enjoy what I do in class
19	M5	I always try to do my best
20	O4	Things I learn will help me in adult life
21	A4	I know how to cope with the work
22	T5	The teachers help me to do my best
23	M6	I get excited about the work we do
24	P5	I find that learning is a lot of fun
25	O5	I am given the chance to do work that really interests me
26	A5	I know I can do well enough to be successful
27	O6	The things I am taught are worthwhile learning
28	P6	I feel safe and secure
29	T6	Teachers treat me fairly in class
30	A6	I am a success as a student

The responses to each item on the attitude to school scale are on a four-point scale as follows:

<i>Strongly disagree</i>	<i>Disagree</i>	<i>Agree</i>	<i>Strongly agree</i>
1	2	3	4

II. Construction of the Attitudes to School Measure

When using a measure of attitudes to school such as that used in the present investigation, there is a question of whether an overall measure or separate measures for each domain is appropriate. The five domains of the attitudes to school scale are often considered separately. Mok and Flynn (2002) investigated the structure of a larger 40-item measure of attitudes to school (from which the present set is derived) and concluded that there was a basis for using a single-factor, a multi-factor or a nested-factor model depending on the purpose. The domains are highly correlated (the correlation coefficients between domains range from 0.50 to 0.77) suggesting that there is an overall dominant dimension underlying them. Ainley and Sheret (1992), in an investigation of the progress of students through high school in New South Wales, also reported using an overall score for a similar measure of attitudes to school. An overall measure of general attitudes to school is of interest in this investigation. In the present investigation, using the five domains concurrently as predictor variables in the regression analyses also may lead to multicollinearity due to the high correlations between them.

Rasch calibration was used to evaluate the fit of data to the one-dimensional Rasch model and for the construction of the overall attitudes to school measure. The 30 items were analysed using the partial credit model (Masters, 1982). Items were calibrated in terms of the degree to which respondents agreed with the items (this corresponds to item difficulty for an ability test) and the three category/step thresholds were estimated for each item. A high item difficulty means low levels of agreement with the item. *Quest* (Adams & Khoo, 1996) test analysis computer software was used to perform the partial credit analysis. The item difficulties and step thresholds as well as indicators of the extent to which each item fitted the model were examined. Only item 11 ('I like to ask questions in class') had a less than acceptable fit to the model based on the criteria used (it has an infit mean square of 1.33). The overall fit to the model is quite good¹⁴.

In the Rasch calibration, the estimates of the respondents' levels of attitude to school and the item difficulties are measured on the same logit scale. On a four-point scale, there are three item step thresholds separating the four categories. We examine the item step thresholds (Thurston threshold) within each of the items and across the items. Each item step threshold is the attitude level required for a respondent to have a 50% chance of endorsing that step or a higher step.

Figure A1 is an item map showing the step thresholds of the 30 items on a *unidimensional* scale, grouped in the respective domains on the right-hand side of the picture. The distribution of the respondents' estimates of the *overall attitude to school* is shown on the left-hand side. It shows a good spread of the items and person estimates. The scale was recalibrated without the misfitting item 11. A Rasch 'attitudes to school' score was estimated for each respondent, based on their responses to the remaining 29 items. These scores were used in all subsequent analyses as an overall measure of attitudes to school. The classical equivalent measure of reliability for these scores was given by coefficient alpha of 0.93.

¹⁴ For the item estimates, both the infit mean squares and the outfit mean squares have a mean of 1.00 and a standard deviation of 0.11. For the person estimates, the infit mean squares have a mean of 0.99 and a standard deviation of 0.61, and the outfit mean squares have a mean of 0.99 and a standard deviation of 0.64.

Figure A1 Item thresholds for attitude to school items

(N = 13613 L = 30 Probability Level=0.50)

	<u>MOTIVATION</u>	<u>POSITIVE AFFECT</u>	<u>TEACHERS</u>	<u>OPPORTUNITY</u>	<u>ACHIEVEMENT</u>
5.0 <i>Iogits</i>	01M1.4 23M6.4				
4.0	18M4.4 15M3.4	24P5.4 17P4.4 09P3.4	02T1.4 16T4.4 06T2.4		
3.0	11M2.4	05P1.4 28P6.4	22T5.4 12T3.4	25O5.4 27O6.4	30A6.4 04A1.4 07A2.4
2.0	23M6.3 19M5.4 15M3.3			20O4.4 03O1.4 10O2.4	21A4.4 14A3.4
1.0		17P4.3 24P5.3	16T4.3		26A5.4
0.0	11M2.3 01M1.3	09P3.3		25O5.3	
-1.0	15M3.2 19M5.3 23M6.2	05P1.3 28P6.3 17P4.2	02T1.3 22T5.3 12T3.3	27O6.3 10O2.3 13O3.3 03O1.3	14A3.3 30A6.3 07A2.3 21A4.3
-2.0	18M4.2 01M1.2 11M2.2	24P5.2 09P3.2 05P1.2 28P2.2	16T4.2 06T2.2 02T1.2 12T3.2	29T6.2 25O5.2	26A5.3
-3.0				10O2.2 20O4.2 03O1.2	30A6.2 21A4.2 04A1.2
-4.0 <i>Iogits</i>	19M5.2				07A2.2 14A3.2

Each X represents 49 students

The threshold estimates in logits for the attitude items are plotted on the right-hand side of Figure A1, labelled by the item ID (combined Item number and Domain ID) and the threshold step. For example, the threshold estimate for step 2 (disagree) on item 19 is -3.41 logits; it is the lowest threshold shown on Figure A1 and labelled as 19M5.2. The ‘M5’ in the label indicates that item 19 is the 5th item in the *motivation* domain. The estimate of -3.41 logits means that it only requires a level of attitude to school of -3.41 logits for a respondent to have a 50 per cent chance of endorsing ‘disagree’ or better rather than ‘strongly disagree’.

The item threshold estimates range from about -4 logits to about $+5$ logits. The items for which there is the least amount of strong agreement (analogous to the most difficult items in a test) have thresholds for step 4 near the top of the item map in Figure A1¹⁵. These are items concerned with engagement with school work (for example, doing interesting work, getting excited about the work, enjoying what is done in class, like to do extra work, learning is fun). Also in this group are items concerned with general aspects of school (for example, liking to go each day, getting enjoyment from being there) and relations with teachers (for example, teachers are fair and just, take a personal interest in my progress, and listen to what I say).

At the other end of the scale are the least ‘difficult’ item steps, which do not require a high level of favourable attitude to school¹⁶. These item steps reflect disagreement with statements concerning engagement with school work (for example, enjoying what is done in class, doing interesting work, trying to do the best), a sense that what is learned in school has future relevance (for example, a good preparation for adult life, learning things that will help in adult life, learning things that are worthwhile, learning useful skills, doing work that is really interesting), a sense of being successful (for example, coping with the work, being successful as a student, learning to work hard, achieving a satisfactory standard) and relations with teachers (for example, teachers give me the marks I deserve, help me to do my best, listen to what I say, take a personal interest in my progress and are fair and just). This level of response reflects disengagement from the content of schooling, classroom tasks and relations with teachers. It also reflects a lack of any sense of success in school.

At the next level up the scale are item steps represented by agreement (but not strong agreement)¹⁷ with items that reflect the content of school work being appropriate (for example, chance to do work of interest, learn worthwhile things, preparation for the future, learn useful skills, learn things that will be useful in adult life and learn things that are important to me), a sense of success (for example, achieve a satisfactory standard, do well enough, cope with the work), a good school environment (for example, school is a place where I like to go, feel happy, feel safe and secure and like learning) and some engagement with work in class (for example, enjoy what is done, interesting work) and with teachers (for example, teachers help me, listen to what I say, treat me fairly, give me the marks I deserve).

In brief, the scale represents attitudes that range from disenchantment with schoolwork, content and teachers, as well as a lack of any feeling of success, through lukewarm attachment to the purposes of school with some sense of success but limited engagement with the work that is done, to a strong sense of engagement with what happens in class as well as across the school more widely.

¹⁵ With a threshold of $+3.0$ logits or higher.

¹⁶ With a threshold of -1.6 logits or lower.

¹⁷ With a threshold of lower than 0 logits.

APPENDIX B: ANALYTIC METHODOLOGY

I. Probit-based Structural Equation Modelling

For the regression of an ordinal dependent variable y on independent variable x , the regression model is usually presented in terms of the conditional probability of y given x :

$$\text{Prob}(y = 1 | x) = F(\alpha + \beta x) \quad (1)$$

where the model is a logit regression if F is the logistic distribution function and is a probit regression if F is the standard normal distribution function.

In a probit regression, a latent (unobserved) continuous variable is hypothesised to underlie the observed ordinal variable (including dichotomous variable as a special case). In *Mplus* (Muthén & Muthén, 2004), a probit regression is incorporated into a structural equation model through a continuous latent response variable that has the observed ordinal variable as its indicator. For example, a dichotomous variable such as *participation in Year 12* (y) can be an indicator for an underlying continuous latent response variable, *the tendency to participate in Year 12* (y^*) through a threshold τ that is defined so that:

$$\begin{aligned} \text{participation} &= 1 \quad \text{if the tendency} > \tau, \text{ and} \\ \text{participation} &= 0 \quad \text{if the tendency} < \tau \end{aligned}$$

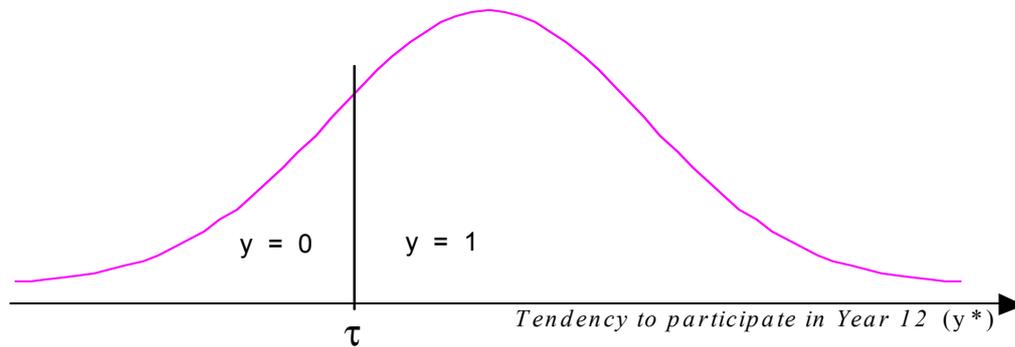


Figure B1 Latent continuous variable underlying a dichotomous outcome

The continuous latent response variable y^* is hypothesised to be linearly related to the set of predictors. For simplicity, take the case of one predictor x :

$$y^* = \beta x + \delta$$

where δ is the residual. The normality assumption is made on the residual δ rather than on the latent variable y^* ; we have $\delta \sim N(0, V(\delta))$.

This latent response formulation results in the same model as (1), with F being the standard normal distribution function Φ ,

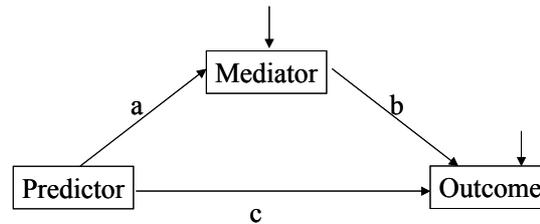
$$\text{Prob}(y = 1 | x) = \text{Prob}(y^* > \tau | x) = 1 - \text{Prob}(y^* < \tau | x) = 1 - \Phi((\tau - \beta x) / \sqrt{V(\delta)}) \quad (2)$$

This formulation, however, focuses on the linear relationship between y^* and x instead of the nonlinear relationship between y and x and the changes in probability of y . It allows for more general models that incorporate probit regressions into structural equation models, such as the multivariate mediation model used in this investigation. The four dichotomous dependent

variables in this investigation, intention to participate and participation in Year 12, intention to participate and participation in higher/tertiary education, will each have an underlying latent response variable in the regression models. The discussion of results focuses on the linear relationships between the predictor variables and the continuous latent response variables (y^*) underlying the dichotomous variables.

II. Assessment of Mediation Effects

The simple mediation model shown in Figure 2 in the main text is reproduced below.



Mediation analysis is commonly used to assess the pathways by which a predictor is related to the outcome of interest. The mediator is regressed on the independent variable to estimate path a and the outcome variable is regressed on the mediator (path b) and independent variable (path c) simultaneously.

The coefficients a and b determine the extent to which the predictor affects the mediator and the extent to which the mediator affects the outcome, respectively. These coefficients should be significant to justify mediation hypothesis. The mediated effect or indirect effect is estimated by the product of the path coefficients a and b . A way for assessing the significance of the mediated effect is to calculate the standard error for the product $a \times b$. A widely-used method for calculating the standard error is based on the multivariate delta method (Sobel, 1982). The path coefficient c gives the residual direct effect of the predictor on the outcome after taking into account the indirect effect through the mediator. If there is complete mediation, the residual direct effect c would be zero. In a more complicated model where there are more than one mediating paths, the total indirect effect is the sum of the specific mediating effects. The sum of the residual direct effect and the mediating effects makes up the total effect. In this investigation, indirect effects and the standard errors (by delta method) are calculated to assess the extent of mediation. Significance of the effects is assessed at 0.05 level.

APPENDIX C: DATA

Sample

The sample from Year 9 cohort in 1995 (known as Y95) consisted of 13 000 students. Seventy-two per cent of the Y95 sample was retained to 1998 (the year of participating in Year 12) and 51 per cent were retained to 2001. Weights are used to allow for initial disproportionate sampling of small jurisdictions and to compensate for differential attrition from the sample. Other investigations (Rothman, in press) have indicated that the effects of differential attrition do not introduce much bias in regression coefficients, especially for analyses such as these that follow the samples to Year 12 or one year beyond.

Data Collection

The sample began participation in the program with tests in reading comprehension and mathematics and a brief questionnaire, providing information about attitudes, intentions and background. Annual surveys were then used in LSAY to determine young people's experiences in school and the labour force, changes in attitudes and aspirations, participation in social and community activities, and some aspects of their personal circumstances. Following the initial data collection in schools and mail surveys in the second wave, subsequent contact with the sample is by a telephone survey that averages 20 minutes in length. Although LSAY does not contain information about 'subjective norms' or 'perceived control', it does contain extensive information about background (including social) characteristics and achievement.

Data Elements

Participation in education and training

In each annual interview, respondents were asked to indicate any current participation in schooling and/or post-secondary education and training, and to provide details of qualifications completed since the last interview. Three sets of measures that refer to cumulative status (that is, 'ever participated in') were developed from this information:

- Participation in Year 12
- Participation in tertiary education (also referred to as further education or post-school education)
- Participation in higher education (also referred to as university education).

Intentions

- Intentions to complete secondary school are based on student responses to a questionnaire item referring to their intended year of leaving school that was administered when they were in Year 9 (and subsequently).
- Intentions to enter tertiary or higher education are based on student responses to a questionnaire item asking about study plans after leaving or completing school that was administered when they were in Year 9.

Intentions are assessed at a point when the full sample is at school and able to provide information about their intentions. For each year after Year 9, successively larger numbers of the sample will have left school and can no longer have an intention to complete Year 12.

Educational achievement

The respondents' combined scores on ACER-administered literacy and numeracy tests undertaken in 1995 measured literacy and numeracy achievement in Year 9. The tests included many items used in previous national studies of literacy and numeracy (the 1975 and 1980 Australian Studies of School Performance (ASSP) studies) and in longitudinal studies of Australian young people (the 1989 Youth in Transition study and the Australian Youth Survey). Each of the tests was reliable (values of coefficient alpha are approximately 0.80) and item response theory indicated only one item on the numeracy test, and none on the literacy test, that did not fit the scale (Marks & Ainley, 1997).

The literacy test comprised 20 items. Students were asked to read some text and then to answer several questions about what they had read. The text comprised short newspaper articles and longer textual passages. The material from newspapers included stories about a tug of war with a camel, a hang gliding flight, an armed robbery, birds trapped by dumped oil, scientific explanations of floating, and the flight of bees. The longer textual passages were on diverse topics such as the birth of a volcano, a railway worker's near fatal experience with an express train and a dispute between two motorists.

The numeracy test comprised 20 questions. Three broad types of questions were asked. The first type dealt with mathematical operations (mainly computations) with little or no practical component. This included simple operations such as addition and subtraction, and more complex operations such as long division, fractions, squares, cubes and square roots. The second type of questions required practical applications of numerical skills. Examples are questions about buying things, reading scales, tables and graphs, and calculating interest. The third type of questions required the application of abstract mathematical concepts. These were mainly logical and spatial problems.

Socioeconomic status

Socioeconomic status is based on student reports of parents' occupations, coded using the ANU3 scale to provide a measure of family socioeconomic status. In the first survey year, respondents reported the occupations of their father (or male guardian) and mother (or female guardian), and described their work. If a parent was not employed at the time of the interview, respondents were asked to describe that parent's last job. The information provided by respondents was coded to the four-digit level of the Australian Standard Classification of Occupations (ASCO First Edition), and responses were assigned occupational status scores based upon the ANU3 scale. Examples of jobs at the bottom of the ANU3 status hierarchy are various mining, construction and related labourers, forklift drivers, cleaners and product assemblers. Examples of jobs at the top of the status hierarchy are medical practitioners, university teachers and legal professionals (Jones, 1989). The ANU3 scale ranges from 0 (low status) to 100 (high status). To make best use of the available information, the occupation of the male parent was taken as the basis for coding, but when information on the occupation of the male parent was not available, the occupation of the female parent was substituted. This approach was taken because a large proportion of the respondents indicated that the occupation of the female parent was 'home duties', an occupation for which there is no occupational class or occupational prestige score.

Parental education

In 1995 respondents were asked to report the highest level of education completed by each parent. For the analyses in this report this was coded in two categories: parents with a higher education qualification and parents without a higher education qualification.

Language background

Language background is based on the country of birth of parents coded as both parents being from a predominantly other than English-speaking country, one parent being from a predominantly other than English-speaking country or both parents from Australia or another country that was predominantly English-speaking. Preliminary analyses indicated that the data were best categorised as a dichotomy: both parents born in Australia or another predominantly English-speaking country and one or both parents born in a country in which English was not the predominant language.

Location

The index of location is based on student indication of their home address when they were in Year 9, which was geocoded to a census collection district and assigned a code based on the modified form of the *Accessibility/Remoteness Index of Australia* (ARIA) (ABS, 2001). Jones (2000) had recommended a modified form of the ARIA classification that was adopted by the Ministerial Council on Education, Employment, Training and Youth Affairs (MCEETYA). Jones also provided a reduced form of the location index that resulted in three categories: metropolitan, regional and remote. For the present analyses, the more limited number of categories was used. For these analyses it was found that geographic location was best used as a dichotomy: metropolitan or non-metropolitan.