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First-Year Undergraduate Student Attrition

Volume 1

William John Patrick
M.A. (Hons.)

University of Glasgow
Departments of Educational Studies and Statistics

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of Doctor of Philosophy in the Faculty of Education

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To Alexis, Graham, and Buster

In memory of my father, the late Robert Sinclair Patrick, who lived to see the inception of this project, but not its completion. We used to enjoy talking about it together.

ASB

Abstract

This is a study of student attrition amongst full-time, first-year undergraduates at the University of Glasgow during the 1999-2000 academic session. The main purpose is to draw upon the relevant literature and to utilise a variety of different, mutually reinforcing research techniques in such a way as to derive broad-ranging explanations of why some students drop out.

The thesis contains an initial assessment of the importance of research in this area (Chapter 1), followed by a review of the literature, focusing in particular on the theories and explanations of student attrition that have been advanced by other authors (Chapter 2) and on appropriate research methodologies and data collection techniques (Chapter 3). Having found extant theory and methods to be less than wholly adequate, the investigation then progresses through a succession of different empirical and data-analytic phases, each building on what has been achieved before in order eventually to formulate a coherent conceptual framework of relevant constructs.

It was natural first to work with the data that were already available. Because of his function within the organisation, the author had uniquely good access to the student records system maintained centrally by the University. This made it practical to sift through this information in such a way as to determine first the simple concomitances of retention (Chapter 4), and then to use it in a more sophisticated manner to develop logistic regression models of retention (Chapters 5 and 8). These models use students' background characteristics and prior academic achievements as their explanatory variables. They emphasise, in particular, the relevance to retention of entry point scores, the stage of schooling at which these have been obtained, residential category, age, and faculty. The predictive power of these models is modestly good but, as explanations of why some students depart prematurely, they are less satisfactory.

The challenge was then to decide which new, additional data should be gathered in order to improve upon these quantitative models. The solutions were found partly in the relevant literature (Chapter 2), and partly by recourse to some focus group work with students and staff (Chapter 6). This resulted in two questionnaires being developed to discover students' attitudes believed to be relevant to retention (Chapter 6). The first survey instrument was administered to all first-year students as part of the matriculation process at the beginning of the academic year. The other was completed on-line in the course of the session as an adjunct to the IT Induction Programme for all first-year students.

The response rates for the two questionnaires were very high: 97.4% for the matriculation questionnaire, and 81.4% for the online questionnaire. However, it became apparent that there were two practical difficulties with the responses to the latter: first, some students were leaving without having completed it and, secondly, it seemed that there might be a general trend towards less positive responses over time. Extensive statistical analysis (Chapters 7 and 9) suggests that the second problem has no practical bearing on the subsequent analysis, whereas the first caused the scope of the study to be narrowed to exclude those students who left the University before the summer months of the session. The quantitative analyses in Chapter 10 and 11 therefore relate only to 'Summer Leavers', and exclude 'Pre-Summer Leavers'. A principal components analysis (Chapter 9) confirms the existence of most but not all of the constructs originally hypothesised to underlie the survey instruments.

Chapter 10 contains the first outcomes of the attempt to improve the logistic regression models described in Chapter 5 by the introduction of attitudinal constructs, first on their own, and then in combination with the original background and prior academic characteristics in order to model summer retention. The predictive power of the models is improved and the importance of certain attitudinal variables is highlighted. Commitment is found to be a very powerful determinant of retention. Conversely, strong social integration, coupled with low commitment, is found to be particularly detrimental. "Time-on-task", measured in terms of students' reported length of time spent studying each week, as well as in terms of time lost because of paid work and commuting, for example, is also important.

Using logistic regression in this way can be somewhat limiting, in that it does not permit causal frameworks to be modelled. The amount of data available in this study is considerable and, consequently, some large-sample structural equation techniques were then used to develop some new, more comprehensive models of retention (Chapter 11). These are more informative, demonstrating how trade-offs can occur between different variables in an overall model of retention, and identifying particular areas where practical policy interventions are likely to be successful in ameliorating student attrition. It is demonstrated that summer retention is affected in roughly equal measure by academic and non-academic factors. On the academic side, it is shown that extra effort and additional academic help and feedback can benefit those students having relatively low entry point scores, for example. Social integration, at least in moderation, is beneficial, and it is positively influenced by living in university accommodation. However, various extraneous problems harm retention through the mediating variables of social integration and commitment. The models have a temporal dimension, and it is argued that students'

attitudes whilst on course owe their origins to those detected at the time of matriculation and, ultimately, back to levels of family support.

The main thrust of the research is quantitative by nature, but some additional telephone interviews were conducted with students who had left (Chapter 12). These exit interviews serve to fill some of the gaps in the quantitative analysis, and to exemplify some of the constructs used.

The study demonstrates the usefulness of methodological triangulation. The focus is on students' attributes and attitudes, rather than on institutional factors, such as the quality of teaching and support services. Nevertheless, it is possible to offer practical policy recommendations for the various institutional stakeholders in the higher education sector, including the University itself. The study concludes by identifying various possible lines of enquiry for future research (Chapter 13).

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Chapter 1 – Introduction

Note: Throughout this thesis the following terms are used to refer to the same phenomenon, and are intended to have the same non-pejorative connotations: attrition, non-continuance, dropout, withdrawal, leaving early, departure, disengagement and non-progression. The converse is referred to variously as persistence, progression, staying on, and, occasionally, perseverance. Non-completion of a degree programme is often a consequence of non-continuance, and these two expressions are therefore also treated as synonymous in some contexts.

Aims and Scope of the Study

Understanding the aetiology of student attrition is one of the biggest challenges confronting researchers of higher education. In this thesis the issue is examined from a variety of different, mutually reinforcing methodological perspectives in order to derive a broad-ranging explanation of the dropout phenomenon by adding to and elaborating upon existing theories and research methodologies. A secondary objective is to be able to offer predictive models of attrition of the type that might, at least in principle, be used to identify students at risk, for example.

The primary research is centred on the experience of one cohort of full-time, first-year undergraduates at the University of Glasgow in the 1999-2000 academic session, distinguishing between those students who returned to the University at the beginning of the following year and those who did not. Efforts were devoted to ascertaining from students their attitudes towards various matters believed to be relevant to retention. The data gathered were combined with administrative information that the University already held centrally in such a way as to develop a variety of statistical models. These analyses demonstrate the relative importance of the attitudinal and other variables, which consist of students' demographic characteristics and prior academic achievements, and illustrate the manner in which they can interact to cause attrition, thereby making this a wide-ranging and innovative examination of the subject.

No theory of student attrition can be all-embracing. Choices have to be made concerning the precise nature of the phenomena to be described, and these will be constrained not just by the principle of parsimony, but by the availability of data and the resources available for

the work in hand. In this study no explicit account is taken, at least in the quantitative analyses, of institutional factors such as the quality of teaching and support services, for example. One consequence of this narrowing of the perspective of the research is that the policy recommendations that follow from it are limited in their scope. It is not intended to make a comprehensive set of recommendations concerning how retention might be improved in practice, although a few useful things can still be said.

Types of Student Attrition

The precise definitions of student attrition used for the purposes of this study are given in Chapters 4 and 7. At the simplest level, student attrition may be thought of as referring to those individuals who do not persist with their academic studies. This straightforward definition may then be elaborated upon in different ways, according to one's purpose. It may be appropriate to distinguish permanent withdrawals from temporary stopouts, the latter generally being held to be those who subsequently resume their studies after a period of absence. Those who leave the higher education sector altogether may be differentiated from those who leave one university but then transfer to another. Those who cease to attend a particular module or course may be distinguished from those who leave their chosen institution altogether. A further contrast may also be made between those who withdraw voluntarily and those who are dismissed for academic or other reasons. This is not an exhaustive exposition of the different ways in which attrition may be defined, but it serves to illustrate the potential complexity of the matter, and the need for clarity in the definition of the dependent variable, especially in any empirical work.

The position becomes yet more complicated if one attempts to classify leavers not according to their observable withdrawal behaviour, but according to the reasons for their departure. This has been the approach taken by the Higher Education Statistics Agency, for example, in its routine requests to institutions to specify in individual cases the predominant cause of withdrawal, selected from a predefined list of possibilities. Some institutional practitioners, particularly in the U.S.A., try to categorise leavers according to whether their withdrawal might be prevented, or whether it is inevitable. The latter category could include those whose personal circumstances or ambitions have changed radically and unpredictably after the start of their course, those for whom the reality of being at university has simply not matched their expectations, and those who have found themselves quite unable to cope. One implication of this very subjective dichotomy

between those who might be ‘saved’ and those who cannot is that there will always be some student attrition; it will never be eradicated entirely. And it is, in any case, conceivable that for some individuals withdrawal may be in their own best interests. The purpose of this study is not, however, to attempt specifically to pigeon-hole individuals according to the reasons for their leaving or to pass judgement on the appropriateness of their going but, rather, to develop different explanations of student attrition and then to combine and compare them; the focus is more conceptual than practical or ethical.

The Significance of Student Attrition

The study of student attrition is important for many reasons.

There has been concern in government circles about the need to obtain value for money in the use of public funds. Institutions of higher education are held accountable for the use of their allocations. A relatively early illustration of this principle is contained in the 1987 consultative document on the future structure of and planning for the higher education sector, in which the Conservative Government placed emphasis on the need for institutions in receipt of public funds to be “accountable for the uses to which the funds are put and for the effectiveness and efficiency for which they are employed” (DES, 1987b, p. 1). The same theme re-emerges later among the corporate aims of the Scottish Higher Education Funding Council, for example; one of its purposes is to “achieve value for public money by seeking to make best use of available resources and securing accountability while recognising institutional autonomy” (SHEFC, 1999, 2000, 2001b).

Student progression is seen as one dimension of institutional effectiveness, and attempts have been made at estimating the cost of non-completion. In evidence to the House of Commons Select Committee on Education and Employment, the Higher Education Funding Council for England (HEFCE) estimated the cost to be in the order of £91M per annum, whereas Professor Mantz Yorke suggested that the true figure was in the region of £200M (House of Commons Select Committee on Education and Employment, Sixth Report, 2001b). It is extremely difficult to know whether figures such as these are correct. The potentially most accurate assessment would involve first making the assumption that spending money on all those who subsequently leave without completing their courses is not an appropriate use of public funds. The cost of recruiting and enrolling such individuals, as well as teaching them and supplying support services up until the time of

leaving could then be said to represent a misdirection of funds that might otherwise have been spent on other students who would have completed their studies successfully. Accurate information concerning such costs may or may not exist at the institutional level but, certainly, it does not exist outwith individual institutions. A further difficulty lies with the assumption that for all those who subsequently leave being present at university serves no useful purpose. Clearly this is not the case: many do re-enter the sector at a later stage, for example, having gained as a minimum a better appreciation of the student experience, and what they might gain by re-engaging with it. In addition, some exits may be unpredictable and unavoidable, as suggested above; in certain cases the cost should therefore be regarded more properly as an additional cost associated with the successful completers, rather than as a form of waste that could be eliminated. Allowances for complications such as these would need to be made before arriving at the right figure. There is thus concern about the wastefulness of student attrition, but such estimates as are available concerning the true cost to the public purse are highly conjectural, and student attrition cannot properly be equated with student wastage.

Behind the emphasis on value for money and institutional accountability lies the Governmental strategy of developing a highly trained workforce in order to compete successfully in increasingly globalised and fast-developing markets, and the pivotal role of institutions of higher education in a modern economy. This was articulated in the Dearing Report (NCIHE, 1997a, para. 4.2):

“higher education has become central to the economic wellbeing of nations and individuals. The qualities of mind that it develops will be the qualities that society increasingly needs to function effectively. Knowledge is advancing so rapidly that a modern competitive economy depends on its ability to generate that knowledge, engage with it and use it to effect”.

This philosophy seems more instrumental than the four objectives for higher education advanced 34 years before in the Robbins Report (Committee on Higher Education, 1963, pp. 6-7):

“instruction in skills suitable to play a part in the general division of labour ... [the promotion of] the general powers of the mind ... the advancement of learning ... [and] the transmission of a common culture and common standards of citizenship”.

It appears that there is less willingness now to accept higher education as being worthwhile for its own sake, but rather to see the sector as part of a supply chain for knowledge in

which the State plays a leading role, both as a supplier and a consumer. The alteration in the nature of the trust placed in institutions has consequences for their internal culture and the way in which they are managed. The cultural changes can manifest themselves in mismatches between students' expectations concerning the learning environment and the expectations that academic staff have of students. These misconceptions, in turn, have ramifications for retention, and this is explored as part of the qualitative research undertaken for the purposes of this study.

The betterment of economic well-being is not, however, the only strategic reason for financing the sector; universities have increasingly come to be viewed as engines of social change in the Government's wider agenda of promoting social inclusion and social cohesion. The House of Commons Select Committee on Education and Employment noted in 2001 that significant progress had been made over the previous twenty years in rectifying the under-representation in higher education of women, mature students, and part-time students. However, it also observed that there remained difficulties in relation to the recruitment of people from poor backgrounds. The Minister for Higher Education reported to the Committee that:

“currently approximately 80 per cent of the children of professional and managerial groups enter higher education, but only about 17 per cent of the children of lower socio-economic groups. She argued that this did not reflect the different abilities of the two groups, but a variety of environmental factors and different levels of opportunity and support” (Select Committee on Education and Employment, 2001a, Section 2, para. 17).

The 2003 White Paper on the future of higher education (DfES, 2003a), coupled with the subsequent proposal to establish a new Office for Fair Access (DfES, 2003b), provides evidence of the Government's continuing intention to increase the proportion of students coming from lower-income families. Whether it is correct to equate the widening of access to higher education with decreased retention rates is currently a matter of some debate (Yorke and Thomas, 2003, for example). This issue is touched upon in the concluding chapter, but it is not a central line of enquiry in this thesis.

The number of students participating in higher education has risen substantially in recent years. In Great Britain the number of undergraduates in full-time higher education rose four-fold from 245,100 in 1979-80 to 1,002,500 in 1999-2000, the year in which data were collected for the purposes of this study; over the same period the equivalent increase in students in Scottish institutions of higher education rose by a factor of three to 113,430

(USR, 1980; HESA, 2001a). This growth in numbers has not, however, been accompanied by a concomitant increase in public financing. For example, the National Audit Office (NAO) observed (2002, p. 9) that “although in recent years the funding per student has been maintained in real terms, over the last decade it has declined by over a third”. In truth, the decline to which the NAO alluded had been in progress over a much longer period, starting in the early 1980s.

The widening of access to include those who previously might not have been admitted, coupled with the significantly deteriorating financial climate, has raised questions about the quality of teaching and pastoral support, as well as the maintenance of academic standards. Because student attrition rates happen to be quantifiable, they have come to be regarded as indicators of institutional effectiveness in coping with these various challenges. Reference to student non-completion as an indicator of institutional performance appears in the 1987 White Paper on “Higher Education: Meeting the Challenge” (DES, 1987a). However, it was not until 1999 that the Higher Education Funding Council for England, prompted in large measure by the National Committee of Inquiry into Higher Education, published its first institutional performance indicators, which included various measures of non-completion. These relate to the non-continuation following the year of entry of students from low participation neighbourhoods and of mature students, for example. The inter-institutional differences thereby revealed may be due to a range of different reasons, of which institutional effectiveness may be only one. The fact that such differences do exist makes it important that they should be investigated.

A further practical reason for the study of student attrition stems from the observation that different countries have widely different completion rates in post-secondary education. It is difficult to make meaningful comparisons between them, though. There are some structural differences. For example, first-degree programmes in the UK usually last for three years, whereas in Germany six years is the norm. There are also cultural differences. Commenting on the position in Italy, Benn (1995, p. 5) observes, “an interesting factor to emerge is the existence of a ‘phantom’ contingent i.e. students who enrol in higher education with no intention of completing the course”. Consequently it is of little surprise that Italy’s apparent attrition rate is higher than that of other OECD countries. Moortgat (1996) also discovered considerable disparities among Western European countries in the quality and availability of data. Notwithstanding obstacles such as these, the Organisation for Economic Co-operation and Development (OECD) (2002, for example) has produced

various comparisons of survival rates. It simply divides the number of graduates in a given year by the number of new students in the most usual year of entry for such graduates. Comparing the resultant ratios for programmes of all durations, and focusing on students on mainly theory-based (as opposed to practical) courses, it appears from the OECD's figures that the UK, along with Ireland, Japan and Turkey experienced survival rates over 80% in the year 2000 whereas, at the opposite extreme, the rates for both Sweden and Italy were less than 50%. The average for institutions in the USA was 66%. HEFCE was therefore able to report to the House of Commons Select Committee on Education and Employment Committee that "UK higher education institutions were, by comparison with other countries, doing a good job at ensuring students made sufficient progress to obtain a higher education qualification" (Select Committee on Education and Employment, 2001b, Section 2, para. 22).

At the institutional level, the dropout phenomenon represents something of a puzzle. Through adherence to admissions standards, usually defined in terms of school leaving qualifications, universities and colleges take care to admit those students considered most likely to succeed. Their subsequent withdrawal is therefore at least in some measure both unplanned and disappointing, as well as a waste of at least some resources, as noted above. Developing a better understanding of why students leave prematurely is therefore one of the first steps that individual institutions can take to reduce the incidence of future withdrawals. A more detailed account of the reasons for this form of institutional research is given below.

The drive towards the expansion of the sector in the 1990s put financial pressure not just on institutions, but on individuals, too, because of the requirement for students and their families to bear an increasing share of the cost. The funding regime switched from one in which tuition for full-time undergraduates was free and living costs were met by means-tested maintenance grants to one in which undergraduate fees continue to be met centrally, at least in Scotland, but in which other expenses are met usually through a complex system of loans administered principally by the Student Loans Company. In 1999-2000, the academic year adopted for this study, the Cubie Report (Independent Committee of Inquiry into Student Finance, 1999) had yet to be assimilated, and at that time students in Scotland, as in other parts of the UK, were required to contribute up to £1,025 towards the cost of tuition, according to their ability to pay. Not surprisingly, discussion about the extent to which the State should contribute to the cost of higher education, the ability of different

individuals to pay, and the manner in which they should do so, remain the topics of considerable political debate. The related issues of student hardship, the extent of its effect on completion rates, and levels of graduate indebtedness are also keenly argued.

For individuals, leaving early can imply not just the loss of time and money expended up to the time of departure, but also a loss of future earnings. Average private rates of return obtained on higher education by graduates have been estimated to be considerable: between about 11% and 14% for entrants of all ages (NCIHE, 1997b), and these figures are appreciably higher than the equivalent social rates of return (7% to 9%), because of the leverage obtained by individuals from public investment in their higher education. (Whether the private and social rates of return will in future remain so high, as the proportion of the workforce possessing a university degree increases, remains to be seen.) If one accepts the tenets of the Robbins Committee described above, it can be expected that leavers will also suffer the loss of other, perhaps less tangible, intellectual benefits. Premature withdrawal can be associated also with a variety of negative emotions, such as feelings of disappointment and frustration, as well as a loss of self-esteem.

The study of student attrition is attractive also to researchers, partly for the reasons cited above, and partly because of the apparent complexity of its causation and the elusiveness of convincing explanations. There is an extensive literature on the subject, in which a rich variety of different explanations and theories have been put forward. These are considered in Chapter 2 of this thesis, and the research methodologies that have been used are appraised in Chapter 3. Even though attempts to comprehend the problem seem likely to remain less than wholly satisfactory, there is no reason why researchers should not strive to produce better models of student attrition, and to improve their understanding of it.

At the time this project was initiated there had been relatively little attention paid at the institutional level within the University of Glasgow to the issue of student retention. A central Student Retention Committee had recently been formed, of which the author was a member, and there had been efforts at least within some faculties to understand the basic parameters of the problem. However, there were no statistics available concerning institutional attrition rates, so that the scale of the problem – to the extent that it might exist at all – was unquantified. The basic statistics presented in Chapter 4 represent some of the first figures seen by the Student Retention Committee, and prompted further research as well as the introduction of various initiatives intended to reduce attrition. The completion of this study should further assist this process.

Institutional Research into Student Attrition

Lenning (1982, p. 43) observed that student retention might be studied by institutional researchers for a variety of reasons. These were, in effect, in order to:

1. Establish baseline figures against which the effects of future changes in institutional practice, including those aimed specifically at improving retention, might be monitored;
2. Evaluate periodically the effectiveness of such changes;
3. Develop an early warning prediction system to identify students at risk of early departure;
4. Identify within this group those who are more likely with special help to persist, and to determine what that special help might be; (The implication here is that there is another group of students whose circumstances are such that the institution will not be able to avert their departure.)
5. Weigh up the likely costs and benefits of proposed retention strategies;
6. Demonstrate to early leavers the institution's concern for them;
7. Identify the correlates of retention;
8. Ascertain students' reported reasons for leaving;
9. Increase understanding of the withdrawal process; and
10. Determine the causes of retention and attrition.

Contextualisation of this Study and Structure of the Thesis

Objectives 1 to 6 are within the domain of those institutional leaders who are responsible for devising and implementing practical policy prescriptions at their particular level. (It would be legitimate also to study retention at the wider national, or sectoral, level, or at the micro level of individual academic subjects, courses and modules.) This thesis touches on such practical matters only tangentially. Its focus is instead on objectives 7 to 10 above. The purpose is to produce several models and explanations of first-year undergraduate persistence and attrition, using both quantitative and qualitative research methodologies. These different accounts of the same phenomenon are to be used in a cumulative manner in order to produce successively more informative and robust interpretations of the dropout phenomenon, culminating in a proposed framework that may rightfully be described as a

theory of first-year undergraduate attrition. These objectives are set out more explicitly in Chapter 2 and 3.

It is generally true – and certainly true at the University of Glasgow – that leaving rates are at their highest during the first year of study; it is for this sort of reason that some of the HEFCE's performance indicators in higher education are published for full-time first-degree students, for example (HEFCE, 1999a *et seq.*). The Council's figures suggest *inter alia* that mature students have appreciably higher attrition rates than young students. Some authors point to the fact that the first two to six weeks are the most critical in a student's career (Levitz and Noel, 1989). Furthermore, Myers (1981) reported that of those students who leave during term-time, as opposed to vacation-time, half dropped out in the first six weeks. Others, however, have found that voluntary withdrawal is highest at the end of first year (Eckland, 1964; Iffert, 1958; Marsh, 1966; and Pantages and Creedon, 1978). There is therefore ample material for study in the subject of first-year undergraduate attrition.

The remainder of the thesis is divided into the following chapters:

Chapter 2 describes the better-known theories and explanations of student attrition to be found in the literature, and sets out in more detail the concepts to be investigated in this study. This literature review constitutes a baseline set of theories and research outcomes from which to develop the current study. The purpose at this stage is to identify possible avenues for exploration and to form at least a preliminary view, based on the findings of others, of the most important lines of enquiry.

Chapter 3 is a critique of the more common methodological approaches that have been used in the past to study student attrition. While Chapter 2 concentrates on matters of substance, Chapter 3 describes the advantages and disadvantages of various research designs and data collection techniques. The process is again one of first presenting a range of options, and then selecting from them, in this case with a view to determining the manner in which the research will be conducted in this study.

Chapter 4 introduces that part of the data set that was derived from the University's central student records system, and contains simple statistics that describe attrition rates according to students' background characteristics and prior academic qualifications. The raw data had not been collected specifically for the purposes of this study, but for the University's various administrative purposes, instead. The use of this "off-the-shelf" information was a

natural starting point for the study. It allows an initial assessment of the scale of the dropout phenomenon to be made. Again, the chapter ends with a filtering process; in this instance those variables that appear to be potentially the most useful for explaining and predicting retention are selected for more detailed examination.

Chapter 5 uses the variables selected in Chapter 4, but in a more sophisticated manner. In this first major statistical analysis, multiple logistic regression models of retention are developed. They allow the main effects of the different explanatory variables and the relevant interactions between them to be quantified. This produces a more coherent description of the correlates of persistence and attrition, in terms of students' background characteristics and prior academic achievements, as well as modestly good predictive models. The drawback of this approach is that, although it is capable of generating reasonably successful predictive models of retention, these models shed relatively little light on the reasons why students leave prematurely. In order to gain a better comprehension of the underlying causations, it becomes apparent that a different approach is required.

Chapter 6 therefore opens up a new line of investigation. The outcomes of focus group meetings with students and staff are described, and are then combined with the conclusions drawn from the literature review and incorporated in the design of the two questionnaires that all first-year undergraduates were asked to complete during the 1999-2000 academic session. The first of these was administered at the time of matriculation at the very beginning of the academic year, and consisted of eighteen items, the responses to which were read using an optical character recognition system. The second was a more detailed, 60-item survey instrument that was administered as an adjunct to the University's introductory IT course for all first-year students. Although not described in this thesis, considerable use was made of relational database technology to maximise the response rates (by issuing reminders) and to prepare the responses for statistical analysis.

Chapter 7 contains an initial scrutiny of the responses to the two questionnaires, examining, in particular, non-response rates, reliability and changes with the passage of time in responses to the second questionnaire, which had to be administered over a nine-month period. The most important finding for the subsequent conduct of the research was that there had been a substantial response bias, with most early leavers departing before having completed the second questionnaire. As a result, much of the remainder of the thesis is concerned only with those whose departure took place over the summer months of

the academic year (Summer Leavers), and those who left earlier have to be discarded from the analysis.

Chapter 8 therefore contains a brief reworking of the logistic regression analysis of Chapter 5, but considering Summer Leavers and Pre-Summer Leavers separately. The results form an addendum to those shown in Chapter 5, although they also reveal some interesting differences between these two groups of leavers.

Chapter 9 begins the analysis of the responses to the questionnaires with a principal components analysis. In this exploratory phase, the constructs underlying the responses are identified and compared with those which had been intended to be incorporated in the questionnaire design, and which are described in Chapter 6. There is a good but by no means perfect match between the two sets of constructs. Some of the survey items need to be reinterpreted as indicators of constructs that are different from those originally intended. The latent variables defined in this chapter are then subsequently used first for the purposes of the logistic regression models described in the following chapter, and then to initiate the formation of the structural equation models covered in Chapter 11.

Having established a set of attitudinal constructs believed to be relevant to retention, the next step, described in Chapter 10, is to apply the logistic regression techniques first described in Chapter 5 in such a way as to create a new model of retention. The predictive power of the new, attitudinal model created in this way is superior to the earlier models, which were based only on demographic and academic characteristics. The analysis in Chapter 10 yields some convincing and novel insights concerning the relevance to retention of a small subset of the variables, but does not produce a comprehensive model of retention. Repeating this part of the exercise by combining the background and attitudinal data in one equation again produces a model with good predictive power. It, too, provides informative results with commendable parsimony but, again, fails to do justice to the complexity of the available data set. In particular, it does not allow the existence of a causal structure among the variables to be modelled, and this, coupled with the fact that some of the basic assumptions underlying logistic regression analysis appear to be violated, provides an impetus for the development of the structural equation models described in the following chapter.

Chapter 11 contains the third major statistical analysis in the study. Structural equation modelling has become the technique of choice – at least in the U.S.A. – for describing and

quantifying the dropout phenomenon, and the information collected for the purposes of this study is of sufficient magnitude and complexity to make this approach worthwhile. The results are consistent with the results of the earlier logistic regression analyses (although in appearance they seem slightly different) and, in addition, they offer a comprehensive demonstration of how the different variables in the system coalesce to form a causal model of retention. The statistical integrity of the models presented and their practical interpretation are considered in detail.

Chapter 12 constitutes a postscript to the main research effort. Exit interviews were conducted by telephone with some of those students who had withdrawn. This additional piece of qualitative research adds some extra insights to the main quantitative analyses that would otherwise have been missed, as well as exemplifying some of the more abstract constructs used. This relatively brief chapter may therefore be seen as a vindication of the methodological triangulation advocated in Chapter 3.

Finally, Chapter 13 draws together the various different strands of the study by reflecting on the methodology used, the substantive results and their practical implications. Comparisons are also made with the findings of other authors and recommendations are made for the future conduct of research in this area.

Chapter 2 – Introduction to the Literature on Student Retention

Introduction

Any new study of student retention should, where possible, take as its starting point the lessons and conclusions that may be derived from earlier work, rather than starting afresh. Chapter 1 set out the strategic direction for this study. This chapter and the next one now start the process by assessing what other researchers in this field have already achieved. The current chapter focuses on the theories and rationalisations that have been advanced to explain student attrition; Chapter 3 assesses the data-gathering techniques and research designs that have been used.

Pascarella (1986) noted that considerable inter-institutional differences can exist in the causes of attrition, and suggested that it would therefore be necessary for each institution to conduct its own investigations in order to be able to tailor solutions to its own particular circumstances. One of the purposes of reviewing a range of different explanations of student attrition is therefore to anticipate those that might be of particular relevance to the study of first-year undergraduate attrition at the University of Glasgow, without fully pre-empting the outcome of other, preliminary investigations. This chapter concludes with a tabulation of the different variables and concepts identified and, in order to form a bridge to the outcome of the subsequent qualitative research work described in Chapter 6, this table (in Appendix 2.10) includes an indication of which of these variables were subsequently selected for further investigation.

It is convenient to categorise models and explanations of student attrition according to whether they are predominantly empirically driven or theory-driven. The first part of this chapter is devoted to a consideration of empirical work; the second part introduces the theoretical approach.

Lenning (1982)

Lenning (1982) provides an introduction to the issues that have in the past been found to be associated with student attrition. Focusing on what had been written in the US, he

borrowed from earlier reviews by Cope and Hannah (1975), Lenning, Beal, and Sauer (1980), Lenning, Sauer, and Beal (1980), Pantages and Creedon (1978), and Ramist (1981). Lenning's conclusions concerning some of these variables are reported in detail because they are particularly relevant to this study.

Under the heading of *student demographic variables* associated with attrition Lenning included age, sex, socio-economic status, ethnic background, marital status, and hometown location and size. Increasing age tends to be associated with various factors that can cancel each other out to some extent but which, on balance, tend to produce higher attrition rates in older students. Such students can be more highly motivated and mature, but their study skills may be "rusty", and they may be less quick to adapt and think. Lenning does not discuss the effects on attrition of the correlates of age, such as increased family and financial commitments. Four assertions are made concerning gender:

"more men drop out during the freshman year ... women are more likely to drop out when the male-female ratio is large ... men most often give academic reasons for dropping out ... women more often give non-academic reasons" (p. 36).

Students from lower socio-economic backgrounds are more prone to drop out than those from more privileged backgrounds. This is a consequence more of levels of parental education than of income or occupation; parental education levels affect both the aspirations that they hold for their children's education and the home environment that they provide while their children are growing up.

Those *student academic factors* analysed had included aptitude test scores, high school achievement, study habits and attitudes, high school attended, subjects and number of courses taken in high school, college program and college grades. Students having low aptitude test scores experience higher attrition rates and have to work much harder. "Most of those who drop out of college have satisfactory grades, but dropouts do tend to have somewhat lower grades than persisters" (p. 37). Withdrawal purely because of academic failure was recognised as being relatively rare. Students having poor study habits and attitudes are more likely to drop out.

Initial student aspirations and motivational variables had included degree aspirations, termination/ completion plans (i.e. declared intentions either to withdraw or to persist), commitment to the college, vocational and occupational goals and familial aspirations for

college. Those undergraduates who aspire to higher degrees are more likely to persist. Parental aspirations generally have a positive effect on persistence, although “dropping out is one way students can assert their independence from their parents” (p. 38).

Student personality and value variables included maturity and responsibility, independence and autonomy, intellectual orientation, creativity, self-concept, anxiety, assertiveness, student concern about finances, and expressed need for counselling.

“Although lack of finances is often a real problem that discourages persistence and is the reason students most often give for dropping out, there is evidence that in many cases it is a problem more perceptual than real. Even when there is adequate financial support, either through the provision of work and financial aid or the family’s ability to pay, finances are thought to be a socially acceptable reason for withdrawal, one that will protect the ego from having to divulge another, more immediate reason. Conversely, arrangements with even very limited financial resources are worked out by some students who have a strong commitment to persist, no matter what” (Lenning, 1982, p. 39).

Institutional variables had included prestige, size, control (private or public), type (two/four-year; single-sex/co-educational), religious affiliation, selectivity, housing, student services and institutional mission. “Residential campuses tend to have higher retention rates than commuter campuses, and on-campus life in sororities and fraternities tends to promote student retention more than dormitory life does” (Lenning, 1982, p. 40). In saying this Lenning was identifying two issues: practical difficulties with daily travel and the beneficial effects of social integration.

Interaction variables listed by Lenning included student satisfaction, social integration/peer group relations, family-college relationships, out-of-class interactions with faculty; faculty concern for students and teaching, institutionally generated student development; commitment to the college and graduation; extracurricular involvement, responsiveness to student complaints and expressed needs, academic programme involvement and success, learning-preferences and teaching-method congruence, compatibility between student and institutional values, student-body characteristics, student participation in student services, student ability to meet college demands, and the provision of a challenging but not unduly stressful environment. All of these factors had been shown to make some positive contribute towards retention.

Lenning’s 1982 review article thus provided researchers with a rich menu from which to select variables for investigation. One can clearly discern disembodied elements of the

theories put forward by Spady, Bean and Tinto (but not Astin) just before the time at which Lenning was writing, and these are discussed below. Lenning discussed issues of fitness for purpose, model building and practicality, but left the manner in which these might influence the selection of variables to the reader's discretion. It is therefore of interest to consider next some of the primary research that has been conducted, in order to bring some structure and focus to the matter.

The Empirical Approach

There is a long tradition of observational studies of student attrition based not primarily on any theoretical precepts but rather on the idea that "relationships are assumed to exist because they are seen to exist" (Bean, 1982b, p. 18). Four such approaches that have been used in the UK are assessed.

HEFCE's Institutional Performance Indicators

The Higher Education Funding Council for England (HEFCE) produces on behalf of the higher education funding councils a set of annual performance indicators for higher education institutions in the UK (1999a *et seq.*).

The approach used to establish institutional benchmarks for these performance indicators is intended to avoid the construction of crude league tables: the performance of particular institutions is not compared directly with national averages or statistics for other institutions but, rather, with each institution's unique 'adjusted sector benchmark', which represents what the UK figure would have been, had the whole sector had the same academic subject mix and student entry qualifications profile as the institution in question. Further adjustments to take into account regional differences in social inclusion have been introduced relatively recently for the purposes of calculating student access indicators, but there is still scope for interactions between age, gender, social class and schooling, for example, to be conflated in such a way as to produce misleading results.

HEFCE's adjustments for institutional subject mix and entrants' qualifications was predated by Johnes and Taylor's (1989) observation that a large proportion of inter-institutional variation in non-completion rates could be explained by these two factors. It is therefore of interest that HEFCE does not also make adjustments for the third variable

identified by Johnes and Taylor as being particularly relevant, which is the proportion of students accommodated in a hall of residence. Perhaps this is because the extent of such provision is viewed to be within the control of the institutions concerned, although the same might also be said of the other two variables. The positive association between retention and living in university accommodation is discussed later in this thesis.

HEFCE shows figures for dropouts and stopouts separately, the former being given greater prominence. The Council points out in its description of the indicators that:

“no account [is taken] of progression, that is of moving from year 1 to year 2. [The indicators] also ignore ... changes of course within the institution, and changes to mode of study. They simply look at whether or not a student is still in higher education after a year ... Students may leave higher education at various times during their first year, or simply not return after the end of the year. When a student leaves very early in the academic year, there may be reasons for this which are unconnected with the course or the institution. To allow for this, we have removed from the figures all students who are recorded as leaving before 1 December in their first academic year” (HEFCE, 2002, p. 7).

Whether this is an adequate reason for excluding early leavers from the institutional and national non-continuation statistics seems doubtful; institutions are surely responsible for the recruitment and selection processes by which such individuals are admitted. A more convincing reason for their omission is that institutions currently do not include such individuals in their routine statistical returns to the Higher Education Statistics Agency.

The largely unidimensional statistics which emerge from HEFCE's analyses suggest that, for the UK as a whole in 1999-2000 (the academic year used for the purposes of this study):

- Young full-time first-degree students were more likely to continue without a break into a second year of study than their mature counterparts (i.e. those aged 21 or over at 30 September of their year of entry) (89% and 82%, respectively);
- Young full-time first-degree students coming from low participation neighbourhoods were considerably less likely to continue without a break into a second year of study than similar students from other neighbourhoods (71% and 91%, respectively);
- Among mature full-time first-degree students there was little difference in the continuation rates between those already holding a higher education qualification and those having no previous higher education qualifications (84% and 82%, respectively);

- There was a clear relationship among young full-time first-degree students between persistence and A-level, AS-level and Scottish Higher scores: the higher the score, the higher the persistence rate (ranging from 87% to 98%). Furthermore, continuation rates for entrants having the lowest A-level scores were at least as good as those having non-A-level/AS-level/Higher qualifications (ranging from 78% to 87%); those students who had attended some form of access or foundation course were exceptional, however (92% persisted).
- Among mature full-time first-degree students the picture was generally the same, although retention rates were generally lower than for younger students;
- Among different subjects of study, medicine, dentistry, and veterinary science had the lowest non-continuation rate among full-time first-degree students (2%);
- At the other extreme, the highest non-continuation rates were to be found in mathematical sciences and computer science (10%), engineering and technology (10%), and architecture, building and planning (10%);
- A largely similar pattern among subjects emerged for mature students but, again, with higher non-continuation rates overall.

These performance indicators are useful as a simple description of the dropout phenomenon. However, their lack of statistical control over interaction terms and the possible omission of confounding variables makes them potentially misleading, particularly if one wishes to understand the causes of attrition and thereby to take corrective action. The statistics have been successful in attracting public attention to issues of non-completion and social inclusion, for example, but Yorke's comments seem well-placed: "In the end there is no substitute for direct engagement with the institutions(s) that [intending students] are considering ... [institutional league tables] cannot give [them] any meaningful appreciation of the nature of the programme that they may be thinking about joining" (2001, p. 156). Notwithstanding these misgivings, this sort of approach is the first to be attempted using University of Glasgow statistics (Chapter 4). Lenning's article (1982) suggests that this is likely to yield a partial but by no means complete explanation of the dropout phenomenon.

Johnes, 1990

Johnes' study (1990) of the determinants of non-completion at the University of Lancaster demonstrates more comprehensive statistical control, enabling her to identify a range of

variables associated with non-completion rates. The most important of these was A-level score. Other variables found to have a positive effect on completion included having attended a grammar or independent school, prior full-time work experience, living closer to the University, being female, being an overseas student, and parental occupations other than skilled worker or housewife. Johnes' main purposes were to improve selection procedures and to identify students at risk. Her work represents a good example of a predictive model rather than an explanatory model. Each of her findings raises interesting questions concerning whether causation, as opposed to correlation, really exists and, if so, what the underlying mechanisms of cause and effect actually are. The potential drawbacks include omitted variable bias and a lack of any indication of the circumstances under which the model might break down. Some but not all of Johnes' findings were subsequently borne out using national data, as described below.

Smith and Naylor, 2001

Smith and Naylor's analysis (2001) of the probability of non-completion in the 'pre-1992' universities was based primarily on data collected nationally by the Universities Statistical Record, as well as by the Department for Education and Employment. This is the most sophisticated analysis to date using national UK data.

They demonstrated that for the 1989 entering cohort there had been a significant difference between the non-completion rates for males (10.3%) and for females (7.1%). They used probit analysis to demonstrate *inter alia* the beneficial effects on completion rates of A-level and Scottish Higher point scores and of a closer fit in terms of subject content between school and university studies, particularly for students taking science-based degree subjects. They also observed a significantly beneficial effect of marriage for males, but not for females. The deleterious effects of increasing age and of having attended an independent school (contrary to Johnes' earlier, smaller-scale results) were also highlighted. Students having parents in Social Class I were found to be more likely than others to complete their degrees but, otherwise, there were no discernible differences among the social classes. Separate results were reported for students from outwith the UK, but some doubt is perhaps appropriate here, because many non-UK European students, in particular, may not, in fact, intend to complete a full degree programme in the UK, and it is not clear how such students were treated in the analysis.

Students who live at their parental addresses were found to be less likely to complete their degrees, although their attrition rates were not so severe as other students living off-campus. Those living on-campus were the most likely to persist, which Smith and Naylor interpreted as an indication of the importance of Tinto's concept of Social Integration. They also found different completion rates for students studying different subjects. Gender seems to have been relevant in this context, with different rates of completion evident for the sexes in several different subject areas. For females non-completion rates were relatively high, compared to those studying the social sciences, for those studying computing, modern European languages, other languages, architecture and building, and literary and classical studies. For males non-completion rates were relatively high in the biological sciences, physical sciences, mathematics, computing, engineering, technology, literary and classical studies, modern European languages and other languages. Why these differences should have existed remains a matter for conjecture, and serves as a good example of the limitations of this type of approach.

Smith and Naylor looked at various measures of similarity among students within particular university departments in order to find out whether their likeness influenced completion rates. The assumption was that students having the same background traits (gender, type of schooling, social class, tuition-fee-paying status, overseas origin, and age band) might integrate more effectively and therefore be less prone to drop out. They did not detect any particular differences, although it transpired that the greater the proportion of students from the independent school sector in a given university department, the more probable their completion. Whether this was an Oxbridge phenomenon, for example, is not discussed; institution-level effects appear possibly not to have been controlled in this part of Smith and Naylor's work.

They also explored the effects of levels of unemployment in the counties from which students originated. They found that lower-class males from counties with high unemployment rates were less likely to complete their degrees, suggesting that such individuals in particular may be in need of greater financial support and that, additionally, the recruitment of such individuals might be detrimental to the apparent performance of institutions. These issues are relevant to the agenda of improving social inclusion in higher education, but they are not discussed here.

Smith and Naylor also compared unadjusted institution-level rankings of non-completion with the same rankings computed as marginal effects in the main model of individual

student completion, the results of which are summarised above. The two sets of rankings were noticeably different, and the confidence intervals for particular institutions were wide, casting considerable doubt on the validity of institutional comparisons such as those produced by HEFCE, for example. A multilevel analysis of the data might throw some additional light on the matter but, again, this issue is not pursued here.

The logistic regression analyses introduced in Chapter 5 are analogous in some ways to Smith and Naylor's work, although the resultant models have fewer explanatory variables, and use first-year dropout as the response variable rather than non-completion of a degree. Smith and Naylor's analysis is the most comprehensive to date in the UK, and makes a valuable contribution to our appreciation of how academic preparedness and certain aspects of social integration, in particular, affect completion rates. These are issues that are pursued in more detail in later chapters.

Yorke et al., 1997

In April 1996 HEFCE commissioned two reports on undergraduate non-completion in England.

Ozga and Sukhnandan (1997) investigated the usefulness of centrally held administrative data at three universities. In addition, they conducted some qualitative research at one of them, concluding that students' levels of preparedness and compatibility with their institution and with their chosen courses were important determinants of attrition. Their conclusions were elaborated in a second paper the following year (Ozga and Sukhnandan, 1998), and this is considered subsequently in this chapter.

The results of the other report (Yorke *et al.*, 1997) are considered here, and a critique of the methodologies, as well as those of Ozga and Sukhnandan (1997), is provided in the next chapter.

Yorke's approach was essentially to enumerate and then group together by means of factor analysis students' stated reasons for leaving. In that way he derived a list of eight factors "bearing on" the non-completion for full-time and sandwich students. The eight most important factors are shown in Appendix 2.1.

The factor analysis was exploratory by nature. Consequently, the results are to be interpreted as a list of reasons for departure, rather akin to Lenning's list above and without any explanation as to how they may have arisen or how they may have interacted with or compounded each other. For example, two of the three most important variables cited are "chose wrong field of study" and "lack of commitment to the programme". The sequence in which these perceptions arose and the extent to which they may have influenced each other is important. A student who has little predisposition to be committed to anything is unlikely to develop an affinity with any course of study, and is therefore very likely to conclude that she or he has chosen wrongly. On the other hand, a strongly motivated individual who had been misled by an institution's promotional literature could very conceivably experience a substantial loss of commitment to a programme. As a second example, the first factor in Appendix 2.1 includes items that refer to the role of expectations and to the effects of an inadequate academic experience; it would be of interest to disaggregate these effects. (The role of expectations is discussed in more detail below.) Thirdly, it can be appreciated that accommodation problems and not making friends (both factor 2) are two aspects of the same problem for some students, but whether all students would feel similarly disadvantaged is open to question.

The study is nonetheless useful, because it does identify issues which merit further investigation. However, in the absence of any causal explanations, it would be difficult to draw firm conclusions. While the constructs derived by factor analysis each have the merit of consistency with common sense this does not, unfortunately, provide a secure foundation for quantifying either the interplay or the relative importance of the variables identified.

Among the variables described specifically by Yorke are entry through Clearing, Academic Subject Category, gender, age, social class, and ethnicity. These are considered in greater detail later in this study.

Entry through Clearing: Yorke was surprised not to detect any evidence to suggest that dropouts who had entered the system through the Clearing process had been particularly prone to pick the wrong subjects. He was not convinced by the results, and called for further investigation.

Academic Subject Category: Yorke was cautious in drawing conclusions, but perceived difficulty in the Science-based programmes manifesting itself in the reasons given for

withdrawal from this area. Criticism of programme organisation and the quality of teaching in Art, Design and the Performing Arts was also particularly noticeable.

Gender: Males were more likely than females to cite academic and financial difficulties; females were more affected by homesickness. Older females were the most likely to withdraw because of the needs of dependants.

Age: For the purposes of the analysis, age was dichotomised, with those aged 21 and over studied separately from those aged under 21. It appeared that older students were affected particularly by financial problems and the needs of dependants; younger students reported that they had been influenced more by academic problems and issues which might be seen as shortcomings in life skills: accommodation difficulties, problems making friends, and homesickness, for example.

Social class: Working class students were affected more by financial problems, the intrusion of paid work and travel difficulties.

Ethnicity: The number of non-white respondents was too small for Yorke to be able to draw anything other than the most tentative conclusions. :

The main point to note at this stage is that this was *post-hoc* qualitative research. Its main advantage is in exposing issues for further examination. However, the results can only be very tentative. Some of the issues raised were used to guide the primary research conducted for the purposes of this study, and these are referred to in Appendix 2.10 and in Chapter 6.

HEFCE's Report to the Select Committee on Education and Employment

Drawing on the conclusions of Yorke *et al.* (1997) and of Ozga and Sukhnandan (1997), the Higher Education Funding Council for England subsequently (HEFCE 2001 – HE137) reported to the House of Commons Select Committee on Education and Employment's inquiry into retention (2001) that five broad groups of reasons for non-completion had been identified:

“(a) Incompatibility between the student and their [sic] course or institution. When applying to an HEI, students do not always have sufficient information on the institution or course. This can lead to difficulties if the academic or social reality does not meet with the student’s expectations.

“(b) Lack of preparation for the HE experience. Some students do not have the self-management skills to live away from the parental home, or the study skills to cope with HE.

“(c) Lack of commitment to the course. Parental or peer group expectations are often the main reasons a student applies to HE; obtaining a degree can often be low down on the list of reasons for applying.

“(d) Financial hardship. Such hardship was frequently cited as an influence on withdrawal, though the researchers found that this was a supplementary rather than the sole reason.

“(e) Poor academic progress.”

It was also reported that the researchers had concluded that “non-completion was a complex process which usually could not be explained by a single factor”.

But what should only have been tentative conclusions, given the provisional nature of the primary research, became very public assertions of fact. The extent to which they are borne out by the current study is considered in the final chapter.

Conclusions on the Empirical Approach

This brief review of what might be described as the empirical or lightly theorised approach to the study of student retention tends to bear out Lenning’s original contention that there a large number of relevant variables. These consist of relatively objective attributes, such as background characteristics and prior academic achievements, as well as attitudinal data. The studies described so far have tended to emphasise one of these perspectives, while neglecting to varying degrees the other. It seems likely that a comprehensive explanation of the dropout process would require each of these types of variables to be interwoven with one another. Considerable efforts have been devoted in the past to the achievement of such an outcome, and this is discussed below.

The Theoretical Perspective

Given the almost bewildering selection of possible explanations of attrition, it is perhaps not surprising that some researchers have been moved to search for more parsimonious and integrated theories of attrition. American authors have commented somewhat disparagingly on the atheoretical descriptions of attrition produced by their forerunners. For example:

“Beyond a few comfortable and familiar generalizations about the relationship between attrition and family background, ability, or academic performance, [the] literature [on student attrition] lacks both theoretical and empirical coherence” (Spady, 1970, p 64).

“ ... there appears to be a wealth of statistically reliable, *ex post facto* associations that offer a markedly unparsimonious explanation of the dropout process” (Pascarella and Terenzini, 1980, p. 60).

“Emphasis has been on portraying the statistically significant correlates of persistence/withdrawal behavior, with scant attention given to understanding the underlying dynamics of the phenomenon” (Pascarella and Terenzini, 1983, p. 215).

There have been numerous attempts over the past thirty years in the United States, in particular, to produce a theory-driven explanation of student attrition. Success to date has been only partial, however. These endeavours are reviewed below with particular reference to Vincent Tinto’s Student Integration Model, which has received by far the most attention in the literature.

Tinto’s first (1975) version of his theory was, in fact, predated by Spady’s theory (1970, 1971), and the latter is the first of these two frameworks to be described below. By way of contrast, two other, early models of student attrition are also described: first, John Bean’s Student Attrition Model and then Astin’s Integration Model. Although these models approach the issue of student attrition from standpoints that are different from Tinto’s, they are not inconsistent with it, and attempts have been made in recent years to combine some of the constructs of Bean’s and Astin’s models with those of Tinto. The relevance to student attrition of Bourdieu’s theory of social reproduction has attracted interest in recent years and this, too, is reviewed. A more recent and more parsimonious model of undergraduate non-completion, proposed by Ozga and Sukhnandan (1998) is also considered.

Spady's "Sociological" Model

Spady (1970, 1971) was the first author to formulate a multivariate, longitudinal model of student attrition. His "sociological" model includes without detailed elucidation two concepts which he considered to have parallels in Durkheim's (1897) theory of egoistic suicide, and which made up what Spady called "social integration". These are "normative congruence", in other words, "having attributes, interests and personality dispositions that are basically compatible with the attributes and influences of the environment" (Spady, 1970, p. 77) and "friendship support", which was "the establishment of close relationships with others in the system" (ibid.). It should perhaps be remarked that in drawing analogies such as these Spady appears to have been drawing on a narrow and idiosyncratic interpretation of Durkheim's work. In writing about suicide, Durkheim's prime concern was to offer an explanation that was not in some way unique to the individual concerned but, rather, one that illustrated how wider sociological phenomena might influence the behaviour of societies as a whole rather than particular individuals within them. This, in turn, was part of Durkheim's long-standing interest in the evolution of different forms of social solidarity, first articulated in "The Division of Labour" (Durkheim, 1893). Spady's analogies therefore depend on a very selective reading of Durkheim's writing.

Spady's model is illustrated diagrammatically in Appendix 2.2. Spady argued that various aspects of a student's family background influence his or her academic potential and normative congruence. Academic potential is operationalised in terms of various aspects of pre-college academic achievements. Normative congruence, as noted above, is the student's ability to accommodate the influences and pressures encountered in a new college environment. Normative congruence influences friendship support and each of these two variables then combine to determine levels of social integration.

However, full integration depends also on academic success. Academic potential, coupled with normative congruence, influence both grade performance and intellectual development. The latter two constructs then combine with normative congruence and friendship support to affect social integration. Social integration then influences a student's level of satisfaction with the college experience and this, in turn, influences commitment to the institution and the dropout decision. In a minority of cases a student's grade performance is so poor as to exert a direct influence on the dropout decision. A feedback loop from institutional commitment to normative congruence is also posited, emphasising

that the “model is cyclical and flexible rather than immutable” (Spady, 1970, p. 79), and suggesting that changes in a student’s attitudes, goals and motivations will have knock-on effects on the various constructs contained within the model throughout his or her college career.

Spady’s operationalisation of these constructs was dependent on what might unkindly be described as a “kitchen sink” approach, having both the strengths (empirical support) and the weaknesses (lack of parsimony) of being derived from all of the best of the research literature extant at the time of his writing.

Family background consisted of “cosmopolitanism” and “family relationships”. The former was made up of:

- Religious-ethnic origin (using a nominal scale)
- Degree of urbanisation
- Father’s education level
- Mother’s education level
- Father’s occupation

Family relationships consisted of:

- A measure of parental marital stability
- The student’s view of the general happiness of his previous home life
- Perceived freedom from family rule
- Psychological independence from parents

Normative congruence consisted of:

- Patterns of relationships and expectations generated in the high school context
- Various personality dispositions
- Measures of intellectual, moral and vocational values
- Attitudes towards the University of Chicago (where the research was conducted)
- Three measures of campus subcultural orientation (political, extracurricular and academic)

Academic potential was operationalised in terms of:

- Scholastic Aptitude Test (SAT) Verbal and Mathematical scores
- Rank in high school class
- High school quality

Friendship support depended upon the self-reported quality and quantity of students' relationships with peers.

Intellectual development was taken as the student's self-reported "stimulation in his course work, the expansion of his intellectual and cultural perspectives, his ability to think systematically and critically, and his perceived excellence in his academic work" (Spady, 1971, p. 44).

Social integration was measured as:

- A student's sense of belonging and fitting in at the University of Chicago
- Reactions to the general warmth of interpersonal relationships on campus
- Perceived absence of pressures arising from normative differences between the respondent and other students

Satisfaction was obtained from a single questionnaire item asking respondents how satisfied they were with the year so far.

Institutional commitment was also derived from a single questionnaire item asking students how important it was for them to graduate from the University of Chicago.

The model is a marrying together of a myriad of variables, most of which were known to be associated with retention rates. It contains many of the constructs that were subsequently to reappear in Tinto's model, although Tinto dropped many of the psychosocial variables. Spady placed less emphasis on the role of faculty than did Tinto. Some constructs were operationalised using only one questionnaire item, raising doubts concerning both validity and reliability. Spady's analysis was conducted using a series of multiple linear regression models rather than a single structural equations model. It is not always clear how the various subscales were handled statistically. Interaction terms, in particular, appear to have been overlooked. The empirical model that Spady derived

contained a large number of relatively weak dependencies. Although the model appears to give a pivotal role to social integration, his main conclusion was that “formal academic performance is clearly the dominant factor in accounting for attrition among both sexes” (Spady, 1971, p. 38). Although Spady’s model contains many intuitively appealing features, it has been largely superseded in the literature by Tinto’s similar but more parsimonious Student Integration Model.

Tinto’s Student Integration Model

The best established and most tested theory of student attrition is Tinto’s Student Integration Model (Tinto, 1975; 1987; 1993). The longitudinal nature of the model may be more fully appreciated when it is shown diagrammatically (Appendix 2.3). Put succinctly:

“The Tinto (1975) model views the process of voluntary student departure as longitudinal. Tinto postulates that students bring with them to college a set of traits (e.g., ethnicity, secondary school achievement, parental encouragement for college, and family socioeconomic status) that influences their initial levels of commitment to the institution of attendance and to the goal of college graduation. Both student entry traits and initial levels of commitment affect the degree to which an individual becomes integrated into the institution’s academic and social communities. Other things being equal the greater the individual’s level of academic and social integration, the greater his or her subsequent level of commitments to the goal of college graduation and to the institution of attendance. These subsequent commitments, in turn, have a direct influence on the persistence of the individual student.” (Braxton, Vesper, and Hossler, 1995).

Tinto argued that colleges have both academic and social systems. The same actors – students, faculty and (support) staff – have roles to play in each of these two systems. Whereas the academic system is focused on the college’s formal academic requirements, social interactions take place for the most part outwith formal academic settings.

Being integrated into one of these systems can depend to some extent on being integrated into the other. In other words, neither effective academic integration nor effective social integration is a precondition for the other, but there can be interaction effects (both good and bad) between the two. For example, too much studying may damage one’s social life, and feelings of loneliness may have a detrimental effect on academic performance. On the other hand, feelings of academic and social well-being may reinforce one another.

Academic integration and social integration both have a formal and informal dimension. Tinto argues that informal contact with faculty outwith the classroom is critical and, even though the same people may be involved, this is distinct from formal contact between students and faculty in classrooms and laboratories. The social system may also be portrayed as having a formal and an informal part. The former may consist of organised extracurricular activities; the latter may consist of personal friendships and other social activities not referred to in the institution's rules and regulations.

Inevitably, there will be "important interplay" (Tinto, 1993, p. 108) between all aspects – formal and informal – of academic and social integration which are "invariably interwoven" (p. 109).

External forces and external choices may affect the interactions and commitments occurring in college life. Again, the effects of these externalities may be either positive or negative. Families can be supportive, for example, but commitments to one's employers and dependants can detract from one's commitments to college.

Tinto sought to place his theory in the context of Van Gennep's study of "The Rites of Passage" (1909). This is a social anthropological explanation of transitions and their associated rituals which Tinto variously described as "the ascent of individuals from youth to adult status in society" (Tinto, 1993, p. 92) and "the movement of a person or group from one place to another. In that movement, the individual or group leaves an old territory or community (separation), in some fashion crosses a border, whether it be physical or ceremonial, to a new setting (transition), and takes up residence in the new location or community (incorporation)" (Tinto, 1993, p. 93). The distinction between movements within and between cultures is an issue that Tierney (1992) has raised, and this is described below.

Tinto argued that analogies to the three stages of transition in Van Gennep's theory – separation, transition, and incorporation – can be found in the higher education setting. This, he argues, is useful in conceptualising the time-dependent manner in which students become members of the university community (or, alternatively, fail to do so). As such, it can provide an interactional perspective on the early stages of the dropout phenomenon.

The separation phase can be helped or hindered by the extent to which students are able to disassociate themselves from the communities (such as family, friends and school) of their

past. Those attending non-residential colleges may therefore find separation less traumatic. However, the price they pay comes in the form of only loose membership of the college community; for them, college life is less stressful, but also less rewarding. More specifically,

“individuals from disadvantaged backgrounds and/or from families whose members have not attended college may ... find separation more painful than would persons whose parents are themselves college educated. Similarly, foreign students, students from very small rural communities, and students from distinct social, ethnic, or religious communities may also find separation particularly difficult” (Tinto, 1993, pp. 96-97).

Successfully navigating the transition stage depends partly on the extent of the difference between the norms in a student's pre-college and college lives. The greater the gap, the bigger the difficulty. It also depends on an individual's ability to become integrated in the social and academic fabric of the college and her or his ability to withstand the stresses which such transitions often entail.

The third and final stage – that of incorporation – can be facilitated by freshers' orientation programmes, for example, although, in general, it depends on individual efforts: “... daily personal contacts with other members of the college, in both the formal and informal domains of institutional life, are the ... vehicles by which incorporation occurs” (Tinto, 1993, p. 99). Failure to achieve incorporation then leads to withdrawal.

Tinto turned to Durkheim's theory of suicide (1897) to explain the manner in which incorporation takes place. In so doing, he was following in the earlier footsteps of Spady (1970, 1971). Again, only a very limited part of Durkheim's work is borrowed. In drawing an analogy between suicide and withdrawal Tinto's purpose was not to imply that withdrawal necessarily leads to suicide, or even that it represents a form of suicidal behaviour. Rather, he wished to draw attention to the idea that each of these behaviours constitutes a form of voluntary withdrawal from society and a rejection of the norms of that society.

Durkheim had differentiated among four types of suicide: egoistic (or 'egotistical') altruistic, anomic, and fatalistic. Tinto focused in particular on this first type of suicide. Egoistic suicide stems from the failure of individuals to become integrated into the societies in which they find themselves. Tinto chose to distinguish in Durkheim's writing two types of egoistic suicide, resulting from a lack of social and intellectual integration,

respectively, and Tinto then replicated this distinction in his theory. He explained that Durkheim's concept of social integration "refers to that form of integration which results from personal affiliations and from the day-to-day interactions among different members of society", and that intellectual integration "... comes from the sharing of values which are held in common by ... members of society" (Tinto, 1993, p. 101). An individual's failure to be integrated may be caused by that person's social isolation or by her or his holding deviant values. Social isolation may encourage the holding of deviant values, and *vice versa*. Generally, "societies with high rates of suicide are those whose social conditions are such as to constrain [social and intellectual] membership. They are malintegrated societies where the incidence of social and intellectual isolation and deviancy is relatively high" (Tinto, 1993, p. 102). This is again a selective and idiosyncratic interpretation of Durkheim's work. While Tinto's main purpose was to develop a theory of individual student departure, he also pointed out that the analogy with egoistic suicide leads one to suppose that those institutions that are best able to help their students to integrate into their social and intellectual systems should have the lowest attrition rates.

The validity of Tinto's analogies with the work of both Van Gennep and Durkheim have subsequently been challenged, and these criticisms are described below. However, it is convenient first to consider the strength of the empirical support that has been found for his theory.

Braxton, Sullivan, and Johnson's Appraisal of Work on Tinto's Model (1997)

Tinto's model has proved to be a rich source of testable hypotheses. Braxton, Sullivan and Johnson (1997, p. 112) identified fifteen such propositions (Appendix 2.4):

- P1. Student entry characteristics affect the level of initial commitment to the institution;
- P2. Student entry characteristics affect the level of initial commitment to the goal of graduation from college;
- P3. Student entry characteristics directly affect the students' likelihood of persistence in college;
- P4. Initial commitment to the goal of graduation from college affects the level of academic integration;
- P5. Initial commitment to the goal of graduation from college affects the level of social integration;

- P6. Initial commitment to the institution affects the level of social integration;
- P7. Initial commitment to the institution affects the level of academic integration;
- P8. The greater the level of academic integration, the greater the level of subsequent commitment to the goal of graduation from college;
- P9. The greater the level of social integration, the greater level of subsequent commitment to the institution;
- P10. The initial level of institutional commitment affects the subsequent level of institutional commitment;
- P11. The initial level of commitment to the goal of graduation from college affects the subsequent level of commitment to the goal of college graduation;
- P12. The greater the level of subsequent commitment to the goal of college graduation, the greater the likelihood of student persistence in college;
- P13. The greater the level of subsequent commitment to the institution, the greater the likelihood of student persistence in college;
- P14. A high level of commitment to the goal of graduation from college compensates for a low level of commitment to the institution, and *vice versa*, in influencing student persistence in college; and
- P15. A high level of academic integration compensates for a low level of social integration, and *vice versa*, in influencing student persistence in college.

Braxton, Sullivan, and Johnson used a “box score” approach as a means of summarising the extent of the empirical support that had been reported in the literature for each of these fifteen propositions. In particular, empirical support was classified as “strong” provided 66% or more of at least three tests of a given proposition had been found to be statistically significant. The quality of the work and the soundness of the statistical techniques were not assessed; Braxton, Sullivan, and Johnson assumed that, by taking into account only peer-reviewed material, adequate standards of research quality would be assured.

Braxton, Sullivan, and Johnson discovered that out of the fifteen testable propositions stemming from Tinto’s model, only five are strongly supported empirically, taking into account the literature on single-institution tests (Appendix 2.5). Four of these propositions are interrelated: (a) entry characteristics affect the initial level of institutional commitment which, in turn, (b) affects subsequent levels of institutional commitment; (c) subsequent levels of institutional commitment are also positively affected by social integration; and (d) subsequent levels of institutional commitment influence actual student persistence. One

difficulty with this schema is that it leaves social integration unexplained. It also implies that there is no strong support for the role of academic integration and goal commitment (both initial and subsequent) in explaining persistence.

By contrast, Braxton, Sullivan, and Johnson concluded that the multiple-institution tests showed that initial and subsequent goal commitments, rather than institutional commitments, are relevant to persistence (Appendix 2.6).

Of some concern to protagonists of Tinto's model must be the unexplained lack of empirical consistency between these two sets of results and the lack of any strong support for the role of academic integration in the model. These have led Braxton (2002) to call for the revision of the theory but not its abandonment.

A Social Interactionist Perspective of Tinto's Theory

McKeown, Macdonell, and Bowman (1993) offer various criticisms of Tinto's model, and take a social interactionist view in suggesting how research in this area should instead be approached.

Their line of criticism starts with the observation that the background variables contained within Tinto's model are just as subject to "wandering variable selection" (in other words, chosen at the discretion of the researcher) as they had been previously; Tinto provides no theoretical framework upon which to base their selection.

More subtly, the connection between Durkheim's and Tinto's work is by no means clear-cut. Referring to the student experience, Darden and Kuhn had asserted that:

"Durkheim's model described an entirely different phenomenon. It referred to people who were not integrated into life, who lacked significant human ties – people who were unmarried, childless, living with no religion in a society lacking mechanisms for such people to establish ties. Subsequently, these people were not even marginal people for the most part, but unconnected people"(1985, p. 161).

Insofar as academic and social integration might not closely be related to Durkheim's theory they, too, are subject to "wandering variable selection". There is little in Tinto's theory to suggest how these concepts should be operationalised; this, too, is left for other researchers to decide. Indeed, the model is "remarkably plastic", in that it "allows the

inclusion or exclusion of variables in a strikingly free fashion” (McKeown, Macdonell, and Bowman, 1993, p. 72). This encourages the addition of extra variables, such as the role of finances, but with an inevitable loss of parsimony. That Tinto’s model works at all is not due to insightfulness on the part of Durkheim, but on the part of Tinto and those who have operationalised his model, according to McKeown, Macdonell, and Bowman. This is not to deny the importance of these insights. McKeown, Macdonell, and Bowman acknowledge that Tinto’s theory has the merit of being related to a key sensitising concept in sociology to the effect that “our behaviour is profoundly affected by the nature of relationships we have with other people and the extent to which we share certain values” (1993, p. 71). The idea of “fitting in” and the acknowledgement that attrition is affected not just by background factors but also by students’ experiences after they have been admitted to college are very potent. They argue that the theory should be treated as containing certain interesting and useful ideas that should be “treated as loosely sensitizing concepts and not as a theory from which testable propositions may be usefully be derived” (1993, p. 67).

McKeown, Macdonell, and Bowman suggest that an appropriate starting point for the identification of common patterns of shared meanings capable of generalisation would, instead, be to study the perspective of the different actors in the dropout process. Thus: “understanding the actions of students and other players in the university should begin with an effort to grasp the meanings these elements have for them. Unless there is a grounding in that empirical world, all of the adding of variables, clarifying of operational definitions, and improving of statistical techniques are likely to be of limited value” (1993, p. 76). “The decision to drop out is in part a product of the meanings students individually attach to the various experiences in their lives” (1993, p. 75). The difficulty with any theory-based model is that it begins instead with “assumptions about the meanings held by students as they engage in working their ways through and out of universities” (1993, p. 75).

McKeown, Macdonell, and Bowman’s assertion that it would be premature to define sociological concepts definitively without focusing on the point of view of the different actors involved is perhaps overemphasised, given the very considerable extent of the primary research that has taken place in this area. As they themselves point out, one of the attractions of Tinto’s theory is that by including background variables it assimilates the best of the empirical work extant at the time it was conceptualised. Additionally, they acknowledge that “long before this model was introduced, efforts had been made by

postsecondary institutions to encourage ‘fitting in’”(1993, p. 71). Tinto’s constructs of academic and social integration appear to have been based at least to some extent on a common perception of reality. Nevertheless, the comment that “whatever students are integrated into, it may be something very different from the image emerging from the model” (1993, p. 78) still rings true; conceivably it could be “small informal social networks” rather than Tinto’s grander, all-embracing concepts of academic and social integration.

The substantive point that rises from McKeown, Macdonell, and Bowman’s article is that if one’s purpose is to offer a comprehensive explanation of student attrition, then it would be wise first to explore how the student experience is viewed and interpreted by the various actors concerned. To do no more than select and test an off-the-shelf theoretical framework of student attrition is likely to be much less informative.

A Critical Perspective of Tinto’s Theory

In marked contrast to the work of Tinto and others, Tierney (1992) offers a critical theorist’s approach to the issue of student attrition, focusing on the experience of Native Americans in postsecondary education. This is contrasted to the functionalist approach taken by writers such as Spady and Tinto, for example, in Appendix 2.7.

Tierney takes issue with the appropriateness of Tinto’s analogies with the constructs of cultural anthropology. In particular, Tierney identifies two flaws with the way in which Van Gennep’s rituals of transition have been grafted into the setting of ‘Anglo’ higher education. Specifically, Van Gennep had not conceived of rituals of transition as a means of bridging a movement from one culture to another, although this is what is, according to Tierney, being hypothesised by Tinto. Secondly, the concepts of success and failure are simply not applicable to rites of passage: initiation rituals are designed only for success. Tinto’s theory, on the other hand, accepts that some initiates will leave or fail. However, neither of these seems to be a powerful objection. First, it is not clear that Tinto is suggesting that the transition to university life is indeed a movement from one culture to another any more than a transition from youth to adult status, as described by Van Gennep. Secondly, the emphasis on initiation rituals as such is Tierney’s rather than Tinto’s; Tinto points out that such rituals are diffuse and low-key at best in a higher education setting.

A further objection that Tierney has to Tinto's model is that it is implicitly based on the premise that all individuals perceive the world in a similar fashion. This is in contrast to critical theorists' view that any organisational setting will be comprised of multiple realities. "A model of integration that never questions who is to be integrated and how it is to be done, assumes an individualist stance of human nature and rejects differences based in categories such as class, race and gender" (Tierney, 1992, p. 49-50).

Tierney rationalises the "dropout" phenomenon in the following manner: "Instead of appropriating the cultural capital of mainstream society, many minority students either decline to participate in higher education, or they resist the dominant ethos at work in white institutions and leave" (1992, p. 51). Braxton, Sullivan, and Johnson (1997) observe that a "fully developed model based on a critical theory perspective, however, does not yet exist for scholars to weigh further the potential contributions of critical theory to understanding retention; and such a theory is needed before scholars can fully determine the value of a student departure model derived from a critical theory perspective" (1997, p. 154). However, to call for a "fully developed model" is surely to misunderstand the critical perspective.

The absence of such a model does not prevent Tierney from producing some policy prescriptions aimed at improving retention among minorities such as Native Americans. These include a modification of curriculum and pedagogic style, as well as the need to "socialise faculty to the learning styles and lives of those whom they educate" (1992, p. 153). His recommendations may be interpreted as prescriptions for institutional adaptation to embrace more effectively the needs of various clienteles. It is not clear whether Tierney's view is that the betterment of the position of Native Americans should be achieved at the expense of others or whether some form of Pareto optimisation is to be preferred.

Tierney's critical approach is attractive particularly if one's primary objective is to define an agenda for the amelioration of attrition, because it focuses attention on the institution, which is where initial responsibility for such matters must lie. However, it is likely to be incomplete as an explanation of the dropout phenomenon, because of its relative neglect of certain important student-specific factors that have been demonstrated to be relevant, such as background characteristics and integration. Tierney's work serves as a reminder, though, that to neglect issues such as curriculum, teaching methods, support services, and institutional ethos will also limit the explanatory power of one's analysis.

Conclusion on Tinto's Student Integration Model

Notwithstanding its failure to be fully confirmed in practice (Braxton, Sullivan, and Johnson, 1997) and some dubiety concerning its theoretical underpinning (McKeown, Macdonell, and Bowman, 1993; Tierney, 1992), Tinto's Theory of Student Integration has proved to be very attractive, and has been the catalyst for a considerable amount of research in this area. Some of the elaborations that have been made on the theory are considered below.

Bean's Work Turnover Model of Student Attrition

John Bean (1980; 1982a; 1983) sought to develop a theory of student attrition by borrowing concepts from the Price-Mueller model of workplace turnover in work organisations (Price, 1977; Price and Mueller, 1981). Bean's central thesis was that student attrition is analogous to the turnover of employees in a work organisation.

Bean regarded his model as being both "longitudinal" and "tentative". The model, as initially (1980) formulated, contained four types of explanatory variables: background characteristics (as in Spady and Tinto's models); organisational determinants; satisfaction; and institutional commitment (used also by Spady and Tinto). Bean described the process by which these constructs were related thus:

"the background characteristics of students must be taken into account in order to understand their interactions within the environment of the IHE. ... Next, the student interacts with the institution, perceiving objective measures, such as grade point average or belonging to campus organizations, as well as subjective measures, such as the practical value of the education and the quality of the institution. These variables are in turn expected to influence the degree to which the student is satisfied with the IHE. The level of satisfaction is expected to increase the level of institutional commitment. Institutional commitment is seen as leading to a degree in the likelihood that a student will [not] drop out of school." (Bean, 1980, pp. 158, 160).

To be consistent with a model of staff turnover, and as a matter of practical expediency, dropouts were taken to include transfers to other institutions of higher education.

Price (1977) had placed particular emphasis on pay in influencing worker turnover. Recognising that there is no direct equivalent of pay in the student experience, Bean initially used four surrogates for pay in his student attrition model. The most important was

grade point average. The others included development and institutional quality, because these were expected to influence a student's potential earning power. Fourthly, the student's assessment of the practical value of his or her education in obtaining a job was taken into account.

In the second published version of his model (1982a), Bean reduced the number of explanatory variables from 23 to 10. Significantly (and unusually) Bean dropped background characteristics from the model, by then claiming that pre-matriculation characteristics do not contribute significantly to explained variance in dropout. He used "intent to leave" as the penultimate variable in the causal path, acknowledging that it is an "empty variable" because "if people leave because they intend to leave, one still does not know why they leave" (Bean, 1982a, p. 296). He justified the inclusion of this variable on the grounds that (a) not surprisingly, it considerably improved the predictive power of the model; (b) to do so would be consistent with the theory that attitudes and past behaviour act through intentions to affect future behaviour (dropping out, in this case) (Fishbein and Ajzen, 1975); and (c) it allows the distinction to be made in the path model between direct influences on departure and indirect influences which affect departure only through intent to leave. The other nine variables included family approval of the institution, the importance of which has subsequently been alighted upon by other researchers, as explained below.

A schematic representation of the Price-Mueller model, translated into the vocabulary of student attrition as it appeared in Bean's third major publication on this issue (Bean, 1983), is shown in Appendix 2.8. Bean retained the overall structure of the Price-Mueller model, and the manner in which the individual elements were redefined (Bean, 1983, p. 134) may be summarised as follows. Satisfaction with being a student replaced job satisfaction. Intent to leave required no definitional change. Routinisation referred originally to repetitive work, and was surmised to have a negative effect on job satisfaction; it was reinterpreted as "the degree to which being a student is repetitive". Participation referred specifically to participating in job-related decisions, and became the "degree of power that a student exercises in classroom decisions". Instrumental communication meant being informed about job-related issues, and became the "degree to which information about being a student is transmitted by the institution to its students". Integration was narrowly defined as having close friends employed by the same organisation, and this was readily converted into a higher education setting. Distributive justice meant being fairly

compensated, and was converted by Bean into the “degree to which rewards and punishments are related to the amount of input into the student role”, but it is not clear how this was operationalised in practice. Receiving good pay was assumed to be important in a work setting, but could not be directly converted into an educational setting, and consequently necessitated the use of surrogate measures, as noted above. Academic courses were seen as being analogous to job content: both should have a positive effect on satisfaction. Membership of campus organisations was seen as being similar to professionalism. Whereas membership of (external) professional organisations and attendance at the meetings of professional organisations was believed ultimately to have a negative effect on retention in work organisations, it was supposed that membership of (internal) campus organisations would increase student retention. Opportunity to get another job became opportunity to transfer to another college, and would therefore increase intentions to leave. Kinship responsibility to one’s spouse and children had to be modified in view of the nature of the sample of students being analysed, and was operationalised as the likelihood that a student would marry before graduating. It was argued on rather specious grounds that marriage would increase intent to leave.

The dependent variable used was no longer a simple binary variable. Instead, Bean argued that behaviour taking place at the time when an attitudinal or intent measure is taken should be weighted more heavily than subsequent behaviour. This resulted in arbitrary weights being attached to the enumeration of dropouts.

It transpired that by far the most important explanatory variable for dropout was intention to drop out, which is not surprising. Otherwise, the results were disappointing: “although initially useful as an organizing concept, the industrial model is not sufficient to explain the dropout process” (Bean, 1983, p. 146). The model may also be criticised as having the same type of weakness as Tinto’s model, in that it appears to depend strongly on what the researcher assumes to be of importance to students, rather than being derived from what students themselves perceive to be relevant. Social interactionists might therefore find fault with the realism of the models’ assumptions, whereas positivists might highlight its lack of predictive power. Perhaps for these reasons there has since been relatively little attention given to Bean’s models. More recent attempts to meld together Bean’s and Tinto’s models are described under the heading of “Elaboration of Tinto’s Theory” below.

Astin's Theory of Involvement

Astin saw involvement as being crucial to student development and retention, in particular. He defined involvement in behavioural terms: “It is not so much what the individual thinks or feels, but what the individual does, how she or he behaves, that defines and identifies involvement” (Astin, 1984, p. 298). His theory of involvement has five basic postulates:

- Involvement is both physical and psychological, and can be associated with phenomena of differing levels of specificity;
- There can be different levels of involvement, both between individuals, and within the same individual at different times;
- Involvement has both qualitative and quantitative dimensions;
- “The amount of student learning and personal development associated with any educational program is directly proportional to the quality and quantity of student involvement in that program”; and
- “The effectiveness of any educational policy or practice is directly related to the capacity of that policy or practice to increase student involvement” (Astin, 1984, p. 298).

In his earlier work (1975), Astin observed that various practical manifestations of involvement were significant in influencing dropout rates. For example, a student’s type of residence was particularly important: “It is obvious that students who live in residence halls have more time and opportunity to get involved in all aspects of campus life” (Astin, 1984, p. 302). Other types of involvement that Astin found influenced retention include:

- Membership of social fraternities and sororities;
- Participation in sporting activities;
- Enrolment in honours programmes [typically offering special projects and an ‘enriched’ academic environment for students of high ability];
- Involvement in the Reserve Officers Training Corps (ROTC);
- Participation in professors’ undergraduate research projects; and
- Holding a part-time job on-campus (but not holding a full-time job off-campus, which was damaging to retention).

Astin observed that retention at two-year community colleges “where the involvement of both faculty and students seems to be minimal” (1984, p. 302) was not as good as in four-year colleges. The “fit” between student and college was also relevant; this phenomenon might manifest itself in terms of religious background, ethnic origin, or even urbanisation: students from small-town backgrounds tended to fare better in smaller colleges. He suggested that “the act of dropping out can be viewed as the ultimate form of noninvolvement, and dropping out anchors the involvement continuum at the lowest end” (1984, p. 303).

Astin argued that involvement has roots in Freud’s concept of cathexis, whereby “people invest psychological energy in objects and persons outwith themselves” (Astin, 1984, p. 298). Additionally, Astin noted that involvement “resembles closely what learning theorists have traditionally referred to as vigilance or time-on-task” (p. 298). Involvement also seems closely akin to Tinto’s concept of integration: it seems unlikely that one should exist without the other. However, involvement, as defined by Astin, is a behavioural construct, whereas integration depends on perceptions. This distinction has been shown to be useful. Lewin’s postulate (1936) that “behaviour is a function of the interaction between the environment and the person” is an influential model in the social psychology literature (Strange, 1994). “The model suggests that a person’s perceptions within a certain environment will lead to specific behaviours and that new behaviours often modify existing perceptions” (Walsh, 1973). Hence a model that specifies both behavioural and perceptual components of integration is more likely to describe the longitudinal integration process described by Tinto. Such a melding together of behavioural and perceptual constructs has been achieved by Milem and Berger (1997), with generally positive results.

One drawback of Astin’s theory is that it does not explain how involvement combines with other factors to affect retention. It also seems that in practice any investigation of involvement would need to be tailored to a significant extent to fit the circumstances of particular institutions. Few of the examples cited above from the USA would be relevant in the UK, for example. Being a multi-faceted phenomenon, this might necessitate the use of relatively large survey instruments, making it an unwieldy construct to operationalise in practice.

Bourdieu's Theory of Social Reproduction

Berger (2002) has argued that Bourdieu's (1973, 1977) theory of social reproduction is capable of being adapted to explain student departure. Bourdieu hypothesised that individuals have access to different types of capital in different amounts. Of particular interest are cultural and economic capital. The latter refers simply to money and material objects. Cultural capital (Bourdieu, 1964) was the first and the most general of the various forms of capital identified by Bourdieu, and relates to "informal interpersonal skills, habits, manners, linguistics, educational credentials, and lifestyle preferences" (Berger, 2002, p. 97). Cultural capital has only symbolic value, and represents the type of knowledge valued by elite members of society. It has no intrinsic value other than in the ways in which it may be converted, manipulated and invested in order to secure other highly valued and scarce resources, including economic capital (McDonough, 1997). Furthermore, individuals having access to similar types and amounts of capital share a common "habitus", which Bourdieu defines as a "matrix of perceptions, appreciations, and actions" (Bourdieu, 1971, p. 83). Habitus is the "bounded rationality" of specific classes, and acts as a glue by which people sharing common experiences and interactions tend (unconsciously) to develop the same interpretations of the world. Preferences and expectations allow people to classify themselves with others of a similar disposition, while at the same time marginalising those who have access to different amounts and types of capital.

It can be argued that concepts of capital and habitus are pervasive throughout the educational system. For example, Bourdieu (1973) claimed that the school system reproduces and legitimises the existing class structure by transforming class distinctions into distinctions of merit. Subsequently, class plays a strong role in a student's decision as to which university or college to attend. The choice of institution is important: "it provides opportunities for individuals to maximize their previous educational skills, and abilities in socially legitimate ways" (Berger, 2002, p. 100). Furthermore, "students with greater cultural capital may believe not only that they are entitled to college education at a particular type of institution but that they are entitled to a degree from that institution as well, while students with less access to cultural capital may feel less entitled to earn a degree" (Berger, 2002, p. 101). McDonough (1997) has labelled such beliefs "entitlements".

The concept of social reproduction may be applied to educational institutions as well as to individuals. The theory may be advanced that postsecondary educational institutions compete for educational and cultural capital although, in practice, the *status quo* tends to be perpetuated. This may be explained by reference to Kamens' (1971, 1974) concept of a "social charter" in higher education. For example, it has been suggested that at the upper end of the hierarchy,

"highly selective and/or large universities (that have traditionally held access to large sums of economic and cultural capital) hold charters as a result of widespread and important societal constituencies believing that these institutions are more likely to graduate their students and more likely to graduate them into high-status careers" (Berger, 2002, p. 105).

It can then be argued that

"schools with stronger social charters, or greater amounts of institutional cultural capital, are able to more effectively retain students for two reasons. First, they attract students who possess habitus in which graduation from college is most often an inevitable, foregone conclusion. Second, the power these institutions have to allocate graduates to high status roles provides a compelling reason for students to persist at these institutions. Even if students are not satisfied with their collegiate experiences, they are apt to realize that leaving such an institution is a less than optimal use of capital resources" (Berger, 2002, p. 106).

Students' "entitlements" may be thought of as being roughly the equivalent of Tinto's goal and institutional commitments. Additionally, it may be supposed that the students at each institution generally share a common habitus that is largely congruent with the organisational habitus of that institution. This congruence may then be equated with Tinto's concepts of academic and social integration:

"those students who lack the requisite cultural capital may have a hard time or be unable to fully integrate because their frame of reference is just too different from the organizational habitus and the habitus of the dominant peer group on campus" (Berger, 2002, p. 108).

However, the analogies are not precise. Bourdieu's theory is cast at the societal level, whereas Tinto focuses on retention at the level of individual institutions, and points out that his is "not a systems level model of departure" (Tinto, 1993, p. 112). Furthermore, in espousing Van Gennep's concept of rites of passage Tinto postulates that students must relinquish some of the norms and beliefs of their former lives in order to become fully integrated into college life. Bourdieu's proposition is quite the opposite: integration is

achieved not at the expense of predefined norms and beliefs but precisely because of them. Berger noted Braxton, Sullivan, and Johnson's (1997) observation that academic integration has generally not been found to act as a good predictor of persistence, and speculated that this may be because academic integration is more important for some students than others; this is because "the ways in which faculty view and interact with students with different levels of cultural capital may be an important consideration" (2002, p. 109). For example, Astin (1993) had concluded that the expectations that faculty have at institutions which attract students predominantly from higher socio-economic classes tend to be significantly different from their counterparts elsewhere.

The logic behind the departure decision in Tinto's model may be recast to infer that those students who are fully integrated

"are apt to take their college experiences for granted as part of their habitus. As such, the college experience is routinized such that persistence and graduation occur as a natural progression for these students. In other words, not graduating is not an option in the bounded rationality used by these students as they move through the collegiate experience ... In contrast, students who have relatively lower levels of either economic or cultural capital may leave for either voluntary or involuntary reasons. The bounded rationality that occurs as a result of their backgrounds and habitus is more likely to include a range of choices that lead to dropout or stop-out" (Berger, 2002, p. 112).

Berger (2002, pp. 113-117) then put forward some testable propositions; herein lies the potential utility of this approach, judged from a positivist perspective. Two propositions are at the sectoral level, and two are at the student level.

"Proposition 1 – Institutions with higher levels of cultural capital will have the highest retention rates."

The obvious practical difficulty here lies in finding a satisfactory working definition of organizational cultural capital.

"Proposition 2 – Students with higher levels of cultural capital are more likely to persist, across all types of institutions, than are students with less access to cultural capital."

This proposition is also couched at the sectoral level. This time, the issue is to be able to measure students' access to differing levels of cultural capital.

“Proposition 3 – Students with higher levels of cultural capital are more likely to persist at institutions with correspondingly high levels of organizational cultural capital.”

The corollary of this individual-level proposition is given in the fourth:

“Proposition 4 – Students with access to lower levels of cultural capital are most likely to persist at institutions with correspondingly low levels of organizational cultural capital.”

Each of the third and fourth propositions have sub-propositions relating specifically to the academic and social subsystems.

Some of Ozga and Sukhnandan’s conclusions (1998) seem to support the first of these propositions; they comment that

“Some [institutions] have highly valued products and are therefore in a position to select clients, rather than be selected by them. They remain consistent in their internal processes – social and educational – and are under no pressure to change these in order to accommodate new clients. The strength of the market position sustains a continuity of practice that ensures compatibility through selection. The closer institutions are to that privileged market position, the more they can rely on preparedness and the greater the compatibility of expectations of students and staff. However not all institutions enjoy this privileged market position, nor can they count on high levels of preparedness and compatibility” (p. 331).

This is a promising line of enquiry that has been identified only relatively recently. It has not been actively purposed in this study, although the topic is raised again in the concluding chapter.

Ozga and Sukhnandan’s Explanatory Model of Undergraduate Non-Completion

Ozga and Sukhnandan’s 1998 paper was referred to briefly above. Their Explanatory Model Of Undergraduate Non-Completion is cited here as a British example of a longitudinal model of student attrition. It is reproduced in Appendix 2.9. It illustrates that those individuals who are particularly ill-prepared for university life are likely to exit prematurely and join the labour force. Otherwise, preparedness does not on its own affect the likelihood of a student’s withdrawal. However, it does have an impact on the subsequent compatibility between the student and her or his chosen institution and course.

If compatibility is good, then the main reasons for withdrawal, in those cases where it occurs, may be categorised as unplanned external crises. If compatibility is low and identified relatively early in the academic year, then those who leave are likely to transfer to another institution. Otherwise leavers are more likely to enter employment, at least in the first instance.

Although it is not illustrated diagrammatically, Ozga and Sukhnandan detected an association between levels of preparedness on the one hand and the extent to which students' choices had been either proactive or reactive. Proactive choices tend to be influenced by "personal interests, ambitions and career opportunities" (p. 321); reactive choices are the result of "the expectations of parents, friends, teachers and because it was a 'natural progression' having gained the necessary entrance requirements" (p. 321).

It has been pointed out that Spady's concept of normative congruence corresponds closely with Tinto's concept of integration which, in turn, is similar to the matching of individual and institutional cultural capital according to Bourdieu's theory. This conceptual overlap within the models of Spady, Tinto, and Bourdieu is perhaps reinforced and echoed at a more perceptual level by the reference to compatibility in Ozga and Sukhnandan's model. Because of its emphasis on preparedness for university life and the compatibility of institutional and course choices with students' predispositions, Ozga and Sukhnandan's model may be said to represent a much simplified version of the models of Spady and Tinto, in particular.

The proposition that mature students' withdrawal, in particular, is typically precipitated by unplanned external crises is novel, as is the suggestion that younger leavers' subsequent destinations are influenced mainly by the timing (before or after Easter) of their withdrawal. Observations such as these are useful at the operational level, but perhaps less so at the conceptual level. Ozga and Sukhnandan's work is useful mainly in that it offers some useful clues to guide the conduct of future research.

Conclusions on Theoretical Approaches

Of the six models described here, it was decided that Tinto's Student Integration Model should be used as the primary source of testable hypotheses for the purposes of this study, notwithstanding its various theoretical and empirical shortcomings described above. In Braxton's view (2002, p. 258) it would be "fatuous" to ignore those propositions within

Elaboration on Tinto's Theory

The abstraction of theories from one discipline for use in another can offer useful opportunities for advancing knowledge (Kuhn, 1970). Tinto's own use of theories adapted from the work of Durkheim and Van Gennep exemplifies this process. Tinto (1993) identified five types of theory that might be used in this way: psychological; societal; economic; organisational; and interactional. Various attempts have been made either to integrate such theoretical perspectives within Tinto's theory or else to elaborate upon it. Their success is sometimes difficult to judge; in some cases the methodology used seems not wholly satisfactory, and there has been little uniformity in the approach taken by different authors. (There is, of course, no reason in principle why these disciplines should not be used as the basis for models of student departure that are quite independent of Tinto's model. There are examples in the literature, but no systematic review of this work is offered here.)

Three efforts to introduce a psychological perspective into Tinto's model are briefly mentioned. Stage (1989b) included the "motivational orientations" of students along with their demographic characteristics in a path model of attrition, and achieved useful results. Brower (1992) explored with some success the concept of life-task orientations, borrowed from the field of cognitive social psychology. In particular, he argued that "students commit to seven life task domains, including academic achievement, social integration, future goal development, autonomy, identity formation, time management, and physical maintenance/well-being" (Brower, 1992, p. 446). By adding such variables to a model of persistence, its ability to predict the number of semesters students remained in college was significantly improved. Peterson (1993) demonstrated the relevance to academic integration of "career decision-making self-efficacy" (in other words, confidence in one's ability to plan and execute vocationally relevant tasks). She borrowed Bandura's (1977) more general concept of self-efficacy expectations, defined as expectations and beliefs about one's ability successfully to perform specific tasks indicative of certain behaviours. It is a matter of speculation as to whether Peterson would have obtained the same or better results using a wider definition of self-efficacy. In summary, it seems that psychological variables constitute a potentially useful extra dimension to Tinto's model.

In a precursor to Berger's (2002) work, Anderson (1988) gave consideration to status attainment models and, in particular, was interested in the extent to which college

persistence might be interpreted as a manifestation of social reproduction and social attainment. This was, in effect, a theory framed at the societal level. She emphasised the importance of socio-economic status (SES), asserting, for example, that “higher SES students entered institutions characterized by higher SES composition, greater academic orientation, and more cohesive environments. These factors increased students’ attainment levels by encouraging involvement and goal commitment” (Braxton, Sullivan, and Johnson, 1997, p. 141). In effect, she used the constructs of the Tinto model to demonstrate how social attainment might be self-reproducing, although her prime intention was not to elaborate upon or to modify Tinto’s theory, as implied by Braxton, Sullivan, and Johnson (1997). This school of thought is discussed above in more detail.

Under the heading of theories based in economics, some have sought to use a form of cost-benefit analysis to justify students’ withdrawal and persistence decisions within the framework of Tinto’s model. For example, Braxton, Brier and Hossler (1988) conceptualised costs as being “student problems”, and these consisted of not being able to take the desired courses, not being able to enrol on courses at convenient times, difficulty balancing academic workload with home/work demands, being troubled by personal problems, and difficulty financing college expenses. However, none of these problems was found to have a significant effect on persistence. Cabrera, Stampen and Hansen (1990) looked specifically at the effect of ability to pay on academic and social integration, anticipating that students of higher socio-economic status would integrate more easily than those of lower socio-economic status. While they did not find any statistically significant connection between these variables, they did detect a greater tendency for those of lower socio-economic status and those who were less satisfied with costs to withdraw more readily. Cabrera, Nora and Castañeda (1992) discovered that the extent to which a student was in receipt of financial aid had a significant effect on persistence, and affected academic integration, social integration, and goal commitment, too. Although Tinto himself tends to play down the significance of finances, it does appear that the use of this construct, formulated appropriately, could prove useful.

Some writers have attempted the adoption of organisational theories. For example, Braxton and Brier (1989) attempted to meld together some of the concepts of Bean’s Student Attrition Model with Tinto’s Student Integration Model. The results are not convincing, however. Cabrera, Castañeda, Nora and Hengstler (1992) and Cabrera, Nora and Castañeda (1993) attempted a similar fusion, latterly using structural equation models to

demonstrate (perhaps disappointingly) that in a combined Bean-Tinto model, the largest total effects on persistence were exerted by intent to persist and grade point average while at college. Additionally, the largest effects on intention to persist were exerted by institutional commitment and encouragement, the latter construct being derived from Bean's model rather than Tinto's. These constitute only modest grounds for adding institutional variables to Tinto's model.

The various attempts to elaborate upon and to modify Tinto's model demonstrate its flexibility. Researchers are, in effect, given a free hand both in terms of how the constructs of the model should be operationalised and the manner in which it should be altered. In neither respect can it be said that any consensus has so far emerged; the field is still open. With this in mind, various other studies of student retention and student achievement were considered. The issues researched include expectations of college, family support, student finances and paid work, academic self-concept, locus of control, and academic effort. These are discussed below.

The Role of Expectations of College

Normative congruence, student integration, the matching of individual and institutional social capital, and the compatibility between the student and her or his institution and course have all been referred to above. To a greater or lesser extent, all of these concepts have embedded in them the idea that students may hold certain preconceptions of university life generally and, more specifically, what their courses of study will entail. It therefore seems of interest to examine such expectations, and the extent to which they are met in practice.

Although expectations were not central to Tinto's thinking, he did nonetheless allude to their relevance to student retention. Having acknowledged that some students might not have any rational basis for having chosen a particular institution, he argued that others will have formed a view concerning the intellectual and social characteristics they are likely to experience at college. Subsequently these "pre-college expectations generally become the standard against which individuals evaluate their early experiences within the institution" (Tinto, 1993, p. 54).

Braxton, Vesper, and Hossler (1995) have argued that the extent to which such expectations are met will affect academic and social integration, which in turn will affect

goal and institutional commitments and, ultimately, persistence. Unmet expectations may arise because institutions have not served intending students well:

“... infrequently can one obtain accurate information as to the informal social and intellectual climates which characterize student life on campus. Though some colleges attempt to provide that information, it is not always provided in a manner that depicts how the student is likely to experience the institution. More often than not, such information is either self-serving or misleading in character, reflecting the view of adults rather than that of other students. Yet it is precisely the latter sort of information which is most important for accurate expectations and appropriate choice. And it is precisely that sort of information which, short of visiting the campus for several days, is most difficult to obtain” (Tinto, 1993, p. 55).

These remarks predate Yorke’s comments (2001) reported above. If true, the policy implications are obvious. Tinto acknowledged that it is unavoidable that even with perfect information some students will still make mistakes concerning their choice of institution and “for some students, the experience of having made a ‘poor choice’ may in fact be an important part of their coming to identify their own needs and interests” (Tinto, 1993, p. 55).

Braxton, Vesper, and Hossler (1995) found that the meeting of expectations concerning academic and intellectual development and concerning career development, in particular, had a positive effect on both academic and social integration, thereby providing grounds for retaining expectations in future formulations of Tinto’s model.

The Role of Family Support

In their study of the attitudes, aspirations, and destinations of fifth-year school leavers in Tower Hamlets, Kysel, West, and Scott (1992) discovered that parents can and do influence their children’s decisions to enter postsecondary education after leaving school.

The emotional support provided by families and by parents, in particular, has usually been found to reduce students’ propensity to drop out, both directly, and indirectly, through the influence of other constructs (Bean, 1982a; Cabrera, Stampen, and Hansen, 1990; Cabrera, Nora, and Castañeda, 1993; Nora, 1987; Nora and Rendon, 1990; and Nora, Attinasi, and Matonak, 1990). Nora and Cabrera (1996) also found that parental encouragement exerted a positive effect on the integration of students to college, on their academic and intellectual development, and on their academic performance and commitments. Whether this parental

influence is, in fact, positive or negative, as suggested by HEFCE to the House of Commons Select Committee on Education and Employment (HEFCE 2001 – HE 137), is a matter of conjecture, and seems worthy of investigation.

The Role of Student Finances and Paid Work

The issue of student finances has been a matter of general concern in the UK over the past few years, particularly since the publication of the Dearing Report into “Higher Education in the Learning Society” (NCIHE, 1997a). The introduction of the payment of tuition fees, initially set at £1,000 for the 1998-99 academic session (albeit reduced or waived for students from less well-off backgrounds) and the substitution of student loans for grants have sparked debate on the topics of widening access, increased student hardship, and reduced retention, which is still on-going.

The intrusion of paid work into academic study time is a further problem which has manifested itself relatively recently in the UK. For example:

“I constantly heard a litany of woe about financial circumstances. By and large, students are no longer able to concentrate totally on their courses in the way those of us of a certain age could in the past. To survive, they have to take paid employment – it is often easier to find an erring student by visiting the local supermarket where they are stacking shelves than by calling them to your office” (Smith, 2000).

It has also been reported that researchers at Northumbria University discovered that “students with jobs get ‘significantly’ lower examination grades and may be twice as likely to fail, although the authors stress they have not proved any direct causal link” (Utley, 2001).

Callender reported to the House of Commons Select Committee on Education and Employment that there was a strong link between student debt and hardship and students’ perceptions of how they were doing academically, which could in some cases lead to withdrawal (Select Committee on Education and Employment, 2001b).

The issue of student debt was considered in the Cubie Report (Independent Committee of Inquiry into Student Finance, 1999) in Scotland, leading to the ending of tuition fees North of the Border and to a relaxing by the Scottish Parliament of the conditions of loan. While a correlation between social inclusion and retention in the UK has been established

(HEFCE, 1999a *et seq.*), the effects of financial hardship have been much more difficult to measure empirically.

Using the framework of Tinto's model and working in the United States rather than the UK, Cabrera, Nora, and Castañeda (1992) discovered that levels of financial aid made available to students have a significant effect (though intervening variables) on persistence:

“ ... having received some form of financial aid was found to facilitate the student's social interactions with other undergraduates at his or her institution. It is believed that students who have received a financial aid award need not secure employment or, if already employed, spend additional time and effort in their present jobs. In other words, financial aid may provide recipients with enough freedom to engage in social activities and to become fully integrated into the social realm of the institution. Moreover, removing anxieties, time and effort associated with securing additional funds to finance their education, student aid recipients may have not only found it easier to interact with peers and participate in campus activities but may have also found it easier to engage in academic activities that enhanced their academic performance (GPA)” (Cabrera, Nora, and Castañeda, 1992, p. 589).

It is also noteworthy that Cabrera, Stampen, and Hansen had cautioned that financial aid is not a panacea for all the difficulties that can beset students:

“Our results underscore the need for [US] policymakers to modify their expectations that monetary aid alone is sufficient to keep students in college ... Rather, students' commitment, support from significant others, and goodness of fit with a school's academic and social components are also important in explaining college persistence” (Cabrera, Stampen, and Hansen, 1990, p. 330).

The extent to which these findings might be replicated, if at all, in the UK is of considerable interest.

The Role of Academic Self-Concept, Internal Locus of Control and Amount of Effort

Only one reference from the literature on the relationship between psychological measures and student outcomes is described here.

Kanoy, Wester, and Latta (1989) studied the relationship between locus of control and academic self-concept on the one hand and academic achievement (specifically, freshman year GPA) on the other. They wished in particular to compare the predictive power of

these and other psychological variables with that of traditional predictors of academic performance, such as high school GPA and SAT scores.

A person's locus of control may be internal or external. Those having an internal locus of control tend to believe that their "actions produce the reinforcements which follow their efforts", whereas those individuals having an external locus of control believe that rewards and punishments are "meted out to them at the discretion of powerful others or are in the hands of luck or fate" (Crandall, Katkovsky, and Crandall, 1965, p. 92). A student's locus of control in respect of academic work can then be assessed using questionnaire items such as "Whenever I receive good grades, it is always because I have studied hard for that course" and "Often my poorer grades are obtained in courses that the professor has failed to make interesting" (Kanoy, Wester, and Latta, 1989, p. 66).

Academic self-concept equates with students' confidence in their academic ability and in their evaluation of both their ability and of the amount of effort put into their academic studies. Academic self-concept can be measured using questions such as "Most exams are easy for me" and "I have poor study habits" (Kanoy, Wester, and Latta, 1989, p. 67).

Kanoy, Wester, and Latta split the students that they were studying into two groups: those having high expected GPAs and those expected to do less well. For the former group it transpired that the best predictors were high school GPA and academic self-concept. For the latter group, none of the traditional predictors was effective in predicting freshman year GPA (although there appears to have been a certain circularity in the manner in which students were allocated to each of the two groups). Two other variables – locus of control in respect of academic success and the amount of effort put into academic work – were the best predictors of GPA for this group, with internal locus of control and greater effort both associated with higher achievement.

The failure of traditional predictors to forecast academic performance accurately in the case of lesser-qualified entrants – those generally reckoned to be most likely to drop out – makes it seem desirable to include variables such as those described by Kanoy, Wester, and Latta in a model of attrition.

Conclusions on the Elaboration of Tinto's Model and the Role of Supplementary Constructs

Clearly, one needs to be selective in choosing lines of enquiry to complement any operationalisation of the core constructs of Tinto's theory. Theoretical elaborations aimed at better explanatory power may fail precisely because of the greater complexity that they introduce.

It was decided that the psychological perspective might best be investigated by considering the amount of effort put into academic work and the construct of academic self-concept. These are relatively easy to operationalise, but it can be seen from the above descriptions that there are also other lines of enquiry that might also have been followed.

It was thought that the economic aspects of student retention should also be examined. Specifically, it was decided that the effects of student finances and paid work, as discussed above, might be investigated, not least because of the high levels of political interest in the subject in the UK.

The role of expectations of college and of family support should also be included. The only variable germane to Bourdieu's theory to be used is social class. No theories of the organisation were investigated.

General Conclusions

From the foregoing review it is possible to make a summary of the various reasons that might be advanced to explain student attrition:

Student Entry Characteristics

Initial Goal Commitment

Initial Institutional Commitment

Academic Integration

Social Integration

Subsequent Goal Commitment

Subsequent Institutional Commitment

Intention to Persist

Family and Friends' Support
Expectations
Study Time
Academic Self-Concept
Information Source
Academic Help and Feedback
Various Extraneous Factors and Inhibitors
Finances and Outside Paid Work

These are shown in more detail in Appendix 2.10. The actual choice of variables and constructs to be selected for use in the quantitative analyses cannot at this stage be firmly decided, and this is a matter for further consideration in the following chapters. Methodological preferences, the availability of robust data, and the outcome of some focus group work, as well as the need for high questionnaire response rates all influence the eventual choice of avenues to be explored. For convenience, the outcome of these further deliberations is presented in Appendix 2.10 in such a way as to highlight those variables derived from the literature that are subsequently analysed in this study. It will be seen that the scope of the topics covered by this study is wide but by no means complete.

The contrast has been made in this chapter between empirically derived explanations of student attrition and theoretically driven models. It was decided that it would be of interest to pursue each of these approaches for the purposes of this study. The relatively straightforward descriptions of attrition rates (Chapter 4) and the multidimensional statistical analyses (Chapters 5 and 8) may be said to be empirically based. On the other hand, the development of the causal framework, concluding in Chapter 11, is at least in part dependent on existing theory.

The following chapter contrasts different data gathering techniques, distinguishing in particular between quantitative and qualitative research in order to further shape the conduct of the present study.

Chapter 3 – Research Methods

Introduction

The previous chapter contains a review of the theories and findings of other researchers concerning the causes of student attrition, as well as an outline of some of the issues that might be examined in this investigation. This chapter has a similar structure, in that it consists of a critique of the research designs and data collection methods used by other researchers, followed by a description of the manner in which the causes of attrition will be explored in the present study.

The Nature of a Theory

Having declared in Chapter 1 the intention to develop a theory of student retention, it is appropriate to consider briefly at this juncture what might constitute a good theory. Following the positivist school of thought, Kerlinger (1986, p. 9) defines a theory thus: “A theory is a set of interrelated constructs (concepts), definitions, and propositions that present a systematic view of phenomena by specifying relations among variables, with the purpose of explaining and predicting the phenomena.” Expressed in another way, the role of a theory is to say why certain phenomena occur. It does so by explaining how such phenomena are influenced by and interact with others. The same explanations may then also be used to make predictions. The usefulness of a theory consequently lies in its ability to allow researchers and practitioners to focus on certain factors as the causes of certain phenomena to the exclusion of others, secure in the knowledge that their predictions will remain sound. Mouly (1978, p. 35-6) elaborates on this by emphasising the empirical nature of a theory: “A theoretical system must permit deductions that can be tested empirically; that is, it must provide the means for its conformation or rejection... One can test the validity of a theory only through the validity of the propositions (hypotheses) that can be derived from it.” Using this definition narrows down the nature of the research to be predominantly positivist in its approach, and articulates some criteria by which the end result may be judged.

General Approaches: Quantitative and Qualitative Methodologies; Methodological Triangulation

Having clarified the nature of the end goal, it is appropriate also to consider the means by which it is to be achieved. The nature of one's conclusions will inevitably be coloured and constrained by one's methodology. In the absence of experimental control, purely numerical approaches will yield associations, but not causes. Qualitative research will produce explanations without quantifications. The possibility of combining quantitative and qualitative methods is therefore an attractive one, although many authors have preferred to follow either one route or the other, but not both, in any particular study of student attrition.

Work in the general field of educational research in the UK has tended to be qualitative in character, with the results and their practical application depending to a considerable extent on the judgement of the practitioner (Hammersley, 2000; Oakley, 2002). The usefulness of such research has been questioned by Hargreaves (1996), Hillage *et al.* (1998) and, more recently, by Galbraith (2000), for example.

Hargreaves' criticisms of research in education centred on four objections:

- It does not make a serious contribution to fundamental theory or knowledge;
- It compares unfavourably to research in medicine;
- It is largely irrelevant to practice and does not involve practitioners and users sufficiently in decisions about what to investigate; and
- It is uncoordinated with any preceding or follow-up research.

(from Humes and Bryce, 2001, p. 335)

In the same vein, the Hillage Report (1998) suggested that even where research in education does address issues of practical relevance, it tends to:

- Be small-scale and fails to generate findings that are reliable and generalisable;
- Be insufficiently based in existing knowledge and therefore capable of advancing understanding;
- Be presented in a form that is largely inaccessible to a non-academic audience; and

- Lack interpretation for policy makers and practitioners.

(from Humes and Bryce, 2001, p. 335)

As the Scottish Minister for Education, Galbraith (2000) echoed the second of Hargreaves' criticisms of research in education. In effect, he advocated the adoption of the randomised, controlled trials that traditionally have been the cornerstone of evidence-based clinical practice, and he urged the avoidance of conclusions not substantiated by the research.

These implicit endorsements of the classical positivist position may be set in juxtaposition to the advantages claimed for qualitative research. The strengths of symbolic interactionist research, in particular, have been highlighted by Hargreaves (1978) and reinforced by Hammersley (2000). Hargreaves' contention is that a symbolic interactionist approach can have five 'capacities', making it particularly helpful in the study of complex social interactions. These capacities are:

- Its ability to understand and to represent the points of view of different actors (the 'appreciative' capacity) – in educational research these are typically those of teachers and school pupils;
- Its ability to articulate that which is otherwise taken for granted and consequently either overlooked or forgotten (the 'designatory' capacity);
- Its ability for these otherwise unarticulated observations to be echoed back to the actors, in order that they may see what is actually happening, rather than what they think ought to be happening (the 'reflective' capacity);
- Its ability to allow researchers to anticipate more accurately which recommendations for improvement will not fail or be rejected in practice (the 'immunological' capacity); and
- Its ability to remedy or improve the world at the micro level of social interaction as well as at the macro level (the 'corrective' capacity).

None of these advantages are guaranteed by the use of a positivist approach; on the contrary, by placing emphasis on detached objectivity and quantification, positivism is likely to neglect issues such as these and to overlook the fact that "people have agency and are able to engage in reflection about themselves and their environment" (Bryman, 1996, p. xi).

Methodological triangulation is therefore attractive, where practical, because it makes it feasible to obtain results that are more comprehensive, precise and mutually reinforcing, and makes it less likely that inappropriate conclusions will be drawn from the data. However, the objective of achieving internal validity through the use of more than one method of data collection may be difficult to achieve in practice. In other words, the relationship between the postulated causes and the effect (student dropout, in this study) cannot be clearly established. Barbour (2001) claims that “data collected using different methods come in different forms and defy direct comparison. This is true for different types of qualitative data, such as interview and focus group transcripts, as well as for the more obvious differences between qualitative and quantitative data” (p. 1117). Furthermore, “triangulation relies on the notion of a fixed point, or superior explanation, against which other interpretations can be measured. Qualitative research, however, is usually carried out from a relativist perspective, which acknowledges the existence of multiple views of equal validity” (p. 1117). Hence comprehensiveness rather than internal validity may be a more realistic goal for qualitative research (Mays and Pope, 1995).

The purpose of this very brief discourse on the relative merits of quantitative and qualitative methods is not to come down in favour of one or the other but, rather, to recognise that a research design that incorporates both types of approach is more likely to achieve informative results. This study will incorporate both quantitative and qualitative methods, the former to achieve generalisability, and the latter to gain comprehensiveness. At least some degree of methodological triangulation will be achieved by comparing the outcomes of the different techniques employed. The different methods will be used sequentially rather than simultaneously, so that successive stages of the research can draw upon the results of earlier ones, thereby reducing the possibility of producing irreconcilable results.

Research Designs

Terenzini (1982) distinguishes three research designs for capturing quantitative data on student attrition: the “autopsy” or *post hoc* design, the cross-sectional design, and the longitudinal design and comments, in particular, on their internal validity. Each of these is first described below and then exemplified.

An “autopsy” design consists of identifying students who have left and then asking them questions intended to throw light on the reasons for their departure. The rationale is simple enough: “If you want to know why students drop out, ask them” (Terenzini, 1982, p. 57). One disadvantage of this phenomenological approach is that it depends upon individuals’ reconstructions of past situations. It also lacks internal validity. It may be, for example, that an apparent connection is purely coincidental, disguising the existence of other more influential and possibly unidentified factors affecting attrition. A partial remedy is to conduct similar investigations of persisters, although this is not always done in practice. Without doing this, there is no way of knowing whether and the extent to which the traits and experiences of dropouts differ from those of persisters. Terenzini also points out that surveys of leavers generally achieve low response rates, and that those few individuals who do respond may consequently not be representative of all dropouts. Furthermore, having only a small sample will reduce the scope for statistical analysis, particularly when there are a large number of variables under consideration. Examples are given below.

In practice, using a cross-sectional design means conducting a one-off survey of students currently on course, and at a later date dividing them into two groups according to whether to not they have dropped out in the meantime. The issue is then to identify those variables, which may include pre-matriculation characteristics, which best discriminate between the leavers and the persisters. This design is preferable to the autopsy design, because of its superior internal validity and because it is likely to achieve a higher response rate. One disadvantage that Terenzini identifies is that although statistically significant differences may be detected between the two groups, these differences may not, however, have any educational or administrative importance. A further disadvantage is that inevitably one must await the passage of time before one is able to distinguish between the two groups.

Longitudinal panel designs allow for the collection of the same information in respect of the same subjects at two or more points in time. In this way, one can glean an understanding of the dynamics and interplay between the different factors involved. Terenzini notes that this “design benefits from new students’ generosity in providing information requested by the institution ... but such cooperation does not last for ever” (p. 61). The fact that some respondents will drop out and others will become disinclined to supply the information requested of them means that the initial sample needs to be large. (And it will be seen that these points are particularly relevant to this study.) The facility to

compare the characteristics of dropouts and non-dropouts at various different points over the lifetime of the study makes this the most internally valid of the three designs.

One serious difficulty that pervades each of these three approaches is that they are all *ex post facto* designs. There is no experimental control over the explanatory variables. Randomisation is not possible, and there is every possibility that self-selection is present, albeit undetectably. These problems make the degree of certainty that may be ascribed to the inferred causations relatively weak. In particular, it may not be possible to distinguish between cause and effect. (This problem is encountered in the context of the path analysis developed in Chapter 11.) Furthermore, it may not be possible to conclude whether causation may be attributed to those variables included explicitly in a model, or to other extraneous variables with which the modelled variables happen to be correlated. (This is of particular concern when interpreting the logistic regression models developed in Chapters 5, 8, and 10.) Under these conditions, the data may exhibit undue plasticity, and model-building may become deceptively easy. Unfortunately, there is little that the investigator of student attrition can do to avoid these difficulties. Focusing on theories already propounded and tested by others and using some form of triangulation seem to be the most practical ways of improving the robustness of one's findings in the first instance. This study is constrained to these options. Subsequent replication and the disproving of alternative hypotheses, if possible, are other possibilities. But only by engaging in some form of controlled quality enhancement effort actually involving both staff and students might it be possible to achieve something approaching the theoretical ideal of a controlled experimental design.

“Autopsy” Designs

Terenzini's objections (1982) to the use of “autopsy” designs have been described above. At a more practical level, Suskie (1996) recommends the avoidance of exit questionnaires for students who are either in the process of withdrawing or who have just left. Such individuals, she argues, are likely to be angry and frustrated, and are liable to alight on “financial difficulties” or “personal reasons” as the cause of their departure. In truth, it is more likely that these are the symptoms, rather than the underlying problems. Lenning (1982) made a similar claim, as reported in Chapter 2. Spady (1970) observes that “in giving reasons for leaving college, dropouts tend to avoid the stigma of being a failure”.

He noted a “tendency for dropouts to find fault first with the system and only secondly with themselves”. Whether this accusation was fair is impossible to say.

Having left an institution, withdrawals often change their addresses and this, coupled perhaps with disenchantment with the institution, is likely to result in low response rates. Middaugh (1992) writes, “In most instances, students leave the institution with no intention of returning; consequently, these students have absolutely no vested interest in responding to these surveys”. This is consistent with Terenzini’s view reported above.

Such advice seems to be generally accepted in North America, but not in the UK. The difficulties can be allayed to some extent by conducting exit interviews either just before or at the time of leaving, rather than at some point thereafter, and by conducting interviews so far as possible with matched pairs of leavers and persisters, as noted above. The extent to which those who respond to exit questionnaires are representative of all leavers can also be assessed by administering follow-up questionnaires to non-respondents or by conducting telephone interviews with them.

The approach adopted by Yorke and his associates (1997) exemplifies these difficulties. Their survey consisted of a postal questionnaire sent to those who had left their studies, eliciting an initial response rate of only 19.7%. A follow-up telephone survey then brought the total response rate up to 29.3%. Some significant differences between the two groups of respondents emerged, making it difficult to discern which group, if either, was truly representative of all leavers. No questionnaires were issued to control subjects who had not withdrawn, and the views of other stakeholders were not solicited. While this approach might have been helpful as a means of simply exposing some of the issues involved with student attrition, any attempt to rank them, for example, as Yorke did, runs the danger of misrepresenting the true position. This highlights a second drawback inherent in this general approach. Not only is its internal validity insecure, but it also lacks external validity, which is the “representativeness or generalisability” of the results (Kerlinger, 1986, p. 300).

Ozga and Sukhnandan’s related qualitative study (1997) was methodologically more comprehensive, in that it included interviews with staff as well as questionnaires administered to both non-completers and completers, matched in terms of their basic characteristics. Follow-up interviews were also conducted with about half of the non-completers (but not the completers) who had responded to the questionnaire. By filtering

out those issues that appeared to discriminate between the non-completers and the completers it was possible to identify possible reasons for departure among those who had left. The response rate to the initial questionnaire among non-completers was low (28%), nevertheless, and it would therefore be difficult to generalise the findings with any confidence. The results are qualitative by nature, and no other claim is made of them.

Thomas *et al.* (1996) used a postal survey of students who had withdrawn. This seems to have been a relatively unsafe procedure, in that it was coupled primarily with semi-structured interviews with staff, but with no control group of continuing students and achieved only a 20% response rate to the survey. Results are illustrated pictorially, lending the appearance of more precision to the results than is merited by the essentially qualitative nature of the research.

More recently, Davies and Elias's study (2002) of early leavers from higher education, sponsored by the Department of Education and Skills, was based on postal questionnaires issued at the time of students' exit. The initial response rate was only 10% (about 1,520 responses), with 100 follow-up telephone surveys of the respondents. The results have to be treated with some scepticism, because of the absence of control subjects and the possibility of sampling bias.

Cross-Sectional Designs

A survey that simultaneously measured students' background characteristics, attitudes and intentions concerning whether they might subsequently stay or leave would constitute a cross-sectional design. The main advantage of using such a design is that it is not necessary to wait to find out whether students actually drop out or not. The obvious disadvantage is that the dependent variable is not an observed behaviour, but only a stated intention.

In some studies, such as Bean's analyses (1982a, 1983) of attrition, background characteristics have not been taken into account. Bean felt that they would have been of little consequence in his study but, more generally, if one fails to take into account possibly confounding pre-entry characteristics, one runs the risk of falling foul of the *post hoc, ergo propter hoc* fallacy (Kerlinger, 1986, p. 347); one cannot be sure that the phenomena under consideration are indeed the true causes of attrition, or whether even before entering higher education some students may have been predisposed to drop out.

Similarly, if one measures students' stated intentions to persist, rather than their actual persistence, one may encounter response bias. Nevertheless, this approach has been used, for example, by Braxton, Vesper, and Hossler (1995), Berger (1997), Milem and Berger (1997), Berger and Braxton (1998), and Braxton, Milem and Sullivan (2000). Their reasons have been various: a conscious preference for studying intentions rather than actions, stemming from Tinto's emphasis on the former; the non-availability of sophomore-year enrolment data; the claim that there is support in the literature for a strong relationship between intentions and actual persistence; and statistical rectitude: "Although the actual measure of persistence was available for use in this study, the highly skewed nature of this variable with this particular population (less than 9% of entering students fail to return for a second year) made use of this measure impractical and methodologically unsound in regression-based causal models" (Berger, 1997, p. 445). The legitimacy of this approach depends on the exact purpose of one's enquiry; some of these arguments carry more weight than others. For the purposes of this study, both intentions and withdrawal behaviour are analysed.

Longitudinal Panel Designs

This is the approach favoured by Pascarella (1986), for example, for the empirical study of student attrition. Tinto's Student Integration Model, when tested using one-year survival statistics for new entrants, could be represented as requiring data to be collected at four different points in time:

1. At or before entry (using questionnaires and possibly also institutional records): initial Goal and Institutional Commitments; demographic details and prior academic achievements;
2. Part-way through the academic session (using questionnaires): Academic and Social Integration;
3. Thereafter in the academic session (using questionnaires): subsequent Goal and Institutional Commitments;
4. At the beginning of the following academic year (using institutional records): persistence; GPA achieved during the previous year.

One very real difficulty is that some early leavers may depart before steps 2 and 3 have taken place. It is inevitable that there will be a systematic bias in response rates because of this, as noted above (Terenzini, 1982).

In practice, the logistics of administering survey instruments have caused steps 2 and 3 to be combined for the purposes of some studies, with just one questionnaire being administered during the spring semester. The tacit assumption in this particular procedure is that the Academic Integration and Social Integration that have been achieved by this stage will have influenced subsequent Goal and Institutional Commitments at least to the point where the latter two constructs may reasonably be modelled as influencing subsequent withdrawal decisions.

More recently, some authors (Berger 1997; Milem and Berger, 1997; Berger and Braxton, 1998; and Braxton Milem and Sullivan, 2000) have found it expedient to use three standard survey instruments administered at different times during the first year: the Student Information Form (SIF); the Early Collegiate Experiences Survey (ECES), and the Freshman Year Survey (FYS). The use of these instruments is described in more detail below. This approach seems preferable in principle to the use of only two snapshots of student opinion but, in reality, the development of an individual's attitudes and perceptions is likely to be an ongoing and perhaps disjointed process, and the superimposition on this process of a timetable of measurements taken at pre-determined, discrete intervals can only detract from the realism of the results. Nevertheless, given that Tinto's model is longitudinal by nature, there are no other obvious ways in which the causal chain within it can be tested empirically on a large scale.

Occasionally, Tinto's model has been used as a framework for analysing first semester persistence, rather than first year persistence (Stage, 1989a; 1989b), or retention between census dates two years apart (Cabrera, Stampen, and Hansen, 1990).

The temporal aspects of student attrition have also been addressed specifically by using event history modelling (DesJardins *et al.*, 1999), making specific allowance for objective variables that change over time, such as grade point average, the amount of financial aid awarded, and credit load. This is, however, a substantially different approach from that used and discussed in this study.

The conclusions that may be drawn from this survey of quantitative research methods are essentially to confirm Terenzini's contentions (1982), namely that autopsy studies, when conducted on their own, do not produce wholly convincing results and, secondly, that longitudinal panel designs are to be preferred to cross-sectional designs. The fact that they are all susceptible to the *post hoc ergo propter hoc* fallacy should also always be borne in mind.

Data Collection Techniques

There are various ways in which data may be collected in behavioural research. The main sources that have been used in the study of student attrition are:

- Literature review

- National and institutional datasets, including standard assessment instruments

- Questionnaires

- Focus Groups

- Face-to-face interviews

- Telephone interviews

- Case studies

- Multiple data sources

Each of these is discussed and exemplified below.

Literature Review

An initial review of the literature should be undertaken as a matter of course. Suskie (1996) suggests that institutional researchers seeking to reduce attrition may find that this is sufficient, although they may conclude that it is necessary to test whether the reasons for dropout identified by research elsewhere apply also at their own institutions. It is entirely conceivable that the prime causes of attrition can and do vary from one institution to the next (Pascarella, 1986) and perhaps also from one country to the next (Ozga and Sukhnandan, 1997).

National and Institutional Datasets, Including Standard Assessment Instruments

The use of national datasets and individual institutions' central student record systems is quite common in studies of student attrition. It is relatively straightforward to acquire large amounts of information from such sources for statistical analysis. However, one is constrained to use only that information which is already available and which usually will not have been gathered specifically for the purpose in hand. The range of the data held about particular individuals may be relatively limited, at least in the UK, although its accuracy, particularly with respect to previous educational qualifications, for example, is likely to be much better than if acquired through the use of an *ad-hoc* survey instrument. Nevertheless, there can be problems with the completeness and consistency of centrally held data, as noted by Ozga and Sukhnandan (1997). The existence of national datasets makes it possible to analyse and make allowances for inter-institutional differences, as well as differences between individual students. It is also possible to draw a distinction between dropouts from particular institutions and dropouts from the system as a whole. Any large-scale quantitative study of actual retention, as opposed to students' intentions with regard to retention, must inevitably rely on a data source other than the data subjects themselves in order to distinguish accurately between persisters and leavers, and this necessitates the use of official records, either at the institutional or national level. In the UK, inter-institutional datasets are limited in their content to demographic and educational details, but in the USA much more extensive datasets are available.

Morgan, Flanagan, and Kellaghan (2001) looked at the length of time taken to successful completion of degrees in six Irish universities. They reported graduation rates but, in so doing, ignored students who changed their course, even though they may have successfully qualified. Only a small number of variables was examined; it was possible to report on correlations between completion and only four factors: institution, field of study, prior student achievement and ability, and gender. The main methodological issue that emerges is the extent to which the absence of a national database limits the scope of an inter-institutional investigation.

Woodley, Thompson, and Cowan's analysis (1992) of non-completion in Scottish universities was based on data held by the Universities Statistical Record for students in UK universities. This information was sufficiently detailed for the authors to be able to

perform a multivariate analysis of completion relates according to gender, type of term-time accommodation, parental occupation, state/private schooling, age, provenance, academic subject area, and university attended. The results inevitably exclude any reference to attitudinal constructs.

HEFCE's performance indicators (1999a *et seq.*), referred to in Chapter 2, are based primarily on data collected by the Higher Education Statistics Agency (HESA), and are intended as measures of institutional rather than individual performance. They cover not just retention, but also access to higher education, student outcomes, time to completion of degrees, and institutional research output. By using HESA's unique student identifiers, HEFCE is in a singularly good position to identify those students who transfer between institutions rather than leave the sector altogether. The performance indicators are inevitably centred on a relatively narrow range of issues and they lack statistical control over potentially relevant variables, as noted in Chapter 2.

Smith and Naylor's analysis (2001) of the probability of non-completion in the 'pre-1992' universities, also referred to in Chapter 2, was based primarily on data collected nationally by the Universities Statistical Record, as well as by the Department for Education and Employment. The results are described in the previous chapter. This is the most sophisticated analysis to date using national UK data, being based on a probit analysis of an entire cohort of UK undergraduates. Their models controlled for educational background, age, marital status, social class, nationality, type of term-time accommodation, degree subjects(s), university department size, and unemployment rates in students' counties of origin. As well as assessing the effects of individual characteristics on attrition rates, they also studied institution-level effects. Analyses were conducted separately for males and females; the fact that the two sets of results were different is strongly suggestive of the existence of other confounding variables not explicitly included in the analyses. It is a matter of some interest to follow up this observation.

In summary, the UK has a rich central source of information on university students. It may also be remarked that the information held centrally by HESA is simply an aggregation of information collected by individual institutions, so it is available also at that level. There remains ample scope for further work. But there are no centrally held attitudinal data; for that, one needs to look to the USA, and this is considered next.

The US higher education system is much larger and more diverse than the UK system. The availability of both objective and subjective information, garnered from a large number of students at a large number of institutions over a long period of time, places researchers in a relatively strong position to conduct quantitative studies of student progression and outcomes. There is a wealth of attitudinal data available in the USA, obviating to some extent the need to focus one's attention on just one institution, but subject to the caveat that one must be prepared to modify one's investigations to fit the nature of the data available.

The US Department of Education collects and maintains large datasets of student information. For example, the "National Longitudinal High School and Beyond 1980 Senior Cohort" is a dataset derived from a longitudinal panel study of individuals who left high school in 1980. Cabrera, Stampen, and Hansen (1990) were able to use a cross-sectional snapshot of one of the follow-up surveys, coupled with information derived from the Department of Education's "High School and Beyond Post-Secondary Education Transcript Study", to obtain indicators of factors deemed relevant to persistence, such as goal commitment, academic integration, social integration, ability to pay, students' satisfaction with institutional prestige, and the influence of significant others. This allowed them to investigate within the context of Tinto's model the effects on persistence of students' ability to pay, albeit with constructs constrained to be operationalised to fit the available data.

Various standard survey instruments have been developed over a number of years by organisations associated with the higher education sector. For example, the Higher Education Research Institute (HERI) at UCLA and the American Council on Education (ACE) make available the Cooperative Institutional Research Program (CIRP) Freshman Year Survey instrument, which is used by a large number of institutions to collect first-year students' demographic characteristics, expectations of the college experience, secondary school experiences, degree goals and career plans, college finances, attitudes, values and life goals, and reasons for attending college.

Pascarella, Smart, and Ethington's study (1986) exemplifies the use of the constructs in Tinto's model to explain long-term persistence of two-year college students, based primarily on data derived from CIRP surveys. This allowed the investigators to obtain data from 85 colleges and universities but, in order to do so, it appears that, as with the US Department of Education's data, the practical interpretation of Tinto's constructs needed to be changed somewhat. While this is no reason to doubt the validity of the results, it has to

be borne in mind that Tinto's constructs were not operationalised in precisely the same manner as in Pascarella and Terenzini's earlier work (1980, 1983), for example. Braxton, Milem, and Sullivan's work (2000) on the influence of active learning on the college student departure process is a further example of a study making use of CIRP survey items although, in this case, these were complemented by data derived from other survey instruments.

Although used less commonly, the Noel-Levitz Center's Student Satisfaction Inventory (SSI) is a commercially available instrument that has among its purposes the improvement of student retention. It yields student ratings of the importance of and satisfaction with most aspects of the student experience. Allen's quest (1999) for an empirical link between motivation and persistence is an example of a study that uses the College Student Survey (CSS), a similar instrument also devised and analysed commercially by the Noel-Levitz Center. In essence, this is a 194-item survey intended to assess students' needs and risk of dropout. The constructs investigated include parental education, desire to finish college, institutional impression, and family emotional support. In this single-institution study, Allen also used university records to obtain basic information on gender, ethnicity, financial aid, rank in high school, and university GPA.

In summary, national and institutional datasets typically consist of data collected over a period of years relating to a large number of students. Although their use may necessitate some definitional compromises, they make it more practical to identify statistically the marginal effects of a large number of variables, as well as any interactions between them. They are also particularly useful in the study of changes in attrition rates over time. National and institutional databases can be used on their own, or in conjunction with other data collected specifically for a particular research project, provided there is a mechanism to amalgamate the two sets of information for any given student. Obtaining information from a central source can free up valuable space on survey instruments that can then be used to explore other issues. The use of national assessment surveys in order to explore a wide range of student characteristics, attitudes and behaviours in the study of attrition appears to be becoming more common in the USA. However, such avenues are currently not available in the UK.

Questionnaires

The most common method of eliciting information in studies of student attrition is through the use of questionnaires. Questionnaire responses lend themselves easily to quantitative analysis of varying degrees of sophistication, and their use may be justified on the ground that they underpin the positivist approach to the study of attrition alluded to briefly at the beginning of this chapter. While this is a good justification, the choice of the use of questionnaires is not beyond criticism.

Models based on institutional records and fixed-choice questionnaires “effectively strip away the context surrounding the student’s decision to persist or not to persist in college and exclude from consideration the student’s own perceptions of the process” (Attinasi, 1989, p. 250). “Questionnaires usually require their subjects to respond to predetermined topics, however; with students, they are about what adult investigators have decided should be relevant in advance” (Moffat, 1989, p. xv). Social interactionists contend that:

“students, like other human beings, have at their disposal a set of ‘appropriate’ answers which are used in particular contexts. These often reflect what is generally seen as desirable, rather than the actual priorities of the individual as revealed in behaviour. It is very difficult to know if a student who reports studying three hours a day is reporting what she does, or what she thinks is an appropriate response. If someone indicates that getting a degree is important, we have very few ways of knowing to what extent that is simply a handy response, and we certainly have no way of determining from that response how such expressions are related to the actual allocation of resources in the student’s life” (McKeown, Macdonell, and Bowman, 1993, p. 81).

Social interactionists therefore argue for a cautious approach to the interpretation of self-reported attitudes and behaviours. They prefer participant observation as a means of conducting primary research, while not rejecting or denying the usefulness of institutional and questionnaire data, “provided that these data are treated as provisional indicators” (McKeown, Macdonell, and Bowman, 1993, p. 80).

Less subtly, Kerlinger (1986) claims:

“The mail questionnaire ... has serious drawbacks unless it is used in conjunction with other techniques. Two of these defects are possible lack of response and the inability to check the responses given. These defects, especially the first, are serious enough to make the mail questionnaire worse than useless, except in highly sophisticated hands ... As a result of low returns in mail questionnaires, valid generalizations cannot be made. Although there

are means of securing larger returns and reducing deficiencies – follow-up questionnaires, enclosing money, interviewing a random sample of nonrespondents and analyzing nonrespondent data – these methods are costly, time-consuming, and often ineffective... The best advice would seem to be not to use mail questionnaires if a better method can possibly be used. If they are used, every effort should be made to obtain returns of at least 80 to 90 percent or more, and lacking such returns, to learn something of the characteristics of the nonrespondents” (p. 380).

Even if the theoretical objections of the social interactionists and the practical objections of Kerlinger can be addressed adequately, issues concerning the reliability and validity of particular survey instruments remain.

Reliability, in the technical sense, is the extent to which the observable measurements are free from random error. The danger is that a survey instrument may be particularly prone to produce random fluctuations in respondents’ answers. This problem has various related and overlapping aspects. First, it may manifest itself in terms of a lack of stability over time: if certain questions are repeated, the responses may vary, but with genuine changes in respondents’ opinions being masked by other sources of variation. Secondly, the measurements obtained may not reflect with precision the true values of the phenomenon under investigation; in other words, the instrument being used may be prone to variation in the accuracy of the readings taken. In both situations, the errors may be subject to random variation or systematic bias; reliability in this context refers to the former.

Fortunately, there are various steps that one can take to improve reliability. One should avoid ambiguous questions, because respondents may have difficulty in interpreting such items, and consequently the error variance in their responses will be high. Secondly, increasing the length of the response scale (typically between four and seven options – five is usual) will improve reliability, at least in the sense of increasing Cronbach’s alpha. Thirdly, adding additional questions of a similar nature to those already intended to measure a particular construct is likely to reduce the overall random error in an individual’s answers. Fourthly, the adoption of existing survey instruments that have already been tested by other researchers, examples of which are described elsewhere in this chapter, gives one some confidence to believe that problems of reliability are less likely to emerge. Fifthly, one should make the physical environment and the instructions for completion of the survey as uniform as possible.

In the context of the third remedy, the reliability of some of the constructs used by Pascarella and Terenzini (1983), for example, may be criticised because of the relatively few items used to measure some of the underlying constructs. Initial Goal Commitment, initial Institutional Commitment, and subsequent Institutional Commitment were assessed using only two items each, while only one item was used to measure subsequent Goal Commitment. The use of seven items, for example, to measure peer group relations (Cronbach's $\alpha = 0.84$), and five items to measure faculty's perceived concern for teaching and student development (Cronbach's $\alpha = 0.77$) (Pascarella and Terenzini, 1983) are more typical of what appears in the literature.

The stability over time of individuals' responses can be assessed using test-retest procedures (Chapter 7). The internal consistency of particular groups of items can be tested by calculating Cronbach's alpha statistic (Chapter 9), and this is a more or less routine procedure in quantitative studies of attrition.

Validity, in the technical sense, is the extent to which a scale measures what it is intended to measure. For example, it may be inferred that scores on a particular measure represent student self-esteem. Nevertheless, it may be appropriate to seek additional information to establish whether or not this inference is correct. It may transpire that while the investigator has a quite clear perception of what is meant by the use of a particular phrase or expression used in a questionnaire, respondents may interpret it quite differently. The concept may be encapsulated by Kerlinger's question, "Are we measuring what we think we are measuring?" (1986, p. 417). There are different kinds of validity. One commonly used typology is that produced jointly by the American Psychological Association, the American Educational Research Association, and the National Council on Measurements Used in Education (1999), whereby three categories of validity are identified: content validity, criterion-related validity, and construct validity.

Issues of content validity revolve around relevance to purpose. If the purpose of a questionnaire is to explore student finance, for example, then the issue is to ensure that (a) of all the possible questions that might be asked about this multifaceted construct, a truly representative sample has been chosen, and that (b) the questions asked are indeed directly relevant, and not merely tangential to the issue being investigated. One practical way of addressing these potential pitfalls is to conduct pilot studies with students, as Bean (1980) and Cabrera, Nora, and Castañeda (1992) did, for example. This goes at least some way towards addressing the social interactionists' criticisms mentioned above.

The criterion-related validity of particular items may be assessed by examining their power to predict particular outcomes, usually as measured by other items. The issue is to examine the relationship between different scores. For example, those students reporting that they are employed for relatively long periods each week during term-time might be expected also to assert that their studies are being disrupted to a greater extent than other students in paid employment. Usually such a connection would be expressed in the form of a straightforward correlation coefficient.

Construct validity is relevant when one is not primarily interested in the answers to particular questions *per se*, but in the underlying latent variables, the existence of which may be inferred, generally from a number of observable variables, but which cannot be measured directly. Those variables that describe a particular construct should (a) be correlated well with one another (convergent validity), while at the same time (b) correlate poorly with other variables (discriminant validity). The existence of constructs can be theory-driven, and the existence of a theoretical framework may suggest which variables should and should not correlate with one another. Factor analysis or principal components analysis may be used to examine construct validity. Again, the use of existing survey instruments already demonstrated to have good validity enhances the likelihood of success.

The use of questionnaires to formulate preliminary, sensitising postulates is relatively unusual, although it is feasible (Mackie, 1998). More commonly, questionnaire responses are used for some form of statistical analysis, and the major thrust of US research in this area has been based upon them.

Spady's innovative work (1970, 1971) on his "sociological" model of attrition, which was the precursor of Tinto's interactionist model, was tested using questionnaires of Spady's own devising. Similarly, Bean's work turnover model (1980, 1982a) was operationalised using tailor-made survey instruments. Pascarella and Terenzini's seminal work (1980, 1983) on testing Tinto's theory was carried out using survey instruments created specifically for the purpose, and these will be examined in more detail in Chapter 6. They have subsequently been refined and reutilised on numerous occasions.

Their measures of Academic Integration and Social Integration, known together as Institutional Integration (IIS), form a subset of the whole. Mallette and Cabrera's comparison (1991) of the determinants of withdrawal and transfer behaviour made use all of the thirty items in the IIS, for example. Stage's studies of the reciprocal effects between

Academic Integration and Social Integration (1989a) and of motivation, Academic and Social Integration (1989b) also used the thirty IIS items, as did Braxton and Brier's attempt (1989) to meld Bean's organisational theory with Tinto's interactional theory. There are other examples of studies based on the IIS, at least to some extent, such as those of Cabrera, Nora, and Castañeda (1992) and Peterson (1993).

Pascarella and Terenzini's survey instruments also form the basis of the wider-ranging FYS, which has been combined with the SIF and ECES in various longitudinal panel studies, as noted above:

- Berger (1997): associations among sense of community in residence halls, Social Integration, and first-year persistence;
- Milem and Berger (1997): the relationship between Astin's theory of involvement and Tinto's interactionist theory;
- Berger and Braxton (1998): the role of perceived organisational attributes on persistence; and
- Braxton, Milem, and Sullivan (2000): the influence of active learning on the college student departure process.

The advantage of using instruments such as these is that their reliability and validity are already known, and appear to be satisfactory for the purpose in hand. Their use also promotes cohesion of effort in the research community (Hargreaves' fourth point (1996), referred to above). Their use seems likely to increase rather than diminish over time, as the enabling technologies improve and new survey instruments become better tested and more generally accepted.

Other elaborations and modifications of Tinto's model entailing the introduction of additional constructs borrowed from other academic perspectives, but not using these particular assessment instruments, have included:

- Chapman and Pascarella (1983): the effect of type of institution on Academic and Social Integration;
- Braxton and Brier (1989): the melding of organisational and interactional theories of attrition;

- Stage (1989b): motivations for attending college, Academic and Social Integration, and early dropout;
- Cabrera, Nora, and Castañeda (1992): financial aid and the role of finances in the persistence process;
- Braxton, Vesper, and Hossler (1995): the fulfilment of expectations for college; and
- Brower (1992): life task predominance, i.e. the effects on student persistence of the priority given to life tasks.

In some cases, it was possible to import existing survey instruments already developed in other disciplines; in others, new survey items were created specifically for the purpose in hand.

In summary, the strength of questionnaires lies in their undergirding of the positivist approach. There are various potential pitfalls with respect to reliability and validity, nevertheless, which need to be guarded against. Such has been the attraction of empirical, theoretically-based research for investigators in the USA, in particular, that this has become the primary way of conducting research into attrition, at least in that country. To use, perhaps with some modification, survey instruments that have already been developed and found to be satisfactory in other circumstances seems generally desirable, although it would be prudent first to test their suitability for and relevance to local circumstances before adopting them on any large scale.

Focus Groups

Terenzini *et al.* note that focus group research can be useful particularly where there is a “lack of information about which variables may be involved, their relative importance, or the dynamics operating among them” (1994, p. 59).

A focus group consists usually of between four and twelve participants. It is therefore usually not practical to achieve anything like complete coverage of the whole group being investigated. Krueger (1994) asserts that they tend to work because they promote self-disclosure among the participants. He notes that focus group meetings can either be conducted as standalone activities or else combined with quantitative procedures in a variety of ways. Meetings may be used to gain an understanding of the vocabulary and thinking patterns of the research subjects prior to the formulation of survey instruments, for

example. They may also be used to test the logical structure of questionnaires, and whether or not they cover all of the important issues. Quantitative methods can then be used subsequently to make inferences about the wider population. By using focus groups in conjunction with other investigative techniques, one can achieve methodological triangulation, with each approach serving to confirm and enrich the findings of the others. Focus groups conducted after the qualitative procedures have been completed may be used for the twin purposes of obtaining greater understanding of the initial results and of exploring possible policy implications of the research.

Krueger is cautious about the validity of focus group research:

“If anything, the [apparent] validity of focus groups may be too high. Focus group results seem so believable that decision makers may have the tendency to rush out and implement the resulting recommendations without adequate scepticism” (1994, p. 32).

The composition of focus groups usually needs particular consideration. It may be judged appropriate to adopt a purposive sampling strategy, with the intention of obtaining a relatively wide range of opinion. However, if the participants are not truly representative of the group from which they have been selected, it will not be possible to make inferences about the views of the group as a whole. Equally, the results may be distorted by any atypical dynamics of a particular discussion or by the interactions between particular contributors.

Terenzini *et al.* (1994), in their study of students' transition to college, used what they described as a “cross-sectional, focus-group research design” (p. 59) in which the intention was specifically not to draw a random sample of students but, instead, to ensure that participants came from widely diverse personal and academic backgrounds. In this example of a purposive sampling strategy, groups were made up of individuals who were in some ways heterogeneous (e.g. by gender) and in other ways deliberately homogeneous (e.g. by ethnicity). The purpose was to uncover important and valid issues, but not to make generalisations about the population as a whole. For example, nothing could be inferred about the frequency with which particular issues might arise in the larger population. It was also acknowledged that there is a danger of some additional bias in this approach insofar as those individuals less well integrated into institutional life (or less well disposed towards it) might be less likely to respond positively to invitations to attend meetings.

In her study of first-year withdrawal behaviour, Mackie (1998) used a combination of three different approaches. She first used a questionnaire, administered to new students at the post-induction stage. Then she conducted two focus group meetings at the end of the first term. Finally, she conducted individual interviews with both persisters (“doubters”) and those who had withdrawn (“leavers”) in order to explore the factors causing doubt or actual withdrawal, and to see whether any differences could be detected between these two groups. The focus group meetings formed part of the process by which the researcher became familiar with the issues, as perceived by the students themselves.

Thomas’s use of the concept of institutional habitus (2002) to contextualize student attrition was centred primarily on focus group discussions with a total of 32 students, followed by questionnaires. Unusually, these follow-up questionnaires were completed only by the focus group participants, rather than by a broader group of students. As Thomas explains, this was essentially a qualitative approach. Finance was the main concern articulated at the meetings, but the lack of external validity inherent in this approach detracts from its more general usefulness.

Archer *et al.* (2001) used focus group discussions with young working-class males not in higher education as the sole source of primary data to explore their constructions of HE participation and various contrasting discourses of masculinity. The main conclusion – that participation in higher education is in some senses more risky for lower-class males – is perforce a qualitative one.

Returning briefly to the topic of questionnaires, it appears that survey items used for the purpose of studying student attrition have in the past been devised primarily to test specific precepts of the researchers’ choosing or else have been selected from within broader instruments already in common usage. This approach seems to place considerable weight on researchers’ insights, but rather less on the issues that students themselves might identify as being important. It appears that the role of focus group research has been constrained at best to that of “pilot testing” pre-conceived survey instruments. (See Bean, 1980, for example.) It may be concluded, particularly in the light of the criticisms of the use of questionnaires described above, that there is scope for the survey instruments used in the study of student attrition to be constructed with input from focus group work as well as from the literature. This is the approach adopted for the purposes of this study; it is described in detail in Chapter 6.

Face-to-Face Interviews

It is possible to distinguish at least three types of face-to-face interview: structured, unstructured and non-directive (Cohen and Manion, 1994). In structured interviews both the content and the procedure are predefined by the researcher. In unstructured interviews the opposite is true, creating an open situation rather than a closed position, but with the purpose of the research nevertheless acting as the guiding framework. Further along this spectrum, the course of a non-directive interview is determined by the respondent rather than the researcher.

The main potential difficulty is with validity; there is a danger that interviewees may systematically misrepresent a situation, possibly in order to be seen in a better light.

Attinasi (1989) describes how he conducted open-ended “life history” interviews with eighteen Mexican American students in order to explore freshman year persistence. Some had withdrawn; others were persisters. In using what he described as the sociologies of social interactionalism and ethnomethodology, informants were encouraged to recollect and recount their own and others’ experiences of attending college. For each experience, respondents were asked to recall their own perceptions of the experience and to describe how other individuals were involved. Attinasi then used a process of qualitative induction (Goetz and LeCompte, 1984) in order first to code respondents’ perceptions and then to cluster together the different codings in such a way as to reduce their number and make the analysis more conceptually orientated. The intention was to avoid using any of the previously existing conceptual frameworks of persistence and attrition, and this is reflected in the novel and informative character of the outcomes of the study.

Attinasi recognised the difficulties involved in generalising these conclusions and in expanding the number of interviews to encompass a greater range of respondents. In this particular type of analysis, the qualitative induction process creates considerable scope for the researcher to insert her or his own value judgements, which may or may not be considered beneficial. Attinasi’s work demonstrates the usefulness of this approach in generating insightful hypotheses, although it is relatively time-consuming. It was not used for this study.

Telephone Interviews

Kerlinger (1986) expresses a low opinion of telephone interviewing:

“Telephone surveys have little to recommend them beyond speed and low cost. Especially when the interviewer is unknown to the respondent they are limited by possible nonresponse, uncooperativeness, and by reluctance to answer more than simple, superficial questions. Yet telephoning can sometimes be useful in obtaining information essential to a study. Its principal defect, obviously, is the inability to obtain detailed information” (p. 380).

Telephone interviews can be used as a relatively effective method of following up those who have not responded to postal questionnaires. Occasionally, they are used also as a means of obtaining further information about individuals who have withdrawn. Aldridge and Rowley (1999) describe how this was done at Edge Hill College of Higher Education. Their withdrawal survey consisted of a semi-structured telephone interview conducted by a student employed for the purpose. Contrary to Kerlinger’s supposition, Aldridge and Rowley reported that “most respondents were very happy to answer the questions and were positive about the interview process” (p. 9). They achieved a response rate of about 50%. According to their paper, “course not expected” appears to be the single greatest source of attrition but, again, it seems prudent to view this conclusion with caution.

Case Studies

Case studies of individual students are relatively rare in the literature on student retention. Reay’s analysis (1998) of the processes surrounding potential students’ choice of higher education provision is an example of this particular type of qualitative research in a similar field. Its strength lies in the depth of the insights that it produces; its main weaknesses are the time that it consumes and the difficulty in generalising the conclusions.

Multiple Data Sources

The National Audit Office’s study (2002), aimed at producing recommendations for the improvement of student achievement in English higher education, made use of both published HEFCE statistics and unpublished statistics held by HESA and the Universities and Colleges Admissions Service (UCAS). In a departure from the earlier work of Woodley, Thompson, and Cowan, for example, the NAO’s report was based also on a variety of different qualitative techniques. While the quantitative data revealed substantial

differences in completion rates among institutions and among academic subjects, for example, the qualitative research gave insights into the reasons for withdrawal. These included “a lack of preparedness for higher education; changing personal circumstances or interests; financial matters; the impact of undertaking paid work; and dissatisfaction with the course or institution” (NAO, 2002, p. 11). It was not possible to quantify any of these effects, however, and the different conclusions are somewhat disjointed. A noticeable omission from this list of reasons for departure is any mention or suggestion of social integration.

The NAO’s study (2001) of student performance in English further education colleges had also been characterised by the use of data obtained through a variety of different techniques. The investigation had been stimulated in particular by the observation that there was considerable variation in attrition rates between colleges. The study was aimed not at explaining the reasons for attrition but at ameliorating it and improving students’ performance generally through the widespread adoption of best practice within the sector. Data-gathering focused not just on the quantitative and qualitative aspects of the student experience, but also on a study of management practices at different institutions, as well as college visits and meetings with officials of the Department for Education and Employment and the Further Education Funding Council. This exemplifies the need for institutional factors to be taken into account when seeking specifically to derive recommendations for changing existing institutional practice. As with the subsequent study of the HE sector, the resultant recommendations reflected the unstated assumption that colleges should be responsible for students’ learning, narrowly defined to encompass academic and vocational matters, without explicitly taking into account the needs of students to integrate into the social fabric of college life and of younger students, in particular, to develop their wider life skills.

Conclusion Concerning Methodology - Approach to be Adopted in This Study

In conclusion, it seems preferable in a study of the causes of student attrition to avoid reliance on any one source of data but, instead, to use a combination of data collection techniques. Institutionally held data can be helpful. Despite some disadvantages, questionnaires are, for all practical purposes, a *sine qua non* for any statistical analysis from which valid generalisations may be drawn. It is preferable, where possible, to use

existing survey instruments (or parts thereof). Focus group meetings can be used as an adjunct to questionnaires, in order to improve their content validity, in particular. The literature contains numerous examples of *post hoc* analyses and rationalisations of dubious legitimacy, and great care is needed not to overstate the force of one's conclusions. Case studies and face-to-face interviews are useful to gain an in-depth understanding of the issues appertaining to the research subjects, but the conclusions cannot safely be generalised to any great extent. Telephone interviews on their own should not be expected to produce satisfactory results, although they do at least have the merit of economy.

The distinction was drawn in the previous chapter between theory-based and empirical explanations of student attrition. In this chapter the main contrast drawn has been between quantitative and qualitative methodologies. For the purposes of the present study, it was concluded to try to utilise all of these approaches, and that the methodological design should broadly follow the recommendations made by Pascarella (1986). These are described below.

It was decided first to undertake a simple quantitative exploration of the first-year attrition of one cohort of undergraduates, using data already available in the University's central student records system. This descriptive, mainly univariate analysis would reveal the main demographic and prior educational correlates of first-year attrition (Chapter 4). The same data would then be used to formulate statistical models of attrition, using logistic regression techniques (Chapters 5 and 8). These would be primarily empirical in character, without necessarily being particularly informative as to the psychological or sociological dimensions of the dropout process.

Pascarella emphasised, however, that the design of an empirical study should be guided by theory. He was assuming here that there exists a theoretical framework that can be relied upon to produce accurate explanations and dependable forecasts. In Chapter 2 Tinto's Student Integration Model was introduced; although it was demonstrated that it has some theoretical and empirical weaknesses, many of the constructs contained in Tinto's model were nevertheless retained for the purposes of the current study. In order to try to develop models that are to some degree both quantitative and explanatory, it was decided that a major questionnaire-based exercise should be embarked upon. The design would be longitudinal, following the progress of a particular cohort of students over a period of time. For the purposes of the current study, a group of first-year students was monitored over a period of about 14 months, from the time of first matriculation until re-matriculation at the

beginning of the following session. It was recognised that the design would need to reflect the statistical necessity of achieving very high response rates.

The survey instruments were developed with input from focus group meetings with students and academic staff, as well as from the relevant literature (Chapter 6). After an initial analysis (Chapter 7), a principal components analysis was conducted on the responses (Chapter 9), in order to explore the unifying constructs underlying the questionnaires. The same logistic regression techniques as those applied to students' background characteristics were then applied to these data, in an attempt to develop logistic regression models of attrition, incorporating attitudinal data, rather than purely objective student characteristics (Chapter 10).

The results of these two exercises were then combined using structural equation modelling (Chapter 11) in such a way as to derive models which demonstrate the relative importance of different types of variables to the attrition process, and the manner in which they interact with one another.

Pascarella asserts that the results of the quantitative analysis should be “cross-validated with selected *post hoc* interviews of persisting and withdrawing students” (Pascarella, 1986, p. 102). Notwithstanding the reservations expressed above, telephone interviews were conducted with some of the students who had withdrawn (Chapter 12).

Finally, the outcomes of the different strands of the study – the empirical analysis of background characteristics, the focus groups, the structural equation modelling and the telephone interviews – are brought together in the final chapter.

Chapter 4 – Background and Academic Characteristics of the Cohort Analysed and An Initial Examination of Their Associations with Withdrawal Rates

Note: For presentational consistency, percentages are always shown correct to one decimal place, even when the total number of individuals involved is less than 100.

Aims

This chapter contains a description of some of the basic aspects of the cohort analysed, using information obtained from the University's central student records system. The purpose is to identify some of the more important demographic and academic features of the cohort, and to demonstrate how these basic statistics are associated with rates of attrition. The dependent variable is defined. References are made to the national statistics produced by the Higher Education Funding Council for England (HEFCE, 1999a *et seq.*) and to the findings of other authors. At the end of the chapter a summary of the variables to be carried forward to the subsequent multivariate analyses is provided, along with the reasons why certain other variables are not analysed further.

The variables analysed come under Lenning's (1982) headings of 'student demographic variables' and 'student academic factors', described in Chapter 2. The methodology is empirically driven rather than theory-driven, and the results are generally similar to those reported by Johnes and Taylor (1989), Johnes (1990), Woodley, Thompson, and Cowan (1992), HEFCE (1999a *et seq.*), and Smith and Naylor (2001), for example. However, each of these analyses contains a certain element of statistical control, whereas this is not the case in this initial exploration of the Glasgow data.

Sample Selection

The purpose of this thesis is ultimately to examine the characteristics and views of as many as possible full-time students belonging to one first-year cohort of full-time undergraduates who had not previously attended a Degree course at the University of Glasgow.

Consequently an individual's inclusion in the sample under investigation was taken to depend on the following factors:

1. A cohort of students first entering the University in 1999-2000 was selected, because this was the first cohort in respect of whom it was possible to conduct wide-scale research into their perceptions and attitudes.
2. Students who had matriculated at the University during any previous session were excluded in order to ensure that they would be uninfluenced by any previous experience – possibly adverse – of the University.
3. Only undergraduates were included.
4. Only full-time students registered for Degree courses were included. There are a few undergraduate Degree students who enter the University as part-time students. However, it was felt that it would be preferable to exclude such students from the sample, because their performance and attitudes might differ significantly from those of their full-time peers. On the other hand, those students who entered the University in 1999-2000 as full-timers but whose status changed in the following session to that of being part-time were not excluded.
5. Only those students entering first year were included. A small minority of students in particular areas are allowed direct entry to second or third year, but they were excluded.
6. Students who were also members of staff were excluded.
7. Only students studying at the University were included. Any students studying at the University's associated colleges were excluded.
8. Only students who matriculated were included. Amongst those excluded were those on a work placement or an exchange programme (either incoming or outgoing), visiting and distance-learning students (of whom there are very few recorded), and any who died during the session.

This resulted in a cohort of 3,798 students being selected. The numbers in each Faculty Grouping were as shown in Table 4.1.

Faculty Grouping	Gender:			<i>Percentage Female</i>
	Female	Male	Total F+M	
Arts	715	322	1,037	68.9%
Crichton Campus	19	4	23	82.6%
Dentistry	39	30	69	56.5%
Divinity	12	10	22	54.5%
Education	104	11	115	90.4%
Engineering	52	281	333	15.6%
Law & Financial Studies	181	116	297	60.9%
Medicine	154	82	236	65.3%
Nursing	32	1	33	97.0%
Science	574	624	1,198	47.9%
Social Sciences	209	131	340	61.5%
Veterinary Medicine	68	27	95	71.6%
Grand Total	2,159	1,639	3,798	56.8%

Table 4.1 Faculty Grouping and Gender

Most of these organisational entities (called 'Faculty Groupings' for the purposes of this thesis) were Faculties of the University in their own right, but others are treated for the purposes of the study as though they were separate Faculties, even though they were not. In 1999-2000 the University consisted of nine Faculties: Arts, Divinity, Education, Engineering, Law & Financial Studies, Medicine, Science, Social Sciences and Veterinary Medicine. The University had in collaboration with the University of Paisley, Dumfries and Galloway College, and Bell College established a new presence that session in Dumfries on the Crichton Campus. Given that students on the Crichton Campus were geographically remote from Glasgow and that this was an entirely new venture, it was felt appropriate to treat these students as a separate Faculty Grouping. The Faculty of Medicine is treated for the purposes of this study as being divided into three parts: Medicine itself plus Dentistry and Nursing. The entrance criteria and the curricula followed by students in each of these three disciplines were considered sufficiently diverse as to justify treating them as separate Faculty Groupings.

It can be seen that the gender balance of the cohort as a whole was weighed slightly in favour of females. Given the University's policy of admitting students on merit, this is most probably a consequence of females' generally better school-leaving qualifications. Attrition rates are analysed by Faculty Grouping and gender below.

Dependent Variable

It was remarked in Chapter 1 that there is no single, correct definition of a dropout. The definition that one can use in practice is likely to be constrained by the availability of data, and such is the case in this study.

In principle, it may be possible to distinguish between dropouts from the higher education sector as a whole and transfers to other institutions within the sector. As noted in Chapter 3, this is an option open to HEFCE, but it is not possible for individual institutions to do this reliably themselves; trustworthy data relating to all individual cases are simply not available. Consequently, no attempt has been made to draw this distinction for the purposes of this study.

It is also of interest to be able to analyse withdrawals according to the stage in the academic session when they occur. This has been a matter of some interest to authors such as Ozga and Sukhnandan (1997, 1998). The quality of the data held by the University of Glasgow, at least, makes this problematic; this issue is considered below in more detail.

The reasons for students' departure, as recorded centrally, are also of interest. However, given that their reasons were generally (63.7%) unrecorded for this cohort, no attempt will be made in the following chapters to make use of such information as does exist.

Given these practical limitations, a simple definition of the dependent variable to be used for the purposes of this and subsequent chapters is required. It was decided, at least in the first instance, simply to distinguish between the 3,344 students who matriculated in the following session (2000-01) and the 454 who did not. Those whose status changed from one session to the next from full-time to part-time and those who repeated their first-year studies, either in full or in part, were included among the persisters, although to have treated them differently might have significantly altered the number of dropouts enumerated.

Dates of and Centrally Recorded Reasons for Departure

Information is recorded centrally in the University concerning students' leaving dates, along with a reason. The reasons recorded are those which are used when making the University's routine statutory returns to the Higher Education Statistics Agency (HESA).

It will be observed from Table 4.2 that of the 454 students who did not re-matriculate by the following December, 289 (63.7%) were not recorded at all in the central system as having left the University during the session. This is an important feature of the dropout phenomenon. Despite encouragement to the contrary, many students appear not to inform the University that they are leaving. They simply leave. The absence of any central record

of their departure could alternatively be due to a lack of effective communication within the institution. However, advisers of studies and other members of staff are generally well aware of the desirability of having premature withdrawals recorded centrally, so this is likely to be a much less significant explanation, although it cannot be dismissed entirely.

A further 53 of those who did not return were recorded as having withdrawn only temporarily. Of all those students who did return, 31 had been recorded as having withdrawn temporarily, and 14 had been recorded as having left permanently. The latter may have changed their minds or not communicated their intentions accurately to the University authorities. Alternatively, there may have been errors or misunderstandings within the University.

Those 72 (1.9%) students recorded as having left either in October or November 1999 would not have been returned to HESA as withdrawals. Only those 138 (3.6%) recorded as having subsequently left would have been returned. Those 289 students who did not return, but who had not been recorded as having left, would have been returned (correctly) to HESA as “dormant” in the 2000-01 session.

Of the 454 withdrawals analysed, dates of leaving were recorded for 210 (46.3%) students. Of these, 72 (34.3%) left in the first two months of the session (October or November 1999) and 110 (52.4%) had left by the end of the following month.

The main conclusion relevant to this study is that dates of leaving are unknown for the majority of leavers. Of the minority for whom dates of leaving were recorded, almost half left within the first two months of the academic year. It cannot be inferred, however, that a similar proportion of all leavers departed early; this matter is considered in more detail below.

Recorded Month of Leaving	Dropouts				Persisters				Total Dropouts + Persisters
	Leaving Not Recorded	Recorded As Temporary Withdrawals	Recorded As Permanent Withdrawals	Total Dropouts	Leaving Not Recorded	Recorded As Temporary Withdrawals	Recorded As Permanent Withdrawals	Total Persisters	
Oct 1999			24	24			4	4	28
Nov 1999			42	42			2	2	44
Dec 1999		15	12	27		9	2	11	38
Jan 2000		11	8	19		5	4	9	28
Feb 2000		8	4	12		5		5	17
Mar 2000		9	10	19		8		8	27
Apr 2000		4	4	8		1		1	9
May 2000		5	1	6		2	1	3	9
June 2000		1	6	7		1	1	2	9
July 2000			1	1					1
Not Appl.	289			289	3,299			3,299	3,588
Total	289	53	112	454	3,299	31	14	3,344	3,798

Table 4.2 Recorded Month of Leaving and Persistence

Of the 454 withdrawals analysed, reasons of leaving were recorded for 209 (46.0%) students, using the standard classifications prescribed by the Higher Education Statistics Agency. The position is shown in Table 4.3.

Reason for Leaving	Students
Academic Failure	5
Personal Reasons	60
Financial Reasons	2
Gone Into Employment	11
Health Reasons	26
Other	28
Transferred to Other University	39
Unknown	37
Write Off Lapse Time	1
Grand Total	209

Table 4.3 Reason for Leaving

For the majority (245) of withdrawals, no reason was recorded.

Only one reason may be recorded centrally. For anyone leaving for more than one predominant reason, only the “Other” category is available. It is noticeable how few students (5) were recorded as having left because of “Academic Failure”. This suggests that for the majority of students withdrawal is a matter of personal choice, rather than a course of action forced upon them by the University on account of insufficient academic progress, at least by the beginning of the second year of their studies. This information is of some help, but the phrase “Personal Reasons”, for example, which was the cause of departure most frequently cited, is not particularly informative. It is tempting to suggest that the number leaving for “Financial Reasons” (2) is too low, but it will subsequently be

demonstrated that on more detailed investigation this may not to be the case. Those transferring to another university (39) would not have been counted by the Higher Education Funding Council for England as dropouts from the higher education system for the purposes of its institutional performance indicators (HEFCE, 1999a *et seq.*), if they had indeed proceeded to another higher education institution.

The conclusion here is that the Higher Education Statistics Agency's standard reasons for withdrawal are of limited practical value. Institutions that focus exclusively on them as a means of understanding student attrition probably do themselves a disservice; the data tend to be either missing or over-simplistic.

Degree Examination Appearances

Additional information concerning the timing and reasons for students' departure may be adduced from the University's central records of Degree examination appearances and performance.

So long as a student continues to sit Degree examinations, she or he has not physically withdrawn from the University, although conceivably the purpose of sitting examinations may simply be to acquire sufficient qualifications subsequently to transfer to another institution, for example. By analysing the timing of withdrawals' last Degree examination appearances (Table 4.4) one may make some inferences concerning the timing of their departure.

Recorded Month of Leaving	Last Examination Appearance					Total
	(none)	January	March	May/ June	Aug/ Sept	
Oct 1999	24					24
Nov 1999	41	1				42
Dec 1999	23	4				27
Jan 2000	16	3				19
Feb 2000	5	6		1		12
Mar 2000	3	14		2		19
Apr 2000	3	3		2		8
May 2000		4		2		6
Jun 2000		1		6		7
Jul 2000				1		1
(none)	56	37	1	156	39	289
Total	171	73	1	170	39	454

Table 4.4 Recorded Month of Leaving and Last Examination Appearance

It can be seen that 171 (37.7% of withdrawals) did not sit any Degree examinations at all. It appears that these were mainly but not exclusively early withdrawals. All of these students would under normal circumstances have sat Degree examinations not later than May/June 2000.

A few students sat Degree examinations in January 2000. For 73 such individuals, this was their last diet of examinations, although five of these students were recorded as having withdrawn by the end of the previous month.

The analysis identifies 170 (37.4%) students who sat at least one Degree examination in May/June 2000, but who did not re-enrol for the following session. For 156 of these, it would not have been possible to estimate the date of departure without taking into account Degree examination appearances. A further 39 (8.6%) of withdrawals sat at least one examination in the August/September resit diet.

The early part of the session is well recognised as a period of high risk (Levitz and Noel, 1989). There were 93 departures recorded for the first three months. To these could be added the 56 students for whom no date of leaving was recorded, and who sat no Degree examinations. Five might be subtracted because they apparently sat at least one examination in January. This implies that between 88 (19.4% of withdrawals, or 2.3% of the total cohort) and 149 (32.8% of withdrawals, or 3.9% of the cohort) dropped out before the beginning of the second term.

It is of interest that there was a relatively high percentage of leavers whose departure was not effective until after the main diet of examinations in May/June. It seems that 209 students (46.0% of withdrawals, or 5.5% of the cohort) did not decide to completely disengage from the academic process until the summer of the year 2000. This is consistent with Pascarella and Terenzini's observation (1980) that there had, in fact, been a series of reports (Iffert, 1958; Eckland, 1964; Marsh, 1966; and Rootman, 1972) suggesting that attrition is at its heaviest at least in North America at the end of the freshman year.

The remainder of the withdrawals (between 2.6% and 4.2% of the cohort) are likely to have occurred between January 2000 and the commencement of the May/June 2000 Degree examination diet. The relatively large amount of uncertainty is due to the dubiety surrounding the 56 students who did not sit any Degree examinations and for whom no date of leaving was recorded.

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In summary, for many leavers it is not possible to establish a precise date of departure, using the University's central records, even after bringing into the reckoning the relatively robust and objective information concerning students' Degree examination appearances. It seems, however, that just under one half of all withdrawals took place over the summer months, and that the first term was the second highest period of risk, accounting for perhaps very roughly a quarter of all leavers. The rate of attrition during the relatively long period between these two peaks was comparatively low.

It should perhaps also be remarked here that for at least some students no unique date of departure will have existed, in any case. In focus group discussions (which were not part of this study), second-year students talked of “watching people slide away”, the inference being that dropping out can be the consequence of a prolonged 'non-decision', rather than any identifiable, positive decision to opt out.

Degree Examination Successes

It might also be possible to speculate about the motivations of leavers by analysing their Degree examination records. For example, it could be inferred that those leaving in good academic standing would be differently motivated from those whose examination successes had been partial at best.

Of the 454 withdrawals, 105 (23.1%) did not appear on any examiners' lists. The majority of these students left relatively early in the session. The details are shown in Table 4.5.

Month of Leaving	Dropouts not on Examiners' lists
October 1999	23
November 1999	41
December 1999	16
January 2000	12
February 2000	5
March 2000	2
April 2000	1
(unknown)	5
Total	105

Table 4.5 Month of Leaving

A further 147 (32.4% of leavers) sat at least one Degree examination, but did not pass any. For the majority of these (111), the date of leaving was not recorded. These students

appear to have stayed until relatively late on in the session, but never achieved academic success.

One hundred and forty-five (31.9%) leavers passed at least one but not all subjects, either at the first or on a subsequent sitting. This is only a slightly higher figure than for the persisters, of whom 24.5% did not succeed in passing all their first-year examinations. In academic terms these leavers were borderline cases. Possibly other non-academic issues influenced their decisions not to continue.

The remaining 57 students (12.6%) left having passed all their examinations, either at the first or a subsequent sitting. This is in marked contrast to the persisters, of whom 70.9% passed all of their Degree examinations in first year. (It appears that a small minority of students – about 4.6% – were allowed to progress to second year without having passed any first-year examinations.) The reasons why these academically successful students decided to leave are not clear from the central records. Information was recorded concerning only 10 of them. Of these, four left for “personal reasons”, one left to go into employment, three left for health reasons, and two transferred to other institutions.

In summary, the relationship between Degree examination success and persistence is less than clear-cut. It will be argued at the end of this chapter that Degree examination success should be regarded more appropriately as symptomatic of other factors that influence attrition, rather than being in itself a prime driver.

Faculty Groupings and Gender

The apparently superior school performance of females described above is ostensibly perpetuated during the first year of studies at university: Table 4.6 shows that the overall dropout rate was slightly higher for males than for females (13.5% and 10.8%, respectively). This is consistent with the findings reported by Lenning (1982), Johnes (1990), and Smith and Naylor (2001), for example.

It can be seen from Table 4.1 above that there was a remarkable degree of gender stereotyping in some of the Faculty Groupings: Nursing and Education were almost exclusively the domain of women, while most Engineering students were men. Table 4.6 shows that dropout rates varied considerably among Faculty Groupings. It can be seen that, of the three areas identified as having particularly skewed gender balances, two (Nursing

and Engineering) have particularly high dropout rates, at least by comparison to other parts of the University. This possibly reflects the difficulty these areas have in attracting well-qualified applicants of both sexes. The Faculty of Science appears to have had a significantly higher proportion of males than the University as a whole, and the differential in attrition rates for males and females (15.2% and 11.1%, respectively) in this Faculty is particularly noticeable. This is perhaps indicative of the success of various “Women into Science” initiatives.

Faculty Grouping	Female			Male			F+M		
	Total	Drop	Drop%	Total	Drop	Drop%	Total	Drop	Drop%
Arts	715	95	13.3%	322	41	12.7%	1,037	136	13.1%
Crichton	19	2	10.5%	4		0.0%	23	2	8.7%
Dentistry	39	1	2.6%	30	2	6.7%	69	3	4.3%
Divinity	12	4	33.3%	10	2	20.0%	22	6	27.3%
Education	104	13	12.5%	11	4	36.4%	115	17	14.8%
Engineering	52	10	19.2%	281	52	18.5%	333	62	18.6%
Law & FS	181	12	6.6%	116	8	6.9%	297	20	6.7%
Medicine	154		0.0%	82	1	1.2%	236	1	0.4%
Nursing	32	9	28.1%	1		0.0%	33	9	27.3%
Science	574	64	11.1%	624	95	15.2%	1,198	159	13.3%
Social Sciences	209	21	10.0%	131	16	12.2%	340	37	10.9%
Veterinary Medicine	68	2	2.9%	27		0.0%	95	2	2.1%
Total	2,159	233	10.8%	1,639	221	13.5%	3,798	454	12.0%

Table 4.6 Faculty Grouping, Gender, and Dropout

Both Faculty Groupings and gender will be retained for inclusion in the multivariate analysis in the following chapter.

Social Class

The Higher Education Funding Council for England's proposals (HEFCE, 1998) for widening participation in higher education contained reference to how non-completion correlated with factors such as entry qualifications and social class, in particular. It seemed that there were two main ways in which students from “poor backgrounds” might be identified: either in terms of social class or by using geodemographic techniques.

The Universities and Colleges Admissions Service (UCAS) asks applicants aged up to 21 on entry to supply the occupation of whichever parent or guardian earns the most. Older students are asked to supply their own occupations. For the cohort being analysed, this information was then coded by UCAS, using the 1990 Standard Occupational Classification (SOC) devised by the Office of Populations, Censuses and Surveys (OPCS).

The codes (which include “unemployed”, “retired” and “armed forces”) can then be used to determine a student's social class.

HEFCE observed that this information was available only for full-time students, and that part-time students and direct (non-UCAS) entrants would be excluded. HEFCE also commented that the information would be based on a “self-assessment which cannot be audited or verified” (HEFCE, 1998, Annex A, para. 3). On the other hand, it was pointed out that geodemographic techniques would “provide a measure related to social background for almost all students” (HEFCE, 1998, para. 27). While it was acknowledged from the outset that geographic data could not provide a precise measure of social class this has been, nevertheless, the basis on which the Higher Education Funding Council for England (HEFCE, 1999b) and, more recently, the Scottish Higher Education Council for Scotland (SHEFC, 2001a) have chosen to implement governmental policies of widening participation in high education.

An analysis of first-year student attrition by social class, as determined using UCAS's method, produces the outcomes shown in Table 4.7.

Social Class	Students	<i>Percent of Total</i>	Dropouts	<i>Dropout%</i>
Armed Forces	22	0.6%	1	4.5%
I Professional	721	19.0%	76	10.5%
II Intermediate	1,552	40.9%	181	11.7%
IIIN Skilled Non-Manual	418	11.0%	45	10.8%
IIIM Skilled Manual	479	12.6%	49	10.2%
IV Partly Skilled	227	6.0%	39	17.2%
V Unskilled	53	1.4%	14	26.4%
Unemployed, Retired	33	0.9%	4	12.1%
Unknown	293	7.7%	45	15.4%
Grand Total	3,798	100.0%	454	12.0%

Table 4.7 Social Class and Dropout

It can be seen that the cohort was predominantly middle-class, and that dropout rates were considerably higher than average for the relatively few students coming from classes IV and V. It will also be observed that the social class for 7.7% of the cohort is 'Unknown', and that this group experienced a relatively high dropout rate (15.4%). This particular group is made up of two strands: those students not entering the University through UCAS, and those whose social class was recorded as being unknown to UCAS.

Smithers and Robinson (1996) reported that in 1995 the percentage of the full-time, first-degree student intake in the UK from social classes IIIM to V was 28.1%. For the

University of Glasgow in 1999-2000 the equivalent students, expressed as a percentage of students in classes I to V was 22.0%, suggesting that it had a somewhat lower than average proportion of students from lower social classes.

Individual students' social class, as supplied to the University by UCAS, will be used in subsequent analyses in this study.

Geographically-Based Social Factors (Students Domiciled in Scotland Only)

The relationships between home location, geographically-based social factors and higher education participation rates for students domiciled in Scotland has been examined by Raab (1998) and by Johnston *et al.* (1999). Poisson regression was used to determine the linear combination of 1991 Census factors which best predicted Standardised Participation Ratios in higher education in each of Scotland's 895 Postcode Sectors. The factors identified were the proportion of heads of households in social classes 1 and 2 and the proportions of adults with post-school qualifications. The resultant regression equation was used to estimate an “Educational Advantage Score” for each Postcode Sector and these estimates, in turn, were used to group the Sectors into seven groups. The first-year undergraduate attrition rates at the University of Glasgow for each of these seven groups were calculated, and these are shown in Table 4.8.

Area of Educational Advantage	Students	Percent of Total	Dropouts	Dropout%
7 (high)	639	16.8%	87	13.6%
6	581	15.3%	60	10.3%
5	366	9.6%	35	9.6%
4	397	10.5%	43	10.8%
3	339	8.9%	48	14.2%
2	294	7.7%	43	14.6%
1 (low)	236	6.2%	39	16.5%
Unknown	946	24.9%	99	10.5%
Grand Total	3,798	100.0%	454	12.0%

Table 4.8 Area of Educational Advantage and Dropout

Matches with Raab's database were achieved in 75.1% of cases. The other cases were either domiciled outwith Scotland, or else were domiciled in Scotland, but with no matching achieved. The extent to which those social factors that best predict higher education participation rates on a geographical basis are also associated with attrition rates can thereby be assessed.

It will be observed from Tables 4.7 and 4.8 that there was less variation in first-year dropout rates at the University between areas of different Educational Advantage Scores than there was between different social classes. This suggests that basing retention policies on the latter rather than the former is likely to be more effective, because a given level of effort can be focused on a smaller group of students in order to achieve a greater reduction in the number of dropouts.

The results are perhaps not surprising. The proportion of heads of households in particular social classes and the proportion of adults with post-school qualifications are both ecological variables and, as such, may not be the most appropriate for making predictions at the individual level; the units of analysis are different. Furthermore, it might be reasonable to suppose that the social predictors of participation should also be reasonable predictors of retention, but not necessarily to the same extent. The granularity of the occupational codes is, in fact, finer than that used for the Educational Advantage Scores, making the former potentially more useful for statistical analysis. The census data will have been less up-to-date than students' self-declared parental occupations but, on the other hand, UCAS's conversions of job titles to social classes were based on classifications that were also almost a decade old at the time they were used.

Social Classes and Areas of Different Educational Advantage Scores Compared

It is of interest to cross-tabulate the social class data derived from UCAS with Educational Advantage Scores, as calculated by Raab (1998). Table 4.9 shows such a cross-tabulation for all students in the cohort. It will be seen that there is a moderate correlation: generally students from higher social classes come from areas having higher Educational Advantage Scores. However, the correlation is skewed. It seems that students from higher social classes are associated with higher Educational Advantage Scores more commonly than the reverse, and that it is relatively unusual for students from lower social class backgrounds to come from areas having higher Educational Advantage Scores. Areas having low Educational Advantage Scores are more heterogeneous in terms of their mix of social classes than those having higher Educational Advantage Scores.

Social Class	Educational Advantage Score of Postcode Sector							Un-matched	Row Total
	1 (lo)	2	3	4	5	6	7 (hi)		
I Professional	22	25	43	68	70	109	182	202	721
II Intermediate	61	92	135	168	162	263	289	382	1,552
IIIN Skilled Non-Manual	23	41	40	49	42	68	65	90	418
IIIM Skilled Manual	51	61	54	60	47	70	46	90	479
IV Partly Skilled	29	36	31	22	22	30	19	38	227
V Unskilled	16	8	7	6	3	7	2	4	53
Forces		2	1	1	2	5	3	8	22
Unemployed, Retired	10	3	7			3	6	4	33
Unknown	24	26	21	23	18	26	27	128	293
Column Total	236	294	339	397	366	581	639	946	3,798

Table 4.9 Social Class and Educational Advantage Score

The conclusion is that these are two different constructs, empirically as well as conceptually. Educational Advantage Scores were not carried forward for subsequent analysis, mainly because of the unit-of-analysis problems and the difficulties with missing data that this would have entailed.

Since 1999-2000 the funding councils have adopted the Claritas Super Profile postcode-referenced database to classify postcodes for the purposes of grant allocations and institutional performance indicators. Whether the use of this system, which is available only commercially, would have led to the same conclusions, remains a matter of conjecture.

Standardised Participation Ratios (Students Domiciled in Scotland Only)

It is also possible to analyse dropout rates according to Standardised Participation Ratios. This is shown in Table 4.10, in which Scottish Postcode Sectors of differing Standardised Participation Ratios are divided into ten groups, each the home of roughly the same number of first-year undergraduates at the University. The “Unknown” category includes those students who were not domiciled in Scotland and those domiciled in Scotland, but for whom no match was achieved. There is no striking correlation between Standardised Participation Ratios and attrition and, consequently, they were not retained for further analysis.

SPR Grouping of Postcode Sector	Standardised Participation Rate (SPR) Band	Students	Dropouts	Dropout%
1 (lo)	17.26 - 68.22	286	42	14.7%
2	68.22 - 80.03	274	33	12.0%
3	80.03 - 90.41	294	46	15.6%
4	90.41 - 103.47	287	24	8.4%
5	103.47 - 113.64	293	39	13.3%
6	113.64 - 124.31	277	26	9.4%
7	124.31 - 139.11	293	43	14.7%
8	139.11 - 153.81	277	41	14.8%
9	153.81 - 179.05	290	30	10.3%
10 (hi)	179.05 - 308.29	281	31	11.0%
Unknown	-	946	99	10.5%
Total		3,798	454	12.0%

Table 4.10 Standardised Participation Ratios and Dropout

Tuition Fee Status

A small percentage (1.9%) of the cohort came from outwith the European Union and paid significantly higher levels of tuition fees than their European counterparts (Table 4.11). These students appear to have experienced a relatively high rate of attrition (16.2%).

Tuition Fee Status	Students	<i>Percent of Total</i>	Dropouts	<i>Dropout%</i>
Home & EU Fees	3,724	98.1%	442	11.9%
Overseas Fees	74	1.9%	12	16.2%
Grand Total	3,798	100.0%	454	12.0%

Table 4.11 Tuition Fee Status and Dropout

Tuition Fee Status is commented upon below.

Provenance

The provenance of students is recorded in the central student records system. Glaswegians had a higher than average dropout rate (14.0%). Students from outwith the European Union also experienced a high dropout rate (16.4%), which is consistent with the figure for overseas fee-payers although, in both cases, the numbers involved are relatively small.

Provenance	Students	<i>Percent of Total</i>	Dropouts	<i>Dropout%</i>
In/under 30 miles from Glasgow	1,848	48.7%	258	14.0%
Over 30 miles from Glasgow; In Scotland	1,219	32.1%	122	10.0%
Outwith Scotland in UK	562	14.8%	51	9.1%
Outwith UK in EU	107	2.8%	12	11.2%
Outwith EU	61	1.6%	10	16.4%
Unknown	1	0.0%	1	100.0%
Grand Total	3,798	100.0%	454	12.0%

Table 4.12 Provenance and Dropout

Provenance is retained for further analysis in the next chapter.

Residential Category

Students' term-time accommodation is classified in the central student records system according to one of five residential categories. Clearly students may move from one type of accommodation to another in the course of a session. The particular analysis shown in Table 4.13 is derived from the position as it was recorded in mid-February 2000. The database was in a relatively stable and complete position at that time.

Residential Category	Students	<i>Percent of Total</i>	Dropouts	<i>Dropout%</i>
Univ Hall/Student House	1,634	43.0%	140	8.6%
Univ Res/Sub-Let Flat	57	1.5%	10	17.5%
Parental/Guardian House	1,689	44.5%	231	13.7%
Own Home	206	5.4%	39	18.9%
Away From Home	164	4.3%	27	16.5%
Unknown	48	1.3%	7	14.6%
Total	3,798	100.0%	454	12.0%

Table 4.13 Residential Category (centrally recorded) and Dropout

It can be seen that 43% of first-year students were living in halls of residence and that this group has a markedly lower dropout rate than that for other students (8.6%). This is consistent with Johnes and Taylor's (1989) analysis. The numbers living with their parents or guardians more or less matched the number in halls of residence, but were almost 60% more likely to drop out. The few first-year students living in the relative isolation of University-owned flats seem to have suffered a high dropout rate. Those living in their “Own Home” had the highest dropout rate. Presumably these were older students having domestic and perhaps family responsibilities. It is difficult to know with certainty what meaning the phrase “Away From Home” imparted to students as they completed their matriculation forms. The minority who opted for this choice were possibly living in non-University rented accommodation, and seem to have experienced a high attrition rate.

Because of the lack of clarity surrounding some of these descriptions, the question was asked again in a slightly different form as part of the online questionnaire described in Chapter 6.

Residential Category	Students	Percent of Total	Dropouts	Dropout%
Hall of Residence	1,277	33.6%	61	4.8%
University Flat/House	167	4.4%	14	8.4%
Other Rented Flat/House	132	3.5%	18	13.6%
Parental/Guardian's Home	1,318	34.7%	103	7.8%
Own Home	139	3.7%	10	7.2%
Other	25	0.7%	0	0.0%
Blank	740	19.5%	248	33.5%
Total	3,798	100.0%	454	12.0%

Table 4.14 Residential Category (from questionnaire responses) and Dropout, including Blanks

Table 4.14, which is based on questionnaire responses, seems to validate the conclusions derived from the central student records system. It also demonstrates the extent of a bias present in the online questionnaire: many students did not remain in the University for long enough to answer the questions. Consequently blank responses are associated with a very high dropout rate. On the other hand, the proportionalities among those students who did complete the questionnaire, as shown in Table 4.15, match the data from the central student records system (Table 4.13) reasonably well.

Residential Category	Students	Percent of Total	Dropouts	Dropout%
Hall of Residence	1,277	41.8%	61	4.8%
University Flat/House	167	5.5%	14	8.4%
Other Rented Flat/House	132	4.3%	18	13.6%
Parental/Guardian's Home	1,318	43.1%	103	7.8%
Own Home	139	4.5%	10	7.2%
Other	25	0.8%	0	0.0%
Total (excluding Blanks)	3,058	100.0%	206	6.7%

Table 4.15 Residential Category (from questionnaire responses) and Dropout, excluding Blanks

It is, however, not clear why the percentage of students (5.5%) shown in Table 4.15 as being resident in a 'University Flat/House' should be so much higher than those shown in Table 4.13 as living in a 'Univ Res/Sub-Let Flat' (1.5%). The centrally held data were more complete and, for this reason, they were used for subsequent analysis, albeit eventually in a dichotomised form, as described in the next chapter.

Financial Hardship

There are two indicators held centrally which give an indication of students' financial well-being (or, more precisely, financial distress): levels of Access awards and amounts given or lent from the Student Hardship Fund.

There were three criteria for receipt of Access funds: having children, being disabled, and living in rented accommodation. Unfortunately, it is not possible to tell which students qualified for support according to which criteria. Whilst the first two criteria would merit further investigation, the third is a catchall, used by rich and poor alike. As such, it nullifies the usefulness of the data.

Hardship Fund awards are given to students who have applied for support, and whose cases the Student Hardship Fund Committee has considered. The amounts awarded are determined according to individual circumstances, which include the difference between individuals' income and expenditure, and levels of debt.

Of the 36 students in the sample who received awards from the Fund in 1999-2000, five (13.9%) dropped out that year. This figure may be compared with the figure of 12.0% for the sample as a whole. It therefore appears that the Committee was not unsuccessful in providing sufficient support to allow students to continue their studies. Further work could be undertaken to examine the longer-term performance of these particular students and that of other cohorts of similar individuals.

There is some evidence to suggest that awards were focused on students coming from lower social classes, but it appears that in the Committee's view students deserving of assistance could come from all classes (Table 4.16).

Social Class	Students	Awards	
		Awards	<i>Awards%</i>
I Professional	721	3	0.4%
II Intermediate	1,552	11	0.7%
IIIN Skilled Non-Manual	418	3	0.7%
IIIM Skilled Manual	479	7	1.5%
IV Partly Skilled	227	4	1.8%
V Unskilled	53	1	1.9%
Forces	22		0.0%
Unemployed, Retired	33		0.0%
Unknown	293	7	2.4%
Grand Total	3,798	36	0.9%

Table 4.16 Social Class and Student Hardship Fund Awards

In short, the use of these data could be problematic; this is discussed in more detail below.

Age

If one divides the whole cohort according to age into 10 groups of roughly the same size, the dropout rates are shown in Table 4.17.

Age group	Age band (years)	Students	Dropouts	<i>Dropout%</i>
1	16.44 - 17.64	363	37	10.2%
2	17.64 - 17.85	394	38	9.6%
3	17.85 - 18.02	379	45	11.9%
4	18.02 - 18.17	367	39	10.6%
5	18.17 - 18.30	366	36	9.8%
6	18.30 - 18.44	397	34	8.6%
7	18.44 - 18.60	388	45	11.6%
8	18.60 - 19.15	380	48	12.6%
9	19.15 - 20.67	384	58	15.1%
10	20.67 - 63.09	380	74	19.5%
Total		3,798	454	12.0%

Table 4.17 Age and Dropout

Although the oldest student was aged just over 63 on entry, the number of mature students over the age of 21 on entry is small – less than 10% of the total. Paterson (1997) observed that in 1993 22% of entrants to full-time undergraduate courses in Scottish higher education were aged 25 or over and that 37% were aged 21 years and over. The University of Glasgow's undergraduate student population appears to have been younger, being dependent to a greater than average extent on the traditional school-leaver market.

Lenning (1982) noted that various factors could be associated with age, as described in Chapter 2. The lowest dropout rate shown in Table 4.17 is for the sixth decile. Thereafter dropout rates increase steadily with age. From the age of roughly 19 upwards dropout rates are higher than the average for the cohort as a whole. The dropout rates for the youngest entrants are lower than average. These are possibly students who have come to University straight from fifth year at school. It seems likely that there are various confounding factors affecting the apparently uneven dropout rates at the younger ages. Because the relationship is not straightforward, to model it as being linear would not be appropriate. Age is one of the variables to be examined in more detail in subsequent chapters.

Entry Qualification Route

The dropout rates for students coming to University by different entry routes varied considerably. The figures are shown in Table 4.18.

Three groups had relatively low dropout rates: those entrants from sixth year of school in Scotland, having qualified for entry in fifth year (7.2%); those with GCE results (8.5%); and those having successfully completed one of the University's own Access courses (9.1%). The latter is probably due to a marked filtering effect: completion rates for the Access courses are typically about 60% (MacDonald, Karkalas, and Mackenzie, 1996).

Direct entrants from fifth year of school in Scotland were relatively unusual, and experienced a slightly higher dropout rate (10.0%) than their counterparts who opted to stay at school for an extra year. On the other hand, those students coming to the University, having not qualified to do so until the sixth year of school in Scotland, experienced a relatively high dropout rate (14.7%). Those students having a non-UK qualification experienced a similar dropout rate (14.8%).

The highest dropout rates were experienced by those students coming from Scottish schools but who had elected to take a gap year, and by students entering the University with 'Other UK' qualification. The latter include Access courses run by institutions other than the University, HNC, HND, NVQ and SVQ courses (21.3%).

Entry Qualification Route	Students	Percent of Total	Dropouts	Dropout%
Scottish 6th year (qualified in 5th year)	1,163	30.6%	84	7.2%
GCE	568	15.0%	48	8.5%
Glasgow University Access course	55	1.4%	5	9.1%
Scottish fifth year direct	229	6.0%	23	10.0%
Scottish sixth year direct	1,135	29.9%	167	14.7%
Scottish gap year	209	5.5%	45	21.5%
Other UK	282	7.4%	60	21.3%
Non-UK	135	3.6%	20	14.8%
Unknown	22	0.6%	2	9.1%
Total	3,798	100.0%	454	12.0%

Table 4.18 Entry Qualification Route and Dropout

Entry Qualification Routes are further analysed in Chapter 5.

UCAS Admission Scores

UCAS divides applicants according to their best qualifications on entry. The most common classification used by UCAS for the University of Glasgow is 'SCE'. Of the cohort of 3,798, 2,606 students (68.6%) in the cohort were classified in this way. Their average dropout rate was 11.4%. There is a clear relationship between having more Higher points and lower dropout rates, as may be seen from Table 4.19. (See also Woodley, Thompson, and Cowan (1992) for a similar analysis of non-completion according to Highers scores.)

SCE Higher Points	Students	Dropouts	<i>Dropout%</i>
up to 12	144	33	22.9%
14	173	34	19.7%
16	254	47	18.5%
18	316	46	14.6%
20	320	41	12.8%
22	315	29	9.2%
24	258	27	10.5%
26	237	18	7.6%
28	228	12	5.3%
30	361	11	3.0%
Total	2,606	298	11.4%

Table 4.19 SCE Higher Point Scores and Dropout

The second most common code used by UCAS for entrants to the University was 'A/AS Levels' (Table 4.20). There were 535 (14.1%) such individuals, having an average dropout rate of 8.0%. Again, there is a positive relationship between entry points and retention rates. Smith and Naylor's analysis (2001) is similar in its approach, in that it identifies separately the effects of A-level and Highers scores on non-completion.

A/AS Level Points	Students	Dropouts	<i>Dropout%</i>
up to 20	131	14	10.7%
22 - 24	174	16	9.2%
26 and above	230	13	5.7%
Total	535	43	8.0%

Table 4.20 A/AS Level Point Scores and Dropout

UCAS also categorises separately students with Baccalaureate awards and Other Overseas Qualifications. It also identifies entrants having a variety of “non-traditional” qualifications: Partial Degree Credits, Foundation, BTEC /Scotvec Higher, Access, BTEC/Scotvec Lower, Other Degree, None, GNVQ and Other UK Qualifications. Table 4.21 summarises the position by grouping together all of these miscellaneous entry qualifications, combining CSYS with SCE, and adding “UK Degree” and “Unknown”

categories. The high dropout rate for students having 'Other UK' qualifications is of interest, and is consistent with HEFCE's results (1999a *et seq.*), for example. The differences between students having English and Scottish qualifications are also of interest. One practical issue is how performance in these two different types of examination might reasonably be compared, and this is discussed below.

Best Qualification	Students	Dropouts	<i>Dropout%</i>
A/AS Levels	535	43	8.0%
SCE + CSYS	2,632	304	11.6%
Other UK	370	78	21.1%
Non-UK	123	19	15.4%
Unknown	138	10	7.2%
Total	3,798	454	12.0%

Table 4.21 Best Qualification and Dropout

University of Glasgow's Entry Point Scores

The University uses its own point scoring system, which has the pragmatic advantage of combining Scottish Highers and English 'A' Levels, as well as certain other types of qualifications, into a combined scale. The scoring method used is shown in Table 4.22.

Grade	Exam Type				
	A level	AS level	Scottish Higher	CSYS	Irish Higher
A	11	5.5	6	9	6
B	9	4.5	4	7	4
C	7	3.5	2	4	2
D	5	2.5	0	0	1
E	0	0	0	0	0

Table 4.22 University of Glasgow's Entry Point Score System

The algorithm used to calculate Entry Point Scores makes allowance for those students who have sat the same (or similar) examinations under the auspices of one or more examination boards by disregarding or partially discounting the duplicates, thereby precluding the very high Entry Point Scores that might otherwise occur.

Five of the main entry qualification types shown above can be combined using this scoring system, and attrition rates for the different scores calculated. The types are:

- Direct from 5th year
- Direct from 6th year, but qualified in 5th year

- Others direct from 6th year
- GCE with no SCE or other qualifications
- Not direct from school but SCE (or SCE plus other school qualifications)

Score	Students	Dropouts	<i>Dropout%</i>
up to 18	494	107	21.7%
18 - 20	282	41	14.5%
20 - 22	291	35	12.0%
22 - 24	302	42	13.9%
24 - 26	321	33	10.3%
26 - 28	265	21	7.9%
28 - 30	237	21	8.9%
30 - 35	512	31	6.1%
35 - 40	311	11	3.5%
40 and over	228	10	4.4%
Unknown	61	15	24.6%
Total	3,304	367	11.1%

Table 4.23 University of Glasgow's Entry Point Scores and Dropout

Table 4.23 shows a clear inverse relationship between Entry Point Scores and dropout rates. Admission score is important because it is the main and, in many cases, the sole determinant of whether a particular student is admitted. However, these scores are not in all cases the same as those scores taken into account in the admissions process; the scores *on* admission can be different from the scores *for* admission. The figures used throughout this study are Entry Point Scores *on* admission, because these are more likely to represent students' true abilities.

Conclusions

In this chapter the cohort and the dependent variable to be used subsequently in this study have been defined. Various practical problems with the University's centrally held student records have been identified that limit their usefulness.

Unused Variables

Those variables described here but not used in the analysis presented in the next chapter are: the centrally recorded dates and reasons for departure; Degree examination appearances, Degree examination successes, Educational Advantage Scores, Standardised Participation Ratios, tuition fee status and centrally recorded financial hardship. The reasons for their omission are described below.

The centrally recorded dates and reasons for departure: These are missing in most cases. It seems likely that the majority of those leaving did not inform the University of their departure. Furthermore, only one out of several pre-defined explanations for a student's early departure may be recorded, and these allow only a very brief, superficial explanation to be given. A further difficulty is that many different individuals across the institution provide the data. Categorising a student as having left is often a matter of judgement, at least initially, and there may be some variation in practice among data providers in this respect. Often information is circumstantial or incomplete and, in these circumstances, some members of staff may be more ready than others to report departures. Similarly, there may also be inconsistencies of interpretation in selecting the most appropriate reason to explain why a student has left. Consequently little reliance can be placed on the centrally recorded dates and reasons for departure. The wider implication of these observations is that, if other institutions face similar difficulties, the national data held by HESA are not robust, and this conclusion is consistent with Ozga and Sukhnandan's (1997) findings.

Degree examination appearances: By contrast, Degree examination appearances are accurately recorded. All candidates are informed of their examination outcomes. The accuracy of this data is of key importance not just to the candidates themselves, but also to the University, which has an obligation to its students accurately to record their academic progress. These are powerful reasons to believe that this information may be relied upon. Sitting an examination is unequivocal evidence of a student's physical presence in the University. It may additionally be adduced that those sitting examinations perceive that there is greater overall benefit to be gained from sitting the examinations than from not doing so. However, their motivations may differ. While it may be supposed that most students would wish to sit examinations in order to progress academically within the University of Glasgow, others might see examination success as a prerequisite to transferring to another institution. Others might wish merely to be seen to be sitting an examination, perhaps in response to parental or peer pressure, regardless of the likely outcome. In later chapters a distinction is drawn between those students who sat at least one Degree examination either in the May/June diet or else in the August/September diet on the one hand and, on the other, those who did not. Initially, no such distinction is made.

Degree examination successes: The relationship between Degree examination performance and retention was examined briefly. It could be argued that dropout is at one extreme of a continuum of different academic outcomes that includes examination results. However, it

was shown that the relationship is more subtle than this. Although lack of academic success and attrition tend to go hand-in-hand, there are nonetheless a few students who opt not to persist, even though they have passed all the necessary examinations. At the other extreme, it appears that a minority of students is allowed to persist, even though they have not passed any Degree examinations. Persistence, Degree examination appearances, and Degree examination performance may all be thought of as outcomes of the first-year academic process. As such, they are closely related but different phenomena. It is consequently assumed to be outwith the scope of this study to consider the effect of Degree examination performance on attrition rates. This is in contrast to the way in which many researchers have chosen to operationalise Tinto's Student Integration Model, for example. Cumulative freshman year GPA is typically included as an indication of academic integration and, in this respect, the current study deviates from standard practice. While Degree examination performance certainly influences the University's decisions concerning retention and very probably influences (or confirms) students' decisions, too, the issue at hand is to consider the effects on attrition of more long-term, deep-seated phenomena that may originate earlier in a student's academic career. A further practical consideration concerns the availability of data. Not all faculties used the same examination marking schemes. Only by using very coarse-grained measures of examination achievement could consistency be achieved across the institution.

Educational Advantage Scores and Standardised Participation Ratios: There are various difficulties associated with the use of Raab's Educational Advantage Scores and Standardised Participation Ratios. The home residence of 80.8% of the cohort was in Scotland, according to the University's central records. Matches using Raab's Postcode-Sector-based analysis were achieved for 75.1% of the cohort which, it may be inferred, is the equivalent of 93% of those having Scottish provenance. Although this is a very good match, the systematic exclusion of non-Scots can be expected to bias the analysis, particularly in relation to entry qualification routes and residential categories. Furthermore, the use of geographically-based aggregations of students introduces an additional level of analysis which may serve only to mask the individual-level relationships which can be measured using the social class data derived from parental occupations. Dropout rates appear to be influenced to a greater extent by social class than by either Educational Advantage Scores or by Standardised Participation Ratios. The observed attrition rate for social class V is 2.5 times higher than that for class I. The corresponding ranges in the

attrition rates for Educational Advantage Scores and for Standardised Participation Ratios are both smaller than this, having observed odds ratios of 1.7 and 1.3 respectively.

EU and non-EU tuition fee levels: Only a small minority of first-year students were domiciled outwith the EU and paid full-cost tuition fees, which were considerably higher than the standard home fees. For example, in 1999-2000 the standard home tuition fee was £1,025, whereas overseas fees varied from £6,930 in the Arts-side Faculties to £13,640 in Clinical Medicine. Good financial backing is a prerequisite for overseas students. It could be supposed that they might, perhaps, be more prone to homesickness but less prone to the effects of financial hardship than their counterparts from within the UK, for example. A case could therefore be advanced for the exclusion from the analysis of those students paying non-EU fees. However, it might also be supposed that the diversity of their responses to the questionnaires might facilitate rather than hinder the subsequent analyses. It was therefore decided to include them in the sample, undifferentiated from other students.

Financial Hardship (as recorded centrally): It is common to cite financial hardship as a reason why students leave early. However, it has been pointed out that the University's centrally recorded information concerning students' financial circumstances is either subject to serious bias (in the case of Access funding), or else applicable only to a relatively few, self-selected students (the Hardship Fund). Consequently this information cannot be used for the purposes of this study. In order to make good the lack of this important information, various questions were asked of students concerning their financial circumstances both as part of the questionnaire administered at the time of matriculation and as part of the online questionnaire answered in the course of the academic session.

Variables Included

Eight variables have been identified as being associated with attrition and which will be further considered in the next chapter: faculty grouping, gender, age, social class, provenance, residential category, entry qualification route and entry point score.

Because the analysis has been based on the experience of a whole cohort, it seems likely that the results would be replicated in studies of other cohorts of first-year students, at least at the University of Glasgow. The fact that such associations exist is of interest in its own right. However, the next issues to be investigated are the extent to which these associations

still remain, once the effects of the other variables have been statistically controlled, and whether there are any interaction effects among them. Multivariate statistical techniques such as those used in the following chapter are an essential tool in this work. It should also be acknowledged that the figures presented in this chapter are informative rather than explanatory. If one is to obtain an understanding of the causes of student attrition, it will be appropriate also to introduce into the analysis additional, attitudinal variables, and this is done subsequently in the later parts of this thesis.

Chapter 5 – Explaining First-Year Attrition Using Objective Academic and Background Variables

The previous chapter contains an initial examination of some of the more salient and readily available entry characteristics of the first-year undergraduate cohort being studied and their relationships with attrition rates. The purpose of this chapter is further to explore these relationships and, in particular, to express them in statistical terms. The purpose at this stage of the study is not to test any preconceived theories but rather to identify variables that are closely associated with attrition.

Eight variables were previously identified as being putatively associated with attrition and will be further considered in this chapter: faculty grouping, gender, age, social class, provenance, residential category, entry qualification route and entry point score.

In this chapter an overall first-year dropout indicator, expressed as a binary variable, constitutes the response variable. In subsequent chapters, however, dropouts are split into two groups and analysed according to the timing of their departure, as inferred from Degree examination appearances.

Logistic Regression

Logistic regression analysis is used extensively in this study. The main advantage of this approach is that it allows binary response variables to be modelled. The problem is formulated in such a way that the probability of an event (first-year undergraduate persistence, in this case) is expressed as a particular function of the independent variables:

$$\text{Prob}(\text{event}) = \frac{1}{1 + e^{-Z}}$$

where

$$Z = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n$$

X_1, X_2, \dots, X_n represent n independent variables ($n > 0$)

$\beta_1, \beta_2, \dots, \beta_n$ are the coefficients of X_1, X_2, \dots, X_n respectively

β_0 is a constant term.

Maximum likelihood techniques are used to obtain estimates of the coefficients, $\beta_0, \beta_1, \beta_2, \dots, \beta_n$. Z is a linear combination of the independent variables. For example, in the simple case where $\beta_0 = 0$ and $\beta_1 = 1$, $\text{Prob}(\text{event})$ closely resembles the S-shape of a Normal distribution function, as shown in Appendix 5.1.

The model is such that, by definition,

$$0 \leq \text{Prob}(\text{event}) \leq 1$$

and the probability of an event not occurring is simply

$$\text{Prob}(\text{no event}) = 1 - \text{Prob}(\text{event})$$

The odds ratio is defined as

$$\frac{\text{Prob}(\text{event})}{\text{Prob}(\text{no event})}$$

Finally, the natural logarithm of the odds ratio is known as the logit. It can be shown from above that

$$\text{Logit}(\text{event}) = Z.$$

The coefficient, β_j , represents the change in the logit corresponding to a change in the independent variable, X_j , of one unit. Similarly, $\exp(\beta_j)$ represents the change in the odds ratio corresponding to a change of one unit in X_j . Consequently if, for example, X_j exerts no influence on the response variable, β_j is zero and $\exp(\beta_j)$ is one. Furthermore, $\text{Logit}(\text{event}) = 0$ when there is a 50:50 chance of the event occurring, and $\text{Logit}(\text{event}) > 0$ when $\text{Prob}(\text{event}) > 0.5$. Attention focuses in logistic regression not on the probability of an event occurring but, rather, on the logit and the odds ratio, as modelled in β_j and $\exp(\beta_j)$, respectively.

Model One

A series of simple logistic regression analyses were first conducted, each using persistence, as defined in the previous chapter, as the dependent variable. This constitutes Model One. Its formulation is shown in Appendix 5.2.

Each of these variables is considered on its own, and subsequently in conjunction with others, where appropriate. The results of the simple logistic regression analyses are shown in Appendix 5.3. Each of the eight explanatory variables is individually significant in Model One. The results are discussed below.

Persister

The dependent (or target) variable, Persister, is treated as dichotomous. Information as to whether particular students persisted or not, using the specific definition used previously, is available for all 3,798 students in the cohort under consideration.

Faculty Grouping

Summary statistics relating to twelve so-called Faculty Groupings were presented in the previous chapter. It may be seen that in some of these Groupings there were relatively few students. Simple logistic regression was carried out using indicator coding with the Arts Faculty Grouping used as the reference category. The Faculty Grouping variable has a statistical effect, as shown in Appendix 5.3.

Four Faculty Groupings were found to have persistence rates significantly higher than that of the Arts Faculty Grouping ($p < 0.05$): Law and Financial Studies, Medicine, Dentistry,

and Veterinary Medicine. Two Faculty Groupings had significantly lower persistence rates: Engineering and Nursing. Divinity also had a lower persistence rate although, given $p = 0.0619$, the difference was not quite significant at the 5% level. Four other Faculty Groupings had persistence rates that were not significantly different from that of the Arts Faculty Grouping: Crichton, Education, Science, and Social Sciences. It seems desirable to aggregate some of the Groupings in order to take cognisance of this and to avoid problems that would otherwise arise as a result of the existence of sparse data.

The Groupings were therefore combined according to their relative dropout rates into three Faculty Clusters: the Professional Faculties (Dentistry, Law & Financial Studies, Medicine and Veterinary Medicine), the General Faculties (Arts, Crichton, Education, Science and Social Sciences) and Others (Divinity, Engineering and Nursing).

The Professional Faculties are defined for present purposes as consisting of the three Clinical Faculties plus Law & Financial Studies, and are all characterised by relatively high entry qualification requirements and very low attrition rates.

The entry requirements for the three large faculties of Arts, Social Sciences and Science are not as high as those for the Professional Faculties, and their dropout rates tend to be higher. They use the Scottish faculty entry system whereby admission is granted to a particular faculty in the first instance. It is usually only after a student has been admitted that a choice of academic subjects, of which there is a very wide range available, is confirmed. Some subjects can be studied by students matriculated in any of these three faculties. Although the Faculty of Education is predominantly focused on teacher training, neither its entry requirements nor its attrition rates are similar to the Professional Faculties. It is instead included with the General Faculties. The relatively few students at the geographically distinct Crichton Campus at Dumfries almost all study the Humanities and Social Sciences, and it appears that they may reasonably be grouped with the traditional, general faculties.

Although professionally orientated, the Faculty of Engineering's first-year students may with some oversimplification be described as being less well qualified and studying subjects having difficult mathematical content, and this is reflected in its high attrition rate. Those studying Nursing are also confronted by a challenging curriculum, albeit quite different from that of the Engineers, and tend also to be less well qualified on entry. The main distinguishing feature of students in the Faculty of Divinity is that they tend to be

somewhat older than most (36.4% aged over 19.33 years on entry, compared to 18.0% for the University as a whole). It is possibly the additional family responsibilities and expenses that some such students must bear that cause the Faculty's first-year attrition rate to be one of the highest in the University.

For the reasons discussed above, it could be argued that the attrition rates in the Faculty Groupings of Education, Crichton, Nursing and Divinity are affected by factors somewhat different from those applicable to the majority of students in the Faculty Clusters to which they have been attached, and that these Faculty Groupings should either be dropped from the analysis, or else handled separately. The main counter-arguments are that although each of these entities is relatively small, removal of them all would reduce the size of the overall cohort quite considerably, and to keep each of them separate in the analysis would cause the data in some areas to be sparse and therefore difficult to analyse. Clustering the Faculty Groupings in this way also makes it possible to illustrate more succinctly the relationships between the Faculties and the other explanatory variables.

Gender

Simple logistic regression reveals a statistically significant difference in attrition rates between the sexes. The results shown in Appendix 5.3 were calculated using indicator coding with males as the reference category. Although not algebraically necessary, running the same model for a second time using females as the reference category allows the probability of persistence to be obtained from the SPSS output for both males and females. The formulae are:

$$\text{Prob}(\text{persist} \mid \text{female}) = \frac{1}{1 + e^{-(1.8588 + 0.2533)}} = 0.892 \text{ and}$$

$$\text{Prob}(\text{persist} \mid \text{male}) = \frac{1}{1 + e^{-(2.1122 - 0.2533)}} = 0.865$$

These point estimates correspond to the values shown in the previous chapter. Gender was retained for inclusion in the multiple logistic regression model.

Age

It was shown in the previous chapter that dropout rates vary according to age. The simple logistic regression analysis indicates that this relationship is statistically significant. However, an inspection of the relationship reveals that it is far from straightforward. The sample logit function exhibits a complicated pattern, at least at the lower ages which account for about nine-tenths of the cohort. This is illustrated in Appendix 5.4, which shows Logit (persistence) for the mid-point of all but the highest of the age deciles shown in the previous chapter. This may simply represent sampling variability, or it may be that other factors, such as the prescribed age bands for entry into the school system and Entry Qualification Route, might be modifying the relationship between age and attrition rates, at least at these younger ages. No transformation of age could make the corresponding logit function linear. It seems that if age is to be a useful indicator of persistence, then it should be made dichotomous. A cut-off point of 19.5 years of age at entry was chosen for the purposes of the subsequent multiple logistic regression models. It may be seen that above this age Logit (persistence) drops quite markedly.

Social Class

The outcome of the exploratory analysis of Social Class is similar to that for Faculty Groups. Overall, Social Class is a statistically significant categorical variable, as may be seen in Appendix 5.3. However, none of the seven social backgrounds used was statistically different from the 'Unemployed, Retired' category, which was used as the reference category. Appendix 5.5 shows a plot of the sample logit values.

CHAID (Chi-squared Automatic Interaction Detector: Kass, 1980; SPSS, 1998) was used to find the aggregation of the Social Classes having the greatest predictive validity. The optimal solution (chi-square = 17.00, df = 1; sig. = 0.0048) is to group the Social Class variable into two categories:

Social Classes I – III; Armed Forces; and

Social Classes IV and V; Retired; Unemployed.

These two so-called Social Groups were retained for subsequent analysis. Using the more usual aggregation based on Classes I – III on the one hand, and IIII – V on the other,

produced a difference in persistence rates that is not quite significant at the 5% level (chi-square = 3.83, df = 1; sig. = 0.0503).

Residential Category

Some doubts were expressed in the previous chapter concerning the definitions of some of the Residential Categories stored centrally, given that their descriptions seemed to be open to differences of interpretation.

It can also be seen from Appendix 5.6 that there were discrepancies between the University's central records and the responses to the online questionnaire concerning different types of University-controlled accommodation.

Part of the discrepancy may be due to the regrouping of 'Student Houses'. It was decided to continue the analysis using the centrally recorded data, but to combine the two types of University property, leaving four Residential Categories: University-Controlled, Parental/Guardian House, Own Home, and Away from Home. This still leaves some ambiguity concerning the meaning to be ascribed to the phrase 'Away from Home'.

The results shown in Appendix 5.3 are based on this four-way categorisation of Residential Category. University-Controlled accommodation was used as the reference category, and it transpired that the other three categories were associated with persistence rates all significantly lower than that for University-Controlled accommodation.

A classification tree analysis was also conducted, using CHAID, from which it was concluded that the most effective segmentation would be achieved using a dichotomous variable, split between those living in University-controlled accommodation on the one hand, and those living in all other types of accommodation on the other (chi-square = 23.8844, df = 1, sig = 0.0000). A three-way split intended specifically to identify those students living with their parents or guardians was also statistically significant (chi-square = 27.5379, df = 2, sig = 0.0000). However, subsequent experimentation with the multiple logistic regression model suggested that only the University controlled category would produce an estimate significantly different from that of any of the other categories. Residential Category was therefore retained as a dichotomised variable, with University-controlled accommodation in one grouping, and all other types of accommodation in the other.

Provenance/Home Residence Location and Residential Category

Appendix 5.3 shows that Home Residence Location has a significant association with persistence. For the purposes of the simple logistic regression analysis, 'In/under 30 mile Glasgow' was used as the reference category. 'Over 30 miles in Scotland' and 'Outwith Scotland in UK' both had significantly higher persistence rates; 'Outwith UK in EU' and 'Outwith EU' had persistence rates that were not significantly different from 'In/under 30 miles Glasgow'.

The vast majority (83.4%) of those living either in or within 30 miles of Glasgow lived in their parents' or guardians' homes. By contrast, most of those coming to the University from further afield lived during term-time in University-controlled accommodation: 77.5% of those from within Scotland; 96.4% of those from the rest of the UK; 84.9% of those from elsewhere within the EU; and 85.0% of those from outwith the EU (Appendix 5.7).

The crosstabulation of Home Residence Location and Residential Category contains zero-value cells that are to be expected for the relatively few students coming from outwith the UK. This perhaps weighs slightly in favour of omitting such students from the subsequent analysis, although the decisive reasons for doing so hinge on issues relating to Entry Qualification Routes and Entry Point Scores described below.

The high degree of correspondence between these two variables suggests that in the interests of parsimony only one needs to be retained. It seems appropriate not to use information concerning a student's previous address but rather the type of accommodation in which she or he is living during term time. This is likely to be more germane to issues of social integration and commuting difficulties considered later in this study; the mere fact of being of Glaswegian, Scottish, British, European, or of other origin seems in itself unlikely to influence attrition.

Entry Qualification Route and Home Residence Location

Students' Entry Qualification Routes were crosstabulated with their Home Residence Locations. This is illustrated in Appendix 5.8. Two difficulties with zero cells and sparse data are evident.

First, very few students from outwith the UK used UK Entry Qualification Routes, which is to be expected. This creates zero-value cells and suggests that if Entry Qualification Routes are to be retained in the analysis, then it would be appropriate to remove the non-UK students.

Secondly, there are relatively few students coded as “GU_access”. For consistency, these students would need to be combined with the “UK_oth” category, even though they appear to have experienced a markedly lower attrition rate. This issue is, however, subsumed within the broader considerations discussed below.

Entry Point Score

It can be seen from Appendix 5.9 that the relationship between Logit (persistence) and Entry Point Score is reasonably linear up to roughly 37 points. Thereafter, the sample attrition rate increases slightly. It is conceivable that those individuals having the very best entry qualifications might be discouraged by a lack of academic challenge in the first-year curriculum, and that they may have alternative opportunities more readily available to them outwith the University than other students. Sampling variability is another possible explanation for the slightly raised attrition rate for the best-qualified students. The inclusion of these students' unadjusted Entry Point Scores will slightly bias the estimate of the relationship between Entry Point Score and attrition rates. To exclude them from the analysis would be to disregard potentially useful information. A quadratic term was fitted, but this transpired not to be statistically significant. Using a dummy variable to distinguish the best-qualified entrants from the others was similarly unsuccessful. It was therefore concluded to retain these students, but with an Entry Point Score constrained to a maximum of 37 points, so that the logit of persistence is constant above this value.

Entry Qualification Route and Entry Point Score

It can be seen from Appendix 5.10 that the outliers at the top end of the (unconstrained) Entry Point Score range tend to be those coded as '6yr_q5' and 'GCE'. While it can be seen that the different Entry Qualification Routes tend to have differing average Entry Point Scores, the ranges of the Scores for each of the Routes is wide, and the ranges overlap to a considerable extent. It therefore seems appropriate to include both of these variables in the multiple regression analysis, although a stepwise procedure may be appropriate in view of the danger of multicollinearity.

It should be recollected that Entry Point Scores can meaningfully be used in conjunction only with five of the Entry Qualification Routes, and this is a conclusive argument for the exclusion of the other Entry Qualification Routes if Entry Point Scores are to be retained in the analysis. Excluding students from the other Entry Qualification Routes also overcomes the difficulties encountered with the GU_access category alluded to above, and with students from outwith the UK.

In summary, all of the variables analysed produce statistically significant models when fitted separately, as demonstrated in Appendix 5.3. As a result of the findings described above, it was concluded to constrain the scope of the investigation and to modify or discard some of the variables. These decisions are reflected below in the formation of the next model.

Model Two

It is argued above that the initial model should be re-specified, and the outcome is specified in Appendix 5.11. Only students having an Entry Point Score recorded centrally and having been admitted through one of the five relevant Entry Qualification Routes shown were included from Model Two onwards throughout all the remaining statistical analyses. In practice, this resulted in all overseas students being excluded.

A multiple logistic regression was performed, using the variables shown in Appendix 5.11. Indicator coding was employed, using the reference categories indicated in Appendix 5.12.

The summary Goodness-of-Fit statistic, based on an overall comparison between the observed probabilities and those predicted by the model, is difficult to interpret on its own. It can, however, be used to compare different models derived from the same sample.

The Model Chi-Square is highly significant. The null hypothesis that all of the beta coefficients are equal to zero is decisively rejected, and having information about the independent variables makes it possible to make better predictions than a null model having only a constant term.

The Hosmer and Lemeshow Goodness-of-Fit Test leads to the same conclusion. The null hypothesis is that the model fits the data. In this case one does not reject the null

hypothesis. With a rather high p -value of 0.69, the model appears to fit the observations well.

The Cox and Snell and Nagelkerke Coefficients of Determination are poor. Because the sample is large (3,094), the values of R^2 and \tilde{R}^2 are very small, even though the Model Chi-Square Test is significant. Little importance is attached to these statistics.

A classification table having a cut value equal to the overall sample probability of persistence (0.89) was used. The overall percentage of correct classifications was 63.32%. Reducing the cut value to 0.5 (the equivalent of assuming no prior knowledge about dropout rates) improves the overall predictive accuracy of the model considerably. However, this improvement is deceptive, because almost all of the errors are then cases predicted to persist when they had, in fact, dropped out, and the scope for this sort of error is limited by the low overall probability of dropout. The misclassifications made by the model illustrate the distinction between goodness-of-fit and accuracy of prediction. It is entirely possible to have a model that fits well but predicts category membership poorly in individual cases. The model is acceptable with the proviso that it cannot be used to make dependable predictions of dropout in individual cases.

Turning to the coefficients for the individual variables, it will be seen that the coefficients for Gender and for Social Group are no longer statistically significant. This does not invalidate the simple regression results that differences in attrition rates exist between the sexes and between social classes. Rather, being male or coming from a lower social class, for example, do not in themselves affect attrition rates once account is taken of the influence of the other explanatory variables within the model. This was demonstrated by conducting a series of chi-square tests, whereby it was established that Gender and Social Group are both associated significantly with each of the Faculty Category, Age Category and Entry Qualification Route variables. Similarly, t -tests were used to demonstrate that the mean Entry Point Score is significantly different for males and females, and for the two Social Groups analysed.

Age Category is not quite significant at the 5% level (sig. = 0.0851).

Although the Entry Qualification Route variable is significant, some of the individual Entry Qualification Routes are not. There is therefore an argument for combining some of the Entry Qualification Routes, and this is explored in more detail below. All other

variables (and categories thereof) included in the equation are significant at the 5% level. It should be observed, however, that the 95% confidence intervals are generally quite wide. While it may safely be claimed that each of the relevant explanatory variables has a real effect on attrition, it is more difficult to quantify that effect with precision. This may be due to sampling variability, multicollinearity, or sparse data, for example, or simply the fact that it has not been possible to find a set of variables that constitute a good predictive model of persistence.

Model Three

The Entry Qualification Routes were then recategorised into two new groups: Fifth-Year Qualifiers, and Sixth-Year Qualifiers combined with Scottish Gap-Year Students. Model Three (Appendix 5.13) was then run to incorporate this single change.

The overall percentage of classifications correctly predicted remains only moderately good at 62.70% (Appendix 5.14). The p -value for the Hosmer and Lemeshow Goodness-of-Fit Test in Model Three is 0.1949, whereas in Model Two it is 0.6948, suggesting that the overall goodness-of-fit for Model Three is not as good as for Model Two. With the exceptions of Gender and Social Group, all of the variables in this main effects model are now significant at the 5% level. In particular, the significance of age has improved: $p = 0.0214$ in Model Three, but $p = 0.0851$ in Model Two.

An inspection of the diagnostic plots based on individual observations was then carried out in order to identify cases for which the model provides poor estimates and those cases that exert disproportionate influence on the model.

Those cases which should be considered influential, according to Menard (1995), are those having a leverage statistic of over $(k + 1) / N$, where k is the number of independent variables (including each design variable as a separate variable) and N is the number of observations. In this example, $k = 7$ and $N = 3,094$, giving $(k + 1) / N = 0.0026$. It can be seen from Appendix 5.15 that there are a very large number of such cases, but that there are none that stand alone as meriting special attention.

It can be seen from Appendix 5.16 that the standardised residuals form two distinct groups. Those cases for which the observed probability of persistence was 1 (i.e. $P(Y_j = 1) = 1$) are

likely to have small positive values of $[P(Y_j = 1) - \hat{P}(Y_j = 1)]$, given that in most such cases the predicted probability of persistence (i.e. $\hat{P}(Y_j = 1)$) is in the region of 0.9. The other group is made up of those cases for which $P(Y_j = 1) = 0$, i.e. those students who dropped out. These are likely to have high negative values of $[P(Y_j = 1) - \hat{P}(Y_j = 1)]$, given that even the most adverse combination of entry characteristics is associated with a value of $\hat{P}(Y_j = 1)$ of slightly over 0.5. While it is evident in this example that the standardised residuals do not have a standard Normal distribution, the numbers having large negative values is not of itself a matter of concern.

Case number 1084 is an outlier, and is evidently an atypical early leaver.

The decrease in the value of the Pearson chi-square statistic due to the deletion of particular cases is shown in Appendix 5.17 as DIFCHI. The chart of DIFCHI against Predicted Values shows half of the typical goblet shape that one associates with logistic regression models. This is because of the asymmetric nature of the model. The exponential curve which rises as the Predicted Value increases illustrates the change in chi-square which would arise as a result of the deletion from the model of those cases which have, in fact, dropped out. Again, case number 1084 stands out from the rest of this group. Case 3269 is also an outlier, having a very low predicted probability of persistence. This case forms part of the line on the chart that represents cases that have, in fact, persisted. From inspection, it appears that removing any of them from the analysis would affect DIFCHI very little and, in the extreme, where $P(Y_j = 1) = 1 = \hat{P}(Y_j = 1)$, not at all.

The details of the two outliers identified in Appendix 5.17 are shown in Appendix 5.18.

Case 1084 appears to be an example of a particularly well-qualified individual whose departure could not reasonably have been foretold using the information available. On further investigation, it transpired that case 3269 had been miscoded in the University's central records system as having been a Scottish gap-year entrant when, in fact, the Entry Qualification Route was 'Other UK'. The exceptionally low Entry Point Score of 2 bears this out. Students having Entry Qualification Route 'Other UK' should be excluded from this part of the analysis.

The changes in the deviance statistic attributable to the removal of individual cases are charted as DIFDEV in Appendix 5.19. The shape of DIFDEV is not dissimilar to DIFCHI and, as such, does not offer any new insights.

DBETA is the standardised change in the regression coefficients attributable to the removal of a particular case, and is shown in Appendix 5.20. Because it is a standardised measure large values, especially those greater than 1, warrant closer examination. It can be seen that there are no such cases in this model, although case 3269 again appears as an outlier.

It was concluded from this inspection of the diagnostic statistics to exclude cases 1084 and 3269 from further analysis.

Model Four

In order to obtain an impression of some of the practical implications of the main effects model derived thus far, the two non-significant variables, Gender and Social Group, were removed from the analysis to produce Model Four, which is summarised in Appendix 5.21. Removing variables in this way is one of the few effective ways of dealing effectively with multicollinearity, although it runs the danger of introducing omitted variables bias. The full results are shown in Appendix 5.22.

The estimated probabilities of persistence were plotted for three student profiles. Those characteristics that all students in each of these profiles have in common are shown in Appendix 5.23.

Appendix 5.24 shows the estimated probability of persistence charted against Entry Point Score for students in Profile A. Probabilities are shown separately for Fifth-Year Qualifiers on the one hand and for Sixth-Year Qualifiers and Scottish Gap-Year Students on the other. For any given Entry Point Score there is only a slight difference in the estimated probability of persistence between the two Entry Qualification Categories. However, the probability of persistence is relatively insensitive to Entry Point Score, so that those qualifying in sixth year need to have considerably more points than those qualifying in fifth year in order to have the same probability of persistence. In practice, very few of these students have fewer than about 20 points, so the extrapolation of the lines of best fit down

to an Entry Point Score of 10 is only conjectural, and is illustrated simply for the purposes of comparison with the other profiles.

The chart of Profile B (Appendix 5.25) illustrates the effects of Age Category and Entry Point Score for those students categorised as having an intermediate probability of persistence. It can be seen that students aged at least 19.5 years on entry are quite markedly disadvantaged by comparison to their younger counterparts.

Profile C (Appendix 5.26) portrays the position of that group of students which is generally least likely to persist. Those students resident in University accommodation are shown as being less likely to drop out than others, such as those who remain at home with their parents. It may be that this difference is a consequence of the predispositions of the students concerned, or it may be that living in University-controlled accommodation confers some form of advantage, such as better social integration.

The relative importance of the different explanatory variables in this model is summarised by the odds ratios shown in Appendix 5.27, all of which are significant at the 5% level. The relative importance of Faculty Categories is made more clear in this table than in the preceding charts. The other point which is apparent from Appendix 5.27 is that Entry Point Score – the traditionally used predictor of university success – is only relatively weakly associated with persistence by comparison to the other variables included in the model. The odds ratio associated with one A-grade Higher result, for example, which is the equivalent of six entry points, is 1.36, and this is smaller than any of the other estimated odds ratios shown.

It is also apparent from this approach that the modelled probabilities of persistence vary considerably according to students' circumstances as captured by the model. At one extreme, success is virtually guaranteed; at the other, the chances of survival into the second year of study are little better than 50:50. Model Four has the merit of relative simplicity and having only statistically significant explanatory variables. However, the charts disguise the rather mediocre predictive power of the model. Nor does it contain any interaction terms. Their relevance is investigated in the next model.

Model Five

Model Five (Appendix 5.28) consists of all of the main effects contained in Model Three. In addition, all possible first-order interaction terms were defined for stepwise forward inclusion in the model. This was carried out using a p -value of less than 0.05 as the criterion for entry. This relatively cautious approach to what is, in effect, an exploratory phase in the research seems desirable in view of the relatively large number of interaction terms involved, and the danger of overfitting the model. As noted by Hosmer and Lemeshow (1989, p. 83), “Overfitting is typically characterized by unrealistically large estimated coefficients and/or estimated standard errors. This may be especially troublesome in problems where the number of variables is large relative to the number of subjects and/or when the overall proportion responding ($y = 1$) is close to either 0 or 1”. Three significant interaction terms were identified using this procedure:

Faculty Category x Age Category

Faculty Category x Entry Point Score

Gender x Entry Point Score

The same results were achieved using stepwise backwards elimination of variables, giving some reassurance that the forward inclusion method had not excluded some important variables from the model. It may be seen from Appendix 5.29 that the inclusion of these three interaction terms does not improve the accuracy of the model in classifying persisters and dropouts: overall, only 63.13% of cases are classified correctly. The fit of Model Five is appreciably better than that of Model Three, according to the Hosmer and Lemeshow test: $p = 0.4529$ for Model Five, compared to 0.1949 for Model Three. Interactions between Faculty Category and Age Category and between Faculty Category and Entry Point Score are significant overall at the 5% level, but this is not true of all combinations of the categorical variables involved. The interaction between Gender and Entry Point Score is also significant at the 5% level. Social Group remains non-significant. The very wide range of the confidence intervals for Age Category and the General Faculty Category, in particular, are suggestive of sparse data in some cells.

In summary, Model Five is relatively unparsimonious, but this does not appear to improve its predictive power. It is also possible that the estimates are numerically unstable. Faculty

Category appears to be confounded both with Age Category and with Entry Point Score, making interpretation of the results rather more complicated than might be useful in practice. For these reasons, these two interaction terms were omitted from the next version of the model.

Model Six

After some further experimentation, a sixth, final model was produced by dropping Social Group and retaining (Gender x Entry Point Score) as the only interaction term. For completeness, the specification of Model Six is shown in Appendix 5.30. All variables are significant in this model, and the confidence intervals are relatively small. Disappointingly, though, the predictive power of the model is still only modest: 64.18% of cases are classified correctly, as shown in Appendix 5.31.

This model highlights differing estimated persistence rates for males and females. This is exemplified by the plot of the estimated probabilities of persistence for students in Profile D, the common characteristics of which are shown in Appendix 5.32.

Four lines are shown in Appendix 5.33 to illustrate the estimated differences between males and females and between fifth-year and sixth-year qualifiers. At the most common Entry Point Scores – between 20 and 25 points – gender does not make much difference to the relationship between Entry Point Score and attrition. However, it appears that the best qualified males are slightly more likely to persist than their female counterparts. At the other extreme, the least-well qualified males are less likely to persist than females having the same Entry Point Score. (The equivalent line for fifth-year qualifiers representing males and females combined is shown in Model Four, Profile B for students under the age of 19.5 years at entry.)

Comparing Models Four, Five, and Six

Models Four and Six may be seen as restricted sub-models of Model Five. Model Four is also a sub-model of Model Six. This means that three Generalised Likelihood Ratio Tests are possible:

H_0 : Model Four within H_1 : Model Five

H_0 : Model Six within H_1 : Model Five

H_0 : Model Four within H_1 : Model Six

The difference in $-2LL$ may be tested as having a chi-squared distribution, with the number of degrees of freedom equal to the number of restrictions applied. The figures for the three tests are, respectively:

$$(2044.405 - 1934.613) = 109.792 \text{ on 5 degrees of freedom}$$

$$(2039.935 - 1934.613) = 105.322 \text{ on 3 degrees of freedom}$$

$$(2044.405 - 2039.935) = 4.47 \text{ on 2 degrees of freedom}$$

Consequently Model Five may be interpreted as having a significantly better fit than either Model Four or Six. On the other hand, there is no significant difference in the fit of Models Four and Six and, of the two, Model Four might usually be preferred on the grounds of parsimony.

The Hosmer and Lemeshow tests of goodness-of-fit are not wholly consistent with these conclusions, however. The relevant p -values are 0.2769, 0.4529, and 0.9431 for Models Four, Five, and Six, respectively. This last statistic indicates an exceptionally good fit to the data, and suggests that the model may, in fact, be overfitted.

All three models have roughly the same predictive power, each having roughly two-thirds of cases correctly classified. One issue to be addressed in the following chapters is therefore to improve the accuracy of the models in this respect by including additional explanatory variables. The literature review in Chapter 2 suggests that potentially relevant variables may have been ignored thus far.

Using a national dataset, Smith and Naylor (2001) observed a higher overall non-completion rate among males than females, and a greater sensitivity of males' completion rates to entry qualification levels. Their results are therefore consistent with the use of the interaction term between gender and Entry Point Score in Models Five and Six. More research is needed to find out whether these results simply reflect the niceties of the two datasets used or, alternatively, why the performance of the sexes should differ in this way.

Apart from this, there are no *a priori* grounds or further information that support one model to the exclusion of the others. At this stage it seems desirable not to reject any potentially useful variables. Consequently, all three models are carried forward to further stages of the study. This maximises the number of possibilities for subsequent exploration as the results of the questionnaires are introduced into the analysis.

The foregoing analysis is useful in that it quantifies the relative importance to retention of particular variables. In particular, Entry Point Scores are demonstrated not to be greatly influential in determining persistence rates. It also eliminates Social Group as a determinant of attrition, *ceteris paribus*. The approach taken has been data-driven, rather than being based on theory. However, the results are based on the experience of a large cohort of students, and they seem sufficiently convincing that it may be asserted that any alternative models of retention must either control or in some way allow for these variables in order to be truly comprehensive. The models are essentially descriptive by nature, and the underlying causations can only be inferred. This lack of explanatory power, as well as predictive power, is a further reason why it is appropriate next to seek attitudinal variables for inclusion in the models.

Chapter 6 – Determination of Issues to be Explored, Implications for Questionnaire Design and the Structural Model

Introduction

The purposes of this chapter are to describe how the questionnaires used for the study were developed and then to illustrate a tentative causal model of student retention, based on the underlying constructs used for the framing of the questionnaires.

It will be recollected that in Chapter 2 a large number of issues associated with retention were identified. It was proposed that the following constructs, which appear in Tinto's model, should be investigated:

- Student Entry Characteristics
- Initial Goal Commitment
- Initial Institutional Commitment
- Academic Integration
- Social Integration
- Subsequent Goal Commitment
- Subsequent Institutional Commitment
- Intention to Persist

It was also proposed that the following issues, having been described in other contexts as being relevant to retention, should also be explored:

- Family and Friends' Support
- Expectations
- Study Time
- Academic Self-Concept
- Information Source
- Academic Help and Feedback
- Various Extraneous Factors and Inhibitors
- Finances and Outside Paid Work

Strategy for the Formulation of the Questionnaires

It was decided for practical reasons to use two survey instruments for primary research: a paper questionnaire to be administered at the time students were queuing for matriculation at the beginning of the first term, and an online questionnaire to be administered in the course of the academic session as an adjunct to the University's compulsory first-year IT course. In this way response rates could be maximised.

There were no previously published survey instruments relevant specifically to retention that might have been used without substantial modification, and there had been no previous, large-scale research into first-year attrition at the University of Glasgow. It was therefore decided to conduct a series of preliminary focus group meetings with students and, separately, with staff in order to try to identify the variables that might be involved, their relative importance, and the dynamics operating among them. It would also be relevant to explore the extent to which the issues identified in the literature were borne out in practice at the University of Glasgow. This approach is advocated by Terenzini *et al.* (1994). Although the framing of the questions was essentially an iterative process, there were three main, practical steps involved: the holding of focus group meetings that would guide the framing of the questions; the actual drafting of the questions; and the testing of the questionnaires with the help of some students. This chapter includes a description of these three steps.

Appendix 6.1 contains a summary of how the outcomes of the focus group meetings and the review of the relevant literature were brought together in the framing of the questionnaires. This tabulation brings together the material shown below under the headings of “Student Focus Group Outcomes”, “Staff Focus Group Outcomes”, and “Framing the Questions”.

The sections below on “Student Focus Group Outcomes” and “Staff Focus Group Outcomes” contain narrative descriptions of the meetings, interspersed with references to the relevant questionnaire items, shown in square brackets. For example, [mq01] refers to the first question in the matriculation questionnaire, [oq02] refers to the second question in the online questionnaire, and [Study Time] refers to that particular construct (or latent variable). Questionnaire items are shown in abbreviated form in Appendix 6.1; the full

wording of the questions is discussed under the heading of “Framing the Questions”, and the full questionnaires, as used in practice, are reproduced in Appendices 6.3 and 6.5.

Focus Group Organisation

Three meetings with groups of between two and five predominantly second-year students were conducted. Recruitment to these groups was focused on those faculties where attrition was thought to be highest: Arts, Divinity, Social Sciences, Science and Engineering. Such were the practical difficulties in attracting sufficient numbers that no attempt was made to influence sample selection other than by this means. Almost certainly this biased attendance against those students who were less committed to the University and perhaps, therefore, against those most likely to withdraw. One meeting was also conducted with nine first-year course co-ordinators, drawn from the same faculties as the students.

The meetings were conducted under the auspices of the University's Student Retention Committee and with the help of five of its members (led by the author). All meetings lasted for about two hours. It was explained to participants that the University was interested in the general issue of first-year retention, and their views on the matter would be particularly valued. The topics discussed included not just matters of direct relevance to this study, but also a consideration of the ways in which retention might be improved in practice. Facilitators were given a prompt sheet that was intended to be used as a loose framework around which to guide the discussion. The prompt sheet is reproduced in Appendix 6.2. The purpose was to seed the meetings with the issues arising from the literature, rather than any particular preconceptions held by the facilitators.

Student Focus Group Outcomes

Motivations for Coming to University

There had been a wide range of motivations for having come to university. Some participants spoke of the expectations of schools and parents, and of conforming with siblings and peers [mq04]. Others spoke of their determination to secure a good job [mq06], or having been attracted by a particular academic course [mq03, mql3]. Others placed value in the all-round experience, both academic and social, of being at university. There was some evidence to suggest that within the Glasgow area there was perceived to

be a hierarchy of institutions, with the University of Glasgow regarded as being the most desirable, at least in some subjects and by some students [mq07]. For example, one participant spoke of feeling “privileged” to be at the University of Glasgow.

Expectations

Some claimed that there had been no prior indication of what university life would be like: “just lots of paper, which didn't get read, because it didn't look interesting” [oq48]. It was suggested that videos for schools might be useful, but these are only “screen images”; “nothing could convey in advance the true culture of the place” [Academic Integration, Social Integration, oq07, oq23]. More specific concerns were expressed about the meeting of academic expectations [Academic Integration: Academic Preparedness]. For some, there had been a big jump from school work; at University the standard was much harder [oq18, oq50, oq51]. There seemed to be at least a hint that participants had anticipated more academic help than what they had actually received [Academic Integration: Academic Help and Feedback]. It was commented, for example, that course work had been set without sufficient skills having been taught first. The view was also expressed that the University's promotional literature and Open Days paint a more glamorous picture of first-year subject content than transpires to be the case [oq48]. It was claimed, for example, that some Engineering courses focus initially on mathematics, and that only in the second and third years can students engage in the design work which attracted them in the first place.

Sources of Non-Academic Support

It appeared that students obtained support from a variety of different sources. Some spoke of the encouragement that they received from their parents, older siblings and friends [Family and Friends' Support]. Others – especially older students – were less inclined to expect either emotional or financial support from their parents. For some, the University's counselling service was a more likely port of call [mq12, oq28, oq30, oq31, oq33], although some younger students commented that they had found the counselling service patronising.

Academic Feedback

Participants made clear the need for early academic feedback [Academic Integration: Academic Help and Feedback]: “At first you don't take your lectures seriously, but then all

of a sudden you have essays to hand in ... Work comes as a sudden shock, and getting into the flow of it can be difficult". Knowing whether the first essay would be good enough had been a matter of concern for some. It was even suggested that in some subjects there were not enough class examinations.

Communications with Staff and Other Students

Communicating with the academic staff seemed to be problematic [mq10, oq08]. It was difficult to make face-to-face contact with them. Some lecturers were reported to be particularly unapproachable, delivering their lectures and then leaving straight away. Others seemed more approachable, but shyness on the part of students would prevent them from coming forward. Some participants found it hard to admit to a lack of understanding, and for this reason preferred to seek help from other students rather than from a member of staff [oq19]. On the positive side, "contact with other students spurs you on, because everyone else seems to know more than you do". But, on the negative side, such was the ethos of competition among students that even asking one's peers to explain something could be difficult. Nor was it always easy to admit how hard one was working. It seems, therefore, that in the eyes of some students the dominant ethos was one of hard work, and one in which self-sufficiency was encouraged, at least tacitly, if not in the messages which staff might actually articulate. The University had an "impersonal, self-coping" culture, and this extended to personal [oq11, oq30, oq31] as well as academic problems [oq20, oq22]. Advisers of Studies were seen as busy people, with very little time to help, and concerned only with academic issues. It was thought that a lot of people would prefer not to see a student counsellor. There was a feeling of "bigness" [mq15, oq24]. There was not enough advertising of the help that might be available and, consequently, a lack of awareness of the services (such as the Student Health Service) that were available [mq12, oq28, oq30, oq31, oq33].

Reasons for Withdrawing and for Persisting

Respondents' vocabulary when describing why students might opt to leave was more vivid than that encountered in the literature in describing a frame of mind: "apathy ... disillusionment" [oq45]. The failure of one's course to meet expectations was mentioned [Academic Integration: Academic Preparedness], as well as a lack of academic assistance for those who were struggling [Academic Help and Feedback]. It was also suggested that

some might choose to leave simply because other options in life had become available to them.

Possible reasons for staying centred on personality traits: “determined to succeed ... focused [Subsequent Commitment: Goals and Institutional]... competitive ... strong character”. Other suggestions included the idea that some students come to university for the lifestyle (and find it agreeable), and not for the course [Social Integration]. More expectedly, others cited the eventual reward of having a good job [oq13, oq53, oq54].

Social Life

Participants seemed generally satisfied with the social side of university life [Social Integration]. Given that they were to a large extent self-selected, and perhaps more inclined to be sociable, it was impossible to decide whether this was true of all students. Participants commented that they had been made to feel welcome. It was thought that the University helps students to socialise, without overdoing it. If any participants were at university primarily for social reasons, the facilitators failed to establish this. There was a general, implicit assumption that the prime reason for attending university was academic and, consequently, the underlying reasons for leaving would also be academic.

Finances and Outside Paid Work

The general view was that university life is considerably more expensive than expected [oq57]. The cost of travel and books seemed particularly high. Indebtedness was a matter of considerable concern. One student expected that her eventual borrowings would be between £15,000 and £20,000. Although this was daunting, it was “not a reason for not continuing”. While simple cost-benefit considerations might propel some students (perhaps with parental pressure) into vocationally orientated subjects, others might be willing to shoulder substantial debts [oq58] simply because their subjects interested them [Finances and Outside Paid Work].

While having a job might alleviate one's financial position, some respondents felt that it would affect the quality of their academic work [oq41, oq60]. Others felt that simultaneously working and studying would not be viable at all. Some students obtained money from their parents; others preferred not to ask their parents for financial help.

Older Students

Some older students (one aged 23) perceived themselves as being quite different from younger students, and this is consistent with the findings of authors such as Ozga and Sukhnandan (1997, 1998) and Lenning (1982). Such students characterised themselves as sitting at the front of lecture theatres, appreciating the true value of higher education [Initial and Subsequent Commitment – Goals], having a genuine interest in what they are studying [oq12, oq34, etc.], not going to (or not enjoying) Freshers Week activities, not being a member of one of the student unions, and working harder than their younger counterparts: “more work, less play”. Mature students also saw themselves as being at a disadvantage, having got out of the way of studying [Academic Self-Concept]. They characterised younger students as being at the University mainly for the social life [Social Integration], usually with the financial support of their parents: “They think they know everything.”

It seems that at least some older students feel relatively “disconnected” from the rest of the University [oq07]. However, this could be compensated for by their interest in their subjects and their strong motivation to complete their courses. It might be inferred that such students tend to be relatively well integrated academically, and this compensates for their relatively weak integration with the dominant social culture of their younger counterparts. (See Chapter 2: Braxton, Sullivan, and Johnson's Appraisal of Work on Tinto's Model, proposition 15.)

Views on the Questionnaires

Attitudes towards the proposed questionnaires were cautious, and this subsequently influenced the range of questions asked quite considerably. Some saw a questionnaire as being nothing more than another piece of paper, and had no objection to the use of matriculation numbers as identifiers. It was thought that it would be important to have helpers on hand to explain the purpose of the matriculation questionnaire. However, at the other extreme, one participant expressed the view that attempting to categorise students according to their answers would be “repugnant”. It was concluded that it should be made very clear to respondents that they were under no obligation to answer questions against their will.

Participants thought that matriculation would be a good time at which to administer the first questionnaire. On the other hand, they were critical of the administrative arrangements for the IT course and the tutors teaching it, whom they saw as being unsympathetic. Response rates were therefore subsequently monitored very closely.

Conclusions from Student Focus Groups

The focus group meetings with students provided useful material for inclusion in the questionnaires. Generally, they tended to reinforce the issues identified in the literature. This was reassuring, given Pascarella's warning (1986) that investigations into the causes of attrition generally need to be sensitised to the circumstances of particular institutions, and that no previous work of this nature had been conducted at the University of Glasgow. Those nuances that might otherwise have attracted less attention in the design of the questionnaires were:

- The variety of motivations for coming to university, which can be both academic and non-academic;
- The importance of expectations and the meeting of academic expectations, in particular;
- The strong emphasis in the University on academic success, coupled with an “impersonal, self-coping” culture;
- The suggestion that there might also be a subculture more focused on simply enjoying oneself socially;
- Greater feelings of alienation experienced by some older students;
- The variety of reasons for leaving or staying, although the main reasons tended to be academic; and
- The strong emphasis placed on finances and outside paid work.

Staff Focus Group Outcomes

The meeting with first-year course co-ordinators produced a plethora of reasons as to why students might leave. Much of what was said, particularly about the cultural and academic differences between the schools system and the University, was subsequently echoed with remarkable similarity in Universities Scotland's submission (2002) to the inquiry into the purposes of education initiated in March 2002 by the Education Committee of the Scottish

Parliament. The submission lends credibility to the views expressed by the course co-ordinators. However, the focus group meeting took place three years before this, and it is appropriate simply to report and assess what was said at that meeting, because of the bearing it had on the research then being planned.

For the most part, these were senior academics of relatively longstanding service, so their views were inevitably coloured by memories of how the University had operated in the past. Their main contention was that academics were having to deal with a much more diverse group of students which was much less academically orientated than before. This manifested itself in a variety of ways: less ability and skills (such as time management and study skills) [oq18, oq23, oq50, Academic Self-Concept], less motivation and maturity, and a preference for having a good social life [Social Integration]. At the same time, academics were obliged to respond to increased pressures to improve research productivity.

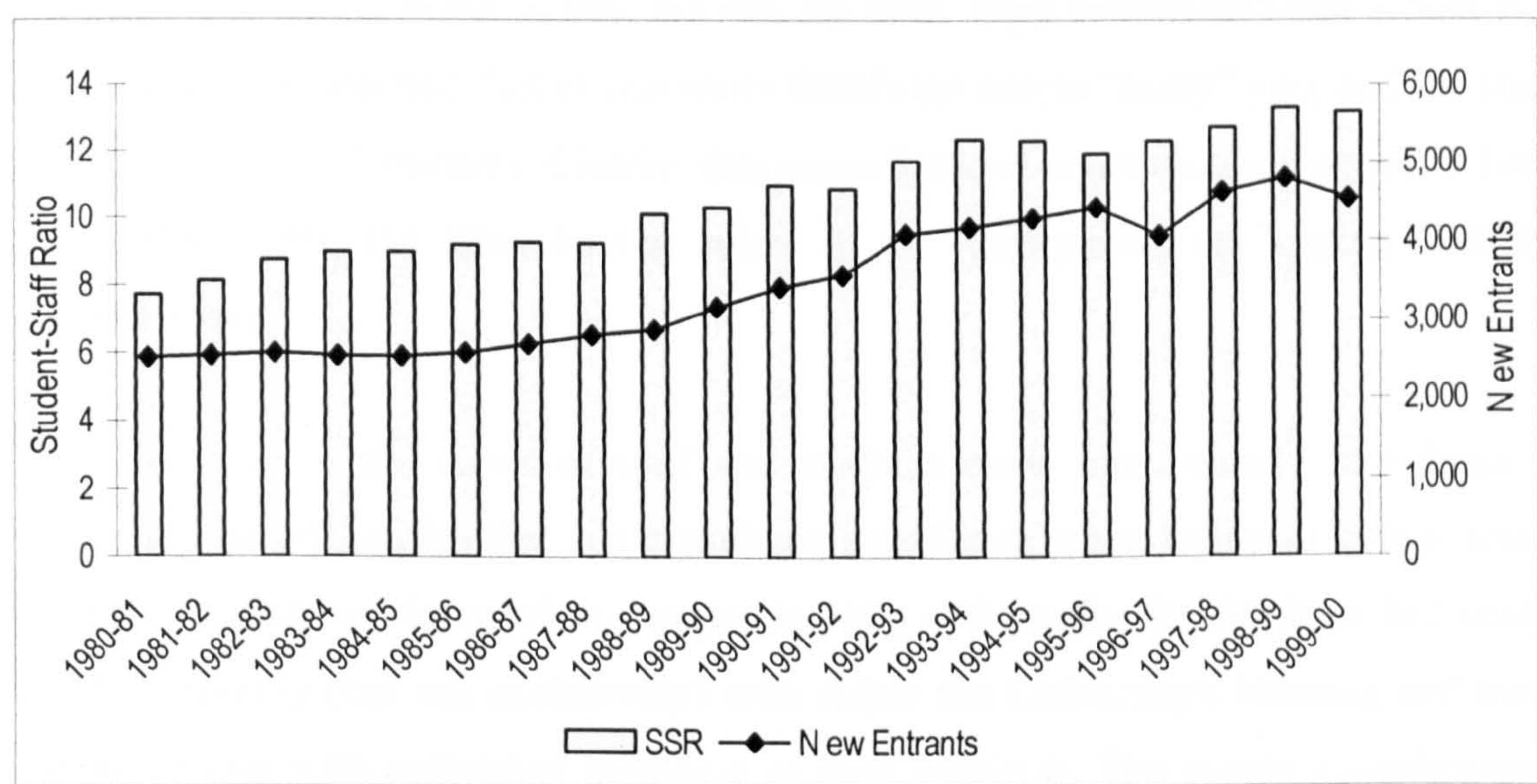


Figure 6.1 Student-Staff Ratios and New Home Full-Time Undergraduates at the University of Glasgow from 1980-81 to 1999-00

It seems worthwhile to place what they said in a historical context. Figure 6.1 shows the trends in the numbers of full-time home undergraduates admitted to the University over the previous 20 years, along with the equivalent ratio of full-time undergraduates to full-time teaching and research staff paid from University funds. Over this period, the number of new entrants rose by 81% from 2,512 to 4,520 and the ratio of students to staff increased from 7.7:1 to 13.2:1 in the University as a whole – an increase of 71% (USR, 1982-94; HESA, 1996-2001a and 1996-2001b). These overall figures conceal considerable variation across the institution as well as, almost certainly, greater percentage increases over time in

those areas not protected by external policy constraints, such as Clinical Medicine, Dentistry and Veterinary Medicine.

The fact that staff-student ratios rose significantly, coupled with the fact that pressure to perform research certainly did not decrease, meant that teaching methods would inevitably have had to change over that period. The course co-ordinators felt that retention was predominantly a facet of learning and teaching, and that this would be improved only if substantially more university resources were devoted to this whole area.

While concern was expressed about increasing staff workloads, blame was also placed on what was perceived to be the increasing gap between academic standards and expectations of students whilst at school on the one hand and at university on the other. Some of this was presumably due to the widening range of the student population's abilities. Whether some of it was due also to lower standards in schools is less obvious. To establish the truth of the matter is outwith the scope of this study, although it was evident that many present at the meeting clearly believed that this was the case. They commented that school work is much easier, and asserted that at university there's no one to "harry" you, and the staff are not there to "nanny" students. Clearly, this was a focus of some mutual discontent between staff and students, the latter having talked of an "impersonal, self-coping" culture, as reported above.

The divergence in the views of staff and students came more clearly into focus when explaining the difficulties that some students experience when trying to obtain academic assistance [Academic Integration: Academic Help and Feedback]. Students had tended to find fault mainly (but not exclusively) with either the University's learning and teaching system, or else with individual members of staff within it. The course co-ordinators, for their part, blamed not just the system, but also the students. They commented that some students were reluctant to speak to staff, and asked for assistance only in crisis situations. They did not always recognise that they needed help, and some were even resistant to help. Attendance at revision lectures was reported to be sparse, for example.

Staff expressed concern about students' lack of involvement with university life. This could manifest itself in a variety of ways. Some students were disinclined to engage with the academic process [Study Time]: attendance at lectures was deteriorating and some students never appeared at all at lectures. The "clubbing" culture was having a particularly negative effect on academic performance. For some students, one's social life seemed all-important

[Social Integration]; they spent all their time clubbing, with consequentially poor attendance at lectures the following day. As a result of increasing financial pressure, more students had outside jobs, thereby detracting from their commitment to all aspects of university life [Finances and Outside Paid Work]. While these problems might be more diffuse in their origins, others were more specific. Large seminar groups could cause feelings of isolation [oq24]. There was often a lack of opportunity at the outset to make friends with other students in one's own classes [oq10]. Freshers Week, in particular, was seen as placing too much emphasis on clubbing, while at the same time causing others to feel isolated [oq15]. It was also remarked that those travelling from home tend just to go straight home after class work; the University is not their social environment [oq39]. Furthermore, groups of students all coming from the same school could have the effect of excluding others from their social circle.

There were differing views among the course co-ordinators about the need for more realistic pre-matriculation publicity [oq48]. Some thought that it was desirable, but others felt that detailed advice should wait until students actually arrived. It was commented that students are not given sufficiently clear guidance at the outset concerning what is expected of them academically [Academic Integration: Academic Preparedness], and in the amount of study time required, in particular [Study Time]. In some cases it subsequently proved helpful to find alternative departments for students whose original choice of subjects had transpired to be a mistake [oq12, oq46, oq47].

While some co-ordinators expressed concern about “nannying”, others acknowledged the desirability of providing feedback earlier in the session; for example, in some areas there was a hiatus until the first essay was handed back in January. There were also differing views on examinations as a means of giving students feedback on their progress. Some participants thought that the University conducted too many examinations; others felt that the sole *raison d'être* for most students was to pass examinations.

Difficulty was reported in persuading some students formally to drop out. Leaving, it was acknowledged, might in some cases be in the best interests of the individual concerned.

Conclusions: Comparisons between the Student and Staff Focus Groups

The main advantage in having solicited the views of the course co-ordinators was that this had provided a forum at which the views of a different group of stakeholders could be heard, thereby enhancing the comprehensiveness of the research. Staff and students tended to identify the same pressure points, with the staff meeting producing helpful material supplementary to that provided by the students. Even though the staff tended to interpret the difficulties facing students in a different manner from the students themselves, the accuracy and inclusiveness of the interpretation of these phenomena were much improved. For example, on some issues, such as Academic Help and Feedback, opinions could be quite polarised, but this reinforced the potential relevance of this variable to retention. In addition:

- The students had identified a variety of motivations for coming to university. The staff were concerned especially about those individuals who did not appear to have any strong reasons at all for being at university.
- At the staff meeting particular importance was placed on the concept of academic preparedness.
- The comments made by some first-year course co-ordinators seemed to bear out students' concerns about the University's "impersonal, self-coping" culture.
- Staff concerns about the decreasing academic orientation of the student body seemed convincing.
- The staff more clearly identified the existence of a "clubbing" subculture that had also been alluded to by some students.
- The staff meeting was useful in identifying various ways in which students can fail to become engaged in the academic process.
- The staff tended to bear out the conclusion from the student meetings that although the immediate causes of attrition seemed very diverse, the root cause in most cases was perceived to be academically related.
- When speaking of individuals' reasons for leaving, staff would talk of lack of ability, skills, motivation and maturity. By contrast, students emphasised apathy and disillusionment as being the causes of dropout. The extent to which these are one and the same phenomenon was not clear.

Not all of these points are of immediate relevance to the construction of the two survey instruments, but they are taken up again in Chapter 13. The issues raised in the focus group discussions matched well with the constructs identified in the literature. The similarities between these “problems lists” and those described by other researchers are illustrated in Appendix 6.1, which also shows those constructs and individual questionnaire items that had been alluded to in the focus group meetings.

The relative weight to be placed on the material emanating from the focus groups and from the literature is inevitably a matter of judgement. It would have been possible to use the focus group material as the main, if not exclusive, source of issues to be explored in the questionnaires. However, in soliciting the views of individuals who only seem like the group in which one is interested but who are not necessarily truly representative of that group, there is a danger of drawing conclusions where no such generalisations are warranted. It was therefore decided that the constructs identified in the literature could be followed fairly closely as a framework around which to build the questionnaires, albeit with suitable modifications to take into account particular concerns raised in the focus groups. How this was done is described below.

Drafting the Questions

It was decided broadly but not precisely to follow Tinto's schema when constructing the questionnaires, because it seemed that this would capture most if by no means all of the issues identified in the focus group meetings and in the literature. Different researchers had chosen to operationalise Tinto's constructs in different ways, such is their plasticity, but Pascarella and Terenzini's work (1980, 1983) seemed the most helpful reference point, partly because of the comprehensiveness of its coverage, and partly because the precise wording of the individual questionnaire items had been published. In places the language and sensitivities needed to be updated and rendered more suitable for British respondents. Additional constructs not included in the mainstream formulation of Tinto's model were also introduced, as described in Chapter 2 and at the beginning of this chapter.

Background Characteristics

Background characteristics were taken to include students' previous academic achievements, as well as their demographic characteristics, such as age, gender, ethnicity,

and parental socio-economic standing. Notwithstanding Ozga and Sukhnandan's difficulties (1997) with data supplied both by HESA and by the three institutions which they studied, it was concluded that for the purposes of this study it would generally be satisfactory to rely on the University's central student records system to obtain this sort of information. While it would have been of interest to obtain additional information on parents' levels of education and income, for example, it was felt that such questions might be regarded as unduly intrusive, and answers might consequently be incorrect or missing. In keeping with Pascarella and Terenzini's approach (1980, 1983), information concerning students' previous academic attainments was obtained from University sources, rather than relying on questionnaire responses. Information concerning appearances at examinations and academic performance while at the University was also obtained from official sources. It was considered that this approach would be more complete and more accurate, and that it would be more useful to use scarce space on the survey instruments to explore other issues, instead.

Recent Experiences and Current Frame of Mind

The view was held by those students employed to assist with the piloting of the questionnaires that respondents' answers might be influenced by their recent experiences and particularly by their mood or frame of mind at the time of completing the questionnaires. It was claimed that some students "have a good Freshers Week", while others don't enjoy it at all (or just don't go). Freshers Week experiences could therefore have a significant effect on how students might respond to propositions such as "Coming to the University of Glasgow rather than another university was the right decision" and "I may lose friends as a result of coming to university". It was concluded for logistical reasons that it would not be possible to include a question specifically concerning Freshers Week. A more generally worded question was included in the matriculation questionnaire, instead, and this was repeated verbatim for comparative purposes as the first question in the online questionnaire:

mq01 I've really enjoyed my experience of university so far

oq01 I've really enjoyed my experience of university so far

Spady's (1970, 1971) enquiries into students' general satisfaction to date with their university experiences provide a precedent for these questions.

Family and Friends' Support

For the purposes of this study, two questions were posed. The supposition was that students who come to University from families that are “supportive” (which might be interpreted in terms of encouragement, attitudes, values, or finance) are less likely than others to drop out, as reported by Lenning (1982), for example.

mq02 My family is supportive of my coming to university

oq02 My family is supportive of my being at university

It is not uncommon in the United States to ask similar questions about students' friends, spouses and “romantic partners”. While this line of enquiry might be relevant to older students, it was not pursued in this survey of students who were predominantly in their late teens. Instead, a somewhat different emphasis was sought:

mq09 I may lose friends as a result of coming to university

As a result of the focus groups, a further question was included in the matriculation questionnaire to search for evidence of students having been placed under undue pressure to come to university:

mq04 I made the decision to come to university without pressure from anyone else

These items are generally not included as part of the operationalisation of the Tinto model, but comments made at the meetings with students, coupled with research which had already been conducted elsewhere, as described in Chapter 2, suggested that these matters would be worth exploring.

Initial Commitment - Goals

Students' reasons for being at university had been discussed at both the student and staff focus groups. Students' aspirations had also been referred to by Lenning (1982). Questions might therefore be asked about students' initial goal aspirations, following Pascarella and Terenzini's approach (1980, 1983):

- What is the highest level of education that you expect to achieve? [in UK terms, Ordinary Degree, Honours Degree, Higher Degree, etc.]
- It is important for me to graduate from college

Only a minority of undergraduates at the University of Glasgow proceeds to take a second Degree, and the likelihood of doing so varies according to the subject matter of students' first Degrees. Furthermore, progression to Honours is generally not decided until the end of second year. Consequently, it was felt that it would be inappropriate to ask such a question. The second question above might reasonably have been included in the matriculation questionnaire, but was omitted in order to focus on various dimensions of goal commitment, bearing in mind that a subsequent factor analysis could be used to draw them together into coherent stands supported by the data. It was anticipated that some but not all students would be motivated to come to university by the prospects of a good job:

mq06 I'm coming to university because I have a clear idea of my future career

Strength of commitment to being at university and therefore to graduate might also be measured indirectly by the extent to which respondents had a clear idea of what they wanted to study and the point in time at which the decision to come to university had been taken:

mq03 I'm not sure what I want to study at university

mq08 Coming to university was a last-minute decision

The latter question was included also to explore tangentially the proposition that students who enter through the UCAS Clearing system perform less well than others. This had been an issue considered by Yorke *et al.* (1997), although he had found insufficient evidence upon which to reach a firm conclusion. A question relating specifically to Clearing would not have been productive, however, because only about 1% of the University's entrants had been admitted via this route. It was also thought that levels of initial knowledge of course content might measure strength of commitment:

mq13 I have found out about the subject content of what I'll be studying this year

Questions such as this one were worded in such a way that they could be analysed as standalone items or in conjunction with related items in the subsequent online

questionnaire in order to assess the effects of changes in responses over time. Although these 'first differential' effects have not been analysed in this study, the data remain available for further research.

Initial Commitment - Institutional

Lenning (1982) had included commitment to the institution as one of the factors influencing retention. Pascarella and Terenzini's (1980, 1983) survey instruments included the following items:

- Assume that you made a list last spring of universities. Are you currently attending the university that was your first choice, second choice...?
- Is this college your first choice? [First = 4; less than third = 1]

The Glasgow equivalent, summarising and simplifying what had been said at the focus group meetings, was:

mq07 Coming to the University of Glasgow rather than another university was the right decision

This question was also worded in such a way that it could be analysed in conjunction with the online questionnaire responses.

Expectations

Expectations concerning levels of academic and pastoral assistance were explored as part of the matriculation questionnaire. Although expectations are not included explicitly in Tinto's model, their importance had been identified both by Tinto himself (1993) and by Braxton, Vesper, and Hossler (1995). The approachability of the academic staff in particular had transpired to be of considerable importance to focus group participants. Hence:

mq10 It will be easy to get help with my studies from the staff

mq12 I know where in the University I could get help with any personal difficulties

The latter item was prompted by the view expressed by some students that the University has good help facilities but that, in practice, it is hard to find them when needed.

Students' expectations concerning the teaching environment, which some find intimidating, were included, based on the assumption that those who were already knowledgeable about this would be relatively unfazed.

mq15 I expect that I'll be one of a large number of students all being taught in the same class

Study Time

Kanoy, Wester, and Latta (1989) had taken into account in their study of various psychological variables the amount of effort expended on academic studies. Tinto's study of "Classrooms as Communities" (1997) also used hours studied per week as a predictor of persistence. Students' study time also had been a matter of concern to the staff at the University. Two questions were asked about study time in the matriculation questionnaire, and a follow-up question was included in the online questionnaire:

mq14 I know how much effort will be expected of me with my studies this year

mq18 I expect that the average weekly amount of time I shall spend during term on study outside lectures, tutorials, labs, etc. will be:

There were five possible responses to the latter question:

Up to 5 hours; 6 to 10 hours; 11 to 15 hours; 16 to 20 hours; Over 20 hours

This question was also included in the online questionnaire with the additional response option of 'No time':

oq59 The average weekly amount of time that I spend during term on study outside lectures, tutorials, labs, etc. is:

No time; Up to 5 hours; 6 to 10 hours; 11 to 15 hours; 16 to 20 hours; Over 20 hours

Academic Integration: Academic Preparedness

Pascarella and Terenzini measured academic integration as the sum of a combination of facts and opinions: they took into account cumulative grade point averages on the one hand and, on the other, students' perceptions of their own intellectual development, faculty concern for teaching and learning, and the extent of “nonclass contact” with faculty for academic purposes.

Pascarella and Terenzini obtained students' cumulative grade point averages from central university records. The same would be the case at the University of Glasgow, although the problem in so doing is that different Faculties have different examination marking systems, and only Degree (as opposed to class) examination marks are held centrally. More importantly, though, it is argued in Chapter 4 that Degree examination performance is a response variable rather than an explanatory variable and, as such, is not relevant to this study.

Pascarella and Terenzini obtained students' perceptions of their intellectual development using the following items:

- I am satisfied with the extent of my intellectual development since enrolling in this university
- My academic experience has had a positive influence on my intellectual growth and interest in ideas
- I am satisfied with my academic experience at this university
- Few of my courses this year have been intellectually stimulating
- My interest in ideas and intellectual matters has increased since coming to this university
- I am more likely to attend a cultural event (for example, a concert, lecture, or art show) now than I was before coming to this university
- I have performed academically as well as I anticipated I would

The following items were used for the current study. The emphasis on intellectual development was played down, because it did not seem to be an issue of particular importance to focus group participants. Academic preparedness was of particular concern to Yorke *et al.* (1997) and to Ozga and Sukhnandan (1997, 1998), and consequently some

items were included to explore this in terms of subject choice, subject content and level of difficulty. The opportunity was also taken to explore the extent to which prior expectations had been met, in view of the importance placed on this issue at the focus group meetings:

oq12 I made the right choice of subjects to study

oq23 Nothing I'd done before prepared me properly for university life

oq24 My classes are too big

oq34 Most of the content of my subjects doesn't interest me

oq37 The subject content of my studies is meeting my original expectations

oq49 Before I decided to come to University, I did not know what the subject content of my course would be

oq50 Before I decided to come to University, I did not know how difficult my course would be

oq51 I should have found out more about my course before deciding to come to university

Academic Integration: Academic Help and Feedback

This had come across in the focus group meetings as being a matter of some concern to both students and staff, albeit for different reasons. Yorke *et al.* (1997) had made reference to the broader construct of teaching quality. Pascarella and Terenzini measured students' perceptions of faculty concern for student development and teaching using the following items:

- Few of the faculty members I have had contact with are generally interested in students
- Few of the faculty members I have had contact with are generally outstanding or superior teachers
- Few of the faculty members I have had contact with are willing to spend time outside of class to discuss issues of interest and importance to students
- Most of the faculty I have had contact with are interested in helping students grow in more than just academic areas
- Most faculty members I have had contact with are genuinely interested in teaching

Students at the University of Glasgow were not asked to pass comment on members of the academic staff. It was considered that this would be too sensitive in a non-anonymous

questionnaire, and that such questions might reduce response rates, particularly in view of the cautious (and, in one case, hostile) attitude of student focus group participants.

The corresponding items used for the present study were:

oq08 It's difficult to ask the staff for advice or help with my studies

oq19 I'd sooner ask other students for help with my studies than ask a member of staff

oq20 I'm left alone to cope as best I can with my studies

oq22 I have not received enough feedback about my academic progress

Pascarella and Terenzini quantified nonclass contacts with faculty of at least ten minutes that had taken place for the following purposes:

- “To get basic information and advice about my academic program”
- “To discuss intellectual or course-related matters”
- “To discuss matters related to my future career”

Making the distinction between class and nonclass contacts seems perhaps rather artificial. It would be difficult to obtain uniformity of response in the current study, given that different students would respond at different times during the academic session. No attempt was made specifically to address these issues. It was considered that it would be sufficient to use the items described above.

Academic Self-Concept

It was decided to place greater emphasis on the idea of academic self-concept, as described by Spady (1970) and by Kanoy, Wester, and Latta (1989). It appeared from the focus groups that lack of Academic Self-Concept could be a distinguishing feature of older students, in particular. Two items were included in the matriculation questionnaire. (Reference to 'assessments' was necessary to allow for the fact that academic outcomes are no longer determined solely by performance in formal examinations.)

mq11 I feel confident that I shall be able to study effectively

mq16 Generally I put a lot of effort into being well prepared for exams and assessments

The same issues were raised again in almost identical form in the online questionnaire:

oq05 I'm confident that I'm doing well academically

oq09 Generally I put a lot of effort into being well prepared for exams and assessments

oq17 I have been having difficulties with my studies

Information Source

It was also considered that academic preparedness, which seemed from the focus groups to be an important issue, might be affected by the source of students' information:

oq48 Before I decided to come to University, my main source of information about the University was:

The responses available to this question were:

My School/College; Glasgow University Literature; Visit to Glasgow University;
My Parents; Other Relatives/Friends; Other Sources(s)

Social Integration

This construct had received widespread attention in the literature (Spady, 1970; Tinto, 1975 *et seq.*; Lenning, 1982; Bean, 1980, 1982a, 1983; Yorke *et al.*, 1997; Hurtado and Carter, 1997). One of the course co-ordinators' main concerns had been that excessive Social Integration (narrowly defined) had an adverse effect on Academic Integration. Pascarella and Terenzini interpreted Tinto's concept of social integration as the sum of measures of the extent of extracurricular activities, the extent and quality of relationships with peers, "nonclassroom" contacts with faculty, and "nonclass contact" with faculty for what were essentially non-academic purposes.

More specifically, extracurricular activities were those averaging at least two hours a week, using Pascarella and Terenzini's definition. It was decided not to use this precise formulation for the current study. Instead, two items were used to test the strength of feelings of social isolation:

oq04 There are not enough student societies or clubs for people with my interests

oq15 I feel excluded from other students' social activities

More generally, in deference to some of the focus group participants:

oq07 I don't really feel part of the University of Glasgow

Pascarella and Terenzini assessed peer-group interactions by using the following propositions:

- Since coming to this university I have developed close personal relationships with other students
- The student friendships I have developed at this university have been personally satisfying
- My interpersonal relationships with other students have had a positive influence on my personal growth, attitudes, and values
- My interpersonal relationships with other students have had a positive influence on my intellectual growth and interest in ideas
- It has been difficult for me to meet and make friends with other students
- Few of the students I know would be willing to listen to me and help me if I had a personal problem
- Most students at this university have values and attitudes different from my own

The use of language here might with benefit be simplified, and phrases such as "close personal relationships" avoided. For the purposes of the present study, one of these items was retained:

oq11 Few of the students I know would be willing to listen to me and help me if I had a personal problem

The general sense of the final question was retained, but with the concept much simplified:

oq35 I should have gone to another university or college where my friends are

The sense of the first of Pascarella and Terenzini's items was retained, both in the matriculation questionnaire and the online questionnaire:

mq05 I expect to make a lot of new friendships with other students

oq06 I have lots of new friendships with other students

The idea (Hurtado and Carter, 1997) that friendships formed in the classroom or which have at least some academic component are likely to be more conducive to persistence was explored:

oq10 Most of my friends are studying the same subjects as myself

The transitional aspect of social integration was explored, although this was not specifically addressed by Pascarella and Terenzini:

oq03 I have lost friends as a result of coming to university

oq38 I really miss the friends I had before I came to university

oq25 Students like me often feel homesick

Pascarella and Terenzini operationalised the idea of “nonclassroom” contacts with faculty using the following items:

- My nonclassroom interactions with faculty have had a positive influence on my personal growth, values, and attitudes
- My nonclassroom interactions with faculty have had a positive influence on my intellectual growth and interest in ideas
- My nonclassroom interactions with faculty have had a positive influence on my career goals and aspirations
- Since coming to this university I have developed a close, personal relationship with at least one faculty member
- I am satisfied with the opportunities to meet and interact informally with faculty members

Questions such as these were not used in the current study. The culture of the institution (at least as perceived by students) is such that this type of activity is the exception rather than the norm, particularly for first-year undergraduates. Furthermore, some of the concepts alluded to seem quite sophisticated and are not likely to be issues to which many students give much thought.

Pascarella and Terenzini counted instances of “nonclass contact” with faculty for three non-academic purposes:

- “To socialize informally”
- “To discuss a campus issue or problem”
- “To help resolve a personal problem”

The difficulty with items such of these in the context of the current study is that they are likely to elicit different responses at different times in the academic session. Another approach, based on focus group comment, was therefore tried:

oq30 There is no-one in the University to whom I could turn for help with any personal problems

oq31 I’m more likely to seek help with serious personal problems from other students than from the staff

Subsequent Commitment – Goals

Various general student motivations to persist had been put forward at the focus group meetings, as well as appearing in Lenning's (1982) compendium of the correlates of retention. Pascarella and Terenzini used just one item to measure subsequent goal commitment:

- It is important for me to graduate from college

For the purposes of the current study, the following item was used:

oq43 I'm committed to getting a university education

Clarification about objectives in relation to future direction of course and future employment were also sought:

oq52 I’m not clear how my course will develop in future

oq53 I have a clear idea of my future career

oq54 My course will lead to a good job after I graduate

These questions were also seen as follow-ups to some of the matriculation questionnaire items:

mq03 I'm not sure what I want to study at university

mq06 I'm coming to university because I have a clear idea of my future career

mq13 I have found out about the subject content of what I'll be studying this year

Subsequent Commitment – Institutional

More specific commitment to the institution itself had also been alluded to the focus group meetings, and widely in the literature (Tinto, 1975 *et seq.*; Bean, 1980, 1982a, 1983; Cabrera, Castañeda, Nora, and Hengstler, 1992; Cabrera, Nora, and Castañeda, 1993). Pascarella and Terenzini used two items to measure subsequent institutional commitment:

- I am confident that I made the right choice in choosing to attend this university
- It is not important for me to graduate from this university

At the University of Glasgow, the following items were used:

- oq13 I should have gone to a different university or college where the academic work is more relevant to getting a good job afterwards
- oq18 I should have gone to a different university or college where the academic work is easier
- oq44 Coming to the University of Glasgow rather than another university was the right decision for me
- oq46 It would be easy for me to find an alternative course at another university or college if the one I'm on now doesn't work out
- oq47 It would be easy for me to find an alternative course within the University of Glasgow if the one I'm on now doesn't work out

Extraneous Factors and Inhibitors

In deference to the work of various authors, such as Yorke *et al.* (1997) and Ozga and Sukhnandan (1997, 1998), as well as to the focus group participants, themselves, the existence of various extraneous factors and difficulties was acknowledged:

- oq27 I have been having problems with my accommodation
- oq29 I have been having personal problems
- oq39 Daily travel limits the amount of effort I can put into my studies
- oq40 My family responsibilities limit the amount of effort I can put into my studies

oq42 My health problems (or those of my family) limit the amount of effort I can put into my studies

And, in order to be able to analyse item oq27 in more detail, the following questions were also included:

oq28 The University hasn't done enough to help me find appropriate accommodation
[Please tick "Not applicable" if you're in your parental home or your own home by choice]

oq26 Currently my accommodation is:

The six possible responses to this question were:

Parental/Guardian's Home; Own Home; Hall of Residence; University Flat/House;
Other Rented Flat/House; Other

Finances and Outside Paid Work

Given the importance placed on the role of finances and outside paid work, both in the focus groups and in the literature (Lenning, 1982; Cabrera, Stampen, and Hansen, 1990; Cabrera, Nora, and Castañeda, 1992; Yorke *et al.*, 1997), various questions were posed.

Only one item was included in the matriculation questionnaire:

mq17 I have carefully considered the financial implications of coming to university

The "correct" answer to this question is obvious, but the intention was to make it possible to compare individuals' responses to what transpired to be a much more potent online question:

oq57 I did not realize how expensive being at university would be

Two items were designed to explore the extent of students' general malaise concerning financial matters. This seemed to be particularly relevant in view of Lenning's comments quoted in Chapter 2.

oq32 I have been having financial difficulties

oq55 My financial situation worries me

Suggestions elicited from students at focus group meetings were suggestive of the fact that perhaps the University was not doing enough to apprise students of the availability of financial help and advice. The following item was therefore included.

oq33 It would be hard to find where in the University to get help with financial difficulties

Following Mackie (1998), the following item was also included.

oq56 I wouldn't want to leave the University before graduating, because this would waste the money I've already spent on being here

Students' anticipated level of debt (if any) at one given point in time was also sought. It would perhaps have been of interest to investigate patterns of students' indebtedness to different agencies, such as to the Student Loans Company, banks and family members, but this was not explored.

oq58 I expect that by June 2000 I shall have on loan (from all sources, including my family):

The five possible responses were:

£0; Up to £1,000; £1001 to £3,000; £3001 to £5,000; Over £5,000

Two questions were included concerning outside employment.

oq41 My outside paid work limits the amount of effort I can put into my studies

oq60 The average weekly amount of time during term that I spend in outside paid work is:

There were six possible responses to the latter question:

No time; Up to 5 hours; 6 to 10 hours; 11 to 15 hours; 16 to 20 hours; Over 20 hours

Intention to Persist

Some authors (Braxton, Vesper, and Hossler, 1995; Berger, 1997; Milem and Berger, 1997; Berger and Braxton, 1998; and Braxton, Milem, and Sullivan, 2000) prefer not to use actual persist/withdrawal behaviour as the dependent variable. For the purposes of this study one question was inserted in the online questionnaire in order to make this feasible, if desired:

oq45 I am considering leaving the University of Glasgow

Exploring Policies

Finally, the online questionnaire contained four questions intended solely to guide University policy, and which were not intended to be of relevance to the study:

oq14 It would be useful to speak regularly to a student who's already done my first-year subjects

oq16 The "University and Its Ways" induction programme is useful for students like me

oq21 All students should be taught study skills at the beginning of the first term

oq36 The University should try harder to discourage students from missing lectures, tutorials and practicals

Conclusions on Drafting the Questions

It may be seen that Pascarella and Terenzini's operationalisation of Tinto's model was the main but by no means the only source in the literature from which material for the questionnaires was drawn. It can also be seen how this material was bound together with information derived from the focus group meetings to produce the two survey instruments. Although some of the individual questions were borrowed from earlier work, many had to be written *ab initio*. The statistical properties of the questionnaires were therefore essentially unknown. In particular, it was not known whether factor analysis would cause the individual items to coalesce as indicator variables for the hypothesised latent variables in the manner anticipated. Nor was there any information at this stage concerning the internal consistency of these measures. These matters had yet to be explored. There were, nevertheless, good *a priori* reasons to believe that the questionnaires were going to prove

relevant to an investigation into the causes of student attrition. The initial outcomes of the investigation are described in Chapters 7 and 9.

Testing the Questionnaires

Both questionnaires were piloted with a group of eight students employed for the purpose. The exercise was conducted in a computer laboratory, in order that the software for the online questionnaire could be properly tested. It was considered important to establish by observation that the human-computer interface was working properly.

Each of the two questionnaires was tested separately. Students were asked first to complete the questionnaires and to provide their reactions as individuals in writing. Then the researcher led a group discussion in order to establish the extent to which different viewpoints were shared and to gauge the general strength of feeling behind some of the views expressed.

The matriculation questionnaire came across as being uncontentious (“no big deal”), which was encouraging.

The average time to complete the form was 4.5 minutes, with a maximum of seven minutes. This seemed quite long, given that at times the queues for matriculation might be moving quite quickly. It seemed, therefore, that it would be important for there to be helpers available to guide respondents through the process.

The introduction was perceived as being too wordy and “official”. Students felt no one would read it. On the other hand, reassurances concerning confidentiality were needed, particularly because matriculation numbers were being sought. It was suggested that it should be made clear that it would be to students’ advantage that they fill in the questionnaires. The solution adopted was to shorten the introductory text on the face of the questionnaire and, at the same time, to make available more detailed written explanations, should anyone wish to refer to them. A sample of the questionnaire and the accompanying explanatory notes are shown in Appendices 6.3 and 6.4 respectively.

Most questions were perceived as having a “correct” answer, i.e. one which the students thought “the University” would like to see – a “disguised test”. Issues such as doing well in exams, prior knowledge of subject content, effort and time devoted to studying all had

obvious answers. It would therefore be important to stress that this was not a test, and that there were no right or wrong answers.

Fairly strong views were expressed concerning the extent to which responses might be tainted by respondents' frame of mind at the time of completing the questionnaire. This led to the inclusion of an additional question in both the matriculation questionnaire and the online questionnaire, as described above.

Some suggestions were made concerning the ordering of the questions. It was thought that the easier questions should appear first.

The interface for the online questionnaire was thought to be very user-friendly, although one person would have preferred to use a keyboard rather than a mouse.

The questions in the online questionnaire were thought generally to be somewhat more intrusive than in the matriculation questionnaire. Otherwise the same type of comments applied. There was also some concern as to "where it might all be leading". It was asked whether students might be shown the eventual results of the exercise. (Some advice derived from the results of the study concerning recommended weekly numbers of hours of study and paid work, for example, has since been widely disseminated.)

A further problem of confidentiality arose when it was realised that students could obtain access to the answers of other respondents who had previously used the same PC. The simplest and safest solution was for each respondent to quit the browser to prevent the next user from being able to use the 'Back' button for this purpose.

The questions were thought to be slightly repetitive. The average time taken to complete the questionnaire was only 8.5 minutes (excluding two individuals who were comparing answers, who each took 15 minutes). The number of questions (60) had been a major concern, because it had been felt that there was a danger that respondents might lose interest and give up before completing the questionnaire. On the basis of the test, it was decided (a) not to shorten the questionnaire, (b) to include in the questionnaire an estimate of the likely time to completion and some words of encouragement not to give up before the end, and (c) to discourage collaboration among respondents when answering the questionnaire.

A few questions seemed to be problematic. For example, “I think asking to compare old friends and new is a really crappy question and if you’re sitting next to one of your uni mates you’ll obviously say they’re best which may be untrue. I think this Q should be withdrawn.” It was.

It was suggested that the University might render some immediate assistance to those who had indicated that they needed it. It was thought that it would be useful to have a catchall, free-text box for students having particular anxieties that were not covered by the questions posed. This seemed superficially attractive, but not practical; the University did not have the resources to analyse responses rapidly, far less to respond to them. There would also be a confidentiality problem, in that members of staff other than those concerned directly with the administration of the questionnaire would know how at least some identifiable students had responded. The compromise solution was to insert in the final “Thank you” screen some links to the Web pages of the University's various student support services.

The more general issue of having some open-ended, free-text items was considered, but regrettably rejected, because resources would simply not be available to analyse the data.

The online questionnaire and the accompanying notes prepared for the IT course tutors, who would assist with the practicalities of responding, are shown as Appendices 6.5 and 6.6 respectively. The paper version of the online questionnaire is shown in Appendix 6.7, along with a sample of its covering letter in Appendix 6.8.

The testing of the questionnaires took only two hours and, in retrospect, it was a particularly valuable and, indeed, vital part of the study. It confirmed that students were unlikely to experience practical difficulties with the completion of the questionnaires. Additionally, it provided evidence to believe that the questionnaires would achieve widespread acceptance and win students' co-operation, which would be very important in achieving a high response rate. The student testers also made some helpful suggestions for improvement.

Preliminary Causal Framework

Finally, it is possible to anticipate in an approximate manner the way in which the constructs described above might be combined with students' background characteristics in order to derive a causal model of student attrition. A loose framework of possible pathways

is shown in Appendix 6.9. This is, in essence, a modified and more flexible version of Tinto's model (Appendix 2.2). It is constrained by the availability of the information concerning background characteristics, as well as by the length and timing of the two questionnaires.

Students' background characteristics are not discussed in detail at this stage. It may be seen, however, that they may be divided into two groups: those that are established before students first enter the University, and those that do not come into being until after that time. Under the first heading come characteristics such as gender, age, social class, Entry Qualification Route, and Entry Point Score. On the other hand, Residential Category refers to students' term-time accommodation, and belongs to the second group. A student's Faculty defines that person's academic environment whilst at University and, additionally, may be viewed as framing her or his aspirations prior to arrival.

The pre-entry background characteristics and qualifications, along with one's recent experiences and current frame of mind, may be expected to have an initial impact on the four constructs embedded in the matriculation questionnaire: Family and Friends' Support, Initial Commitments – Goals, Initial Commitments – Institutional, and Expectations at Matriculation.

The pre-entry background characteristics and qualifications may also have a direct impact on the constructs underlying the online questionnaire, or their effects may be modified by the constructs in the matriculation questionnaire. How one answers the online questionnaire might also be influenced by recent experiences and one's current frame of mind. It is possible to distinguish in a provisional manner between exogenous and endogenous constructs in the online questionnaire. Among the former are likely to appear Family and Friends' Support, Extraneous Factors and Inhibitors, and Finances and Outside Paid Work. Study Time is exogenous, at least to the extent that it is a prerequisite to academic success for the majority of students, although it is also endogenous, insofar as it may be constrained by other influences, such as the amount of time devoted to Outside Paid Work. The endogenous variables are Academic Integration, Social Integration, Subsequent Commitments – Goals, Subsequent Commitments – Institutional, and Intention to Persist. It was anticipated that these could be demonstrated to be linked together in a manner consistent with Tinto's theory but at this stage no precise formulation was postulated; flexibility was more important. This subject is taken up again in Chapters 11 and 13.

Chapter 7 – Initial Analysis of the Questionnaire Responses

The matriculation questionnaire and the online questionnaire were administered quite separately. Nonetheless, it is convenient to make an initial assessment of the responses to the two questionnaires together. It was found expedient to carry out this assessment under three broad headings: an analysis of non-response rates, a brief examination of the results themselves, and a consideration of changes over time in responses to the online questionnaire.

Analysis of Non-Response Rates

In both the matriculation questionnaire and the online questionnaire students were instructed to leave blank the answers to any questions which, for whatever reason, they felt unable to answer. The main intention was to reassure respondents that they could avoid any questions that they felt were too intrusive but that they could nevertheless go on to answer the other items in the questionnaire. The response rates consequently varied somewhat among individual questions, but perhaps not as much as might have been expected.

A near-universal overall response rate to the matriculation questionnaire was achieved. Usable responses were obtained from 3,698 (97.4%) students, of whom 3,485 (91.8%) supplied complete data. The percentage of responses to individual items varied from 95.5% (mq18) to 97.1% (mq02). From watching and speaking to students at the time the questionnaire was administered, it seems likely that the relatively low response rate to mq18 (concerning anticipated study time) was due to the fact that some respondents were simply unable to predict how much study time would be required of them.

Because of the very high response rate to the matriculation questionnaire, only a relatively simple analysis of the non-respondents is necessary. Specifically, an investigation as to whether subsequent dropouts were more or less likely than average to have responded was undertaken. For this purpose dropouts were divided into two groups: those who stayed on to sit at least one Degree examination the following summer, either in the May/June or the

August/September diet of examinations – “Summer Leavers”, and those who left without having made an examination appearance at that time – “Pre-Summer Leavers”.

It may be seen from Appendix 7.1 that even at this very early stage a pattern of non-response, albeit barely perceptible, was established: Pre-Summer Leavers were less likely to respond to the matriculation questionnaire than Summer Leavers who, in turn, were less likely to respond than the Persisters. These discrepancies are so slight that they are ignored for the purposes of the subsequent analysis (chi-square = 5.90, $df = 2$, $p = 0.052$).

The online questionnaire was answered by 3,090 (81.4%) students, of whom 2,465 (64.9%) supplied responses to all 60 questions. The item response rate varied from 78.8% (oq27) to 81.0% (oq01, and others). The relatively low response rate to oq27 (concerning accommodation problems) is possibly due to the relatively wordy form of the question posed.

It may be supposed that students who departed relatively early in the session may have left before having had the opportunity to complete the questionnaire. Although the overall response rate to the online questionnaire was very high, it is necessary to look for evidence of response bias rather more carefully, because the non-response rate was high by comparison to the dropout rate. The first online questionnaires were completed early in October 1999, but the last ones analysed were not completed until mid-July 2000, by which time many of the leavers would have departed. Although it was initially intended that all students should complete the questionnaire as part of the IT Induction Programme, it became clear that for a variety of reasons this arrangement could not be relied upon. Various other devices were therefore adopted to encourage students to respond, including periodic reminders to non-respondents and, ultimately, the option to complete the questionnaire on paper rather than electronically. The relative ease with which students could avail themselves of the necessary machine time is a second possible source of response bias. This can be expected to vary among Faculties, in particular, because of their differing levels of PC cluster provision, and the extent to which the use of computers forms an integral part of the curriculum. While there are no strong *a priori* reasons for believing that response rates might be associated with the background characteristics considered in the previous chapter, each of these is also considered.

The timing of leavers' departure did, indeed, have a dramatic effect on response rates. For Pre-Summer Leavers, the response rate was only 18.4% (Appendix 7.2) (chi-square =

690.10, $df = 2$, $p < 0.000$). For Summer Leavers, the response rate was 79.9%, which is comparable with, but still noticeably lower than the figure for Persisters (86.1%). The overall non-response rate for all 454 leavers combined was 46.7%.

Because of the evident association between dropping out and not responding to the online questionnaire, it may be supposed that non-response rates have the appearance of being affected by the same factors as were identified in the previous chapter as explaining attrition rates and this, indeed, proves to be the case. For example, those aged over 21 were less likely to respond than those under 21, having 76.1% and 81.9% response rates, respectively. Those having qualified for entry to university in fifth year of secondary school had a response rate of 86.1%; those who had qualified in sixth year had a response rate of 80.0%, whilst the response rate of those having Scottish school-leaving qualifications and who had had a gap year was 70.3%. The response rate for those in University-controlled accommodation was slightly higher (83.1%) than that for other students (80.1%). Response rates did not vary greatly between the two Social Groups analysed: 81.8% for those coming from backgrounds of Social Classes I – III and the Armed Forces, compared to 80.2% for those from Social Classes IV and V, Retired and Unemployed backgrounds, and this is again consonant with the findings presented in the previous chapter, albeit for a spurious reason. Males were less likely to respond than females, having 78.1% and 83.8% response rates, respectively.

Response rates also varied considerably among Faculty Groupings. The average response rate for students in the four Faculties that make up the Professional Faculty Category defined in the previous chapter was 94.1%. Elsewhere the figures were lower. The Science and Engineering Faculties had similar response rates of 82.7% and 84.7%, respectively. The lowest response rates tended to be on the Arts side: for example, 73.8% in Social Sciences, 74.2% in Arts, and 72.2% in Education. A more detailed analysis is shown in Appendix 7.3. This does not match so closely the pattern of attrition amongst Faculty Categories described previously.

It is conceivable that the difference between the sexes is more apparent than real, and might disappear, were the other explanatory variables to be brought into the reckoning. The differences between the Arts-side and the Science-side Faculties seem convincing, however, for the reasons concerning the availability of and familiarity with computers described above. The feature that stands out most prominently, however, is the high non-response rate for Pre-Summer Leavers.

Where there is a pattern in the non-response rate, the sample will not be truly representative of the population. The best means of avoiding this is to aim to maximise the response rate from the outset. Once this strategy has been played out, other solutions that remain include the weighting of certain respondents' answers to match the profile of the non-respondents (poststratification). A poststratification adjustment is an attempt to make the composition of the sample the same as that of the population as a whole. In general, the sample weights used are in inverse proportion to the numbers of particular types of student to have responded. Other options include the use of regression estimates with random augmentation or the EM (expectation-maximisation) method. The latter involves iterating between the maximum likelihood estimates of the parameters that describe the partially missing data and the conditional expectation of the missing data, given the observed values and the current estimates of the parameters. A further approach is to use multiple imputation, which involves imposing a probability model on both the observed and missing values in order to "fill in" the latter with plausible values. In practice, Markov Chain Monte Carlo (MCMC) simulation methods are often used for this. However, it was decided that to attempt to use techniques such as these was outwith the scope of this study; none is wholly satisfactory unless data are missing completely at random (MCAR) and, unfortunately, this does not appear to be the case here.

It was concluded that to proceed with the analysis using only those cases for which online questionnaire responses are available would be misleading. The overall dropout rate would be understated (6.9%, compared to 12.0% for the cohort as a whole). The absence of responses from 53.3% of leavers could significantly bias any estimates derived from the information that is available. Because of the very high non-response rate of the Pre-Summer Leavers, it was concluded that it would be possible to use the online questionnaire to attempt to explain only why the Summer Leavers had departed. Summer Leavers, as identified by their examination appearances, rather than by any recorded dates of departure, constitute a clearly defined sub-group of withdrawals. The causes of earlier departure, as explained by the constructs underlying the online questionnaire, must remain largely unexplained. However, the qualitative research which was undertaken as part of this study throws some light on this issue, and this is discussed in Chapter 12.

For the time being, it is appropriate to remove the Pre-Summer Leavers from the analysis, and then to consider first the extent to which the remaining responders represent the cohort

as a whole and, secondly, the extent to which those Summer Leavers who responded represent all Summer Leavers.

Only 45 (1.5%) of the 3,090 responders were Pre-Summer Leavers, so the analysis presented above already provides a good indication of the extent to which the remaining responses are representative of all those students who were not Pre-Summer Leavers. Specifically, the response rates for those aged over 21 and under 21 were 86.0% and 82.9%, respectively. Response rates for the different Entry Qualification Routes were 89.2% for those who had qualified in fifth year of secondary school, 84.3% for those who had qualified in sixth year, and 79.8% for those having Scottish school-leaving qualifications and who had had a gap year. For those in university-controlled accommodation, the response rate was 86.1%, whereas for others it was 85.6%. For those from backgrounds of Social Classes I – III and the Armed Forces the response rate was 85.6%, compared to 86.1% for those from Social Classes IV and V, Retired and Unemployed backgrounds. For females the response rate was 88.2%; for males it was 82.3%. Among the Faculty Groupings, there were still relatively high non-response rates among the Arts-side Faculties, as may be seen from Appendix 7.4.

Those 167 Summer Leavers who responded to the online questionnaire appear to have been reasonably representative of all 209 Summer Leavers. A series of chi-square tests was performed to test the hypotheses that particular background characteristics of the responders matched those of all Summer Leavers. The results are shown in Appendix 7.5.

In conclusion, it can be seen that by excluding Pre-Summer Leavers, the overall response rates for the remaining two groups – Persisters and Summer Leavers – are made very similar. However, the problem of non-response bias has not been entirely cured. In particular, the Arts-side Faculties are relatively poorly represented among the responders, and this needs subsequently to be borne in mind. On the other hand, those Summer Leavers who did respond appear to be representative of all Summer Leavers in terms of their background characteristics.

Initial Results

The 78 questions described in Chapter 6 are summarised in Appendix 7.6. The questions are shown in the order in which they appeared in the two questionnaires ('mq' for the

matriculation questionnaire and ‘oq’ for the online questionnaire). For convenience, each question has a ‘Short Text’ version. The coding system was not the same for all items, although most were ‘Standard’. As an aid to the subsequent formation of factors, a decision was taken – often in a subjective manner, at least in the first instance – as to whether the coding of each item should be reversed. If a positive response to a particular question seemed likely to be associated with a higher propensity to drop out, and responses could be treated as ordinal rather than nominal, then the coding for that question was reversed (‘y’). The other items having ordinal responses were not reversed (‘n’). Obviously, no purpose would have been served by reversing the nominal scales.

The responses available for each of the original, non-reversed items as seen by the respondents are described in Chapter 6. For the purposes of the analysis, the standard, non-reversed responses are those presented to respondents:

Strongly Agree (‘SA’); Agree (‘A’); Neutral (‘N’); Disagree (‘D’); Strongly Disagree (‘SD’)

These have been assigned numerical scores of 5, 4, 3, 2, and 1, respectively. These values are, of course, arbitrary. While the responses can be ranked perfectly legitimately, nothing is actually known about the relative size of the distances between the different responses. To treat 5-point ordinal scales as though they were interval scales, as is the case in this and the following chapters, is a matter of practical convenience rather than theoretical correctness.

In cases where it is judged appropriate to reverse a ‘Standard’ score, it is convenient to describe the different responses as:

Strongly Negative (‘SN’); Negative (‘Neg’); Neutral (‘N’); Positive (‘P’); Strongly Positive (‘SP’)

Other questions invited what are essentially ordinal responses, but with an additional option to indicate whether the question was relevant to particular respondents:

oq16 Induction programme useful:

Strongly Agree; Agree; Neutral; Disagree; Strongly Disagree; Did not Attend

This particular question was included in the survey for purely administrative reasons, and consequently the responses are not considered further in this study. On the other hand, there are four questions for which the “opt out” option is relevant:

oq28 Accommodation/not enough help; *oq40* Family responsibilities limiting; *oq41* Paid work limiting; *oq42* Health problems limiting:

Strongly Agree; Agree; Neutral; Disagree; Strongly Disagree; Not Applicable

Each of these items constitutes two questions combined, and it would in principle be appropriate to analyse separately the extent of the difficulties reported and the proportion of respondents indicating the existence of such difficulties. In practice, a simpler approach was adopted, with a simple linear scale being used, with ‘Not Applicable’ being treated as the most positive response (score = 6) and ‘Strongly Agree’ being treated as the most negative response (score = 1). The average scores shown in Appendix 7.7 were calculated using this arguably over-simplified approach of combining an ordinal and a nominal scale in such a way as to make one all-embracing ordinal scale.

Whereas the matriculation questionnaire contained a five-point scale to describe students’ anticipated study times, it was appropriate to add an extra ‘No time’ response to the equivalent online question:

mq18 Study time [matriculation questionnaire]:

Up to 5 hours; 6 to 10 hours; 11 to 15 hours; 16 to 20 hours; Over 20 hours

oq59 Study time [online questionnaire]:

No time; Up to 5 hours; 6 to 10 hours; 11 to 15 hours; 16 to 20 hours; Over 20 hours

Of those students who responded to *oq59*, only 61 (2.0%) indicated that they were not spending any time studying. As a matter of practical expediency, these responses were combined with those in the ‘Up to 5 hours’ category, thereby facilitating direct comparisons with answers to *mq18*. The results are shown in Appendix 7.7 (continued).

The same device was used in the online questionnaire to establish whether students had outside paid employment and, if so, how much each week:

oq60 Paid work time:

No time; Up to 5 hours; 6 to 10 hours; 11 to 15 hours; 16 to 20 hours; Over 20 hours

Whether respondents expected to be in debt by the end of the session and by how much was also established by this means:

oq58 Loan amount:

£0; Up to £1000; £1001 to £3000; £3001 to £5000; Over £5000

These two questions were treated in the same manner as oq28, oq40, oq41 and oq42 described above. A six-point linear scale was used, with 'No Time' or '£0' treated as the most positive response (score = 6) and 'Over 20 hours' or 'Over £5000' treated as the most negative response (score = 1). The results are shown in Appendix 7.7 (continued).

The two nominal response frames were:

oq48 Information source:

My School/College; Glasgow University Literature; Visit to Glasgow University;
My Parents; Other Relatives/Friends; Other Sources(s)

oq26 Accommodation type:

Parental/Guardian's Home; Own Home; Hall of Residence; University Flat/House;
Other Rented Flat/House; Other

Question oq26 was included in the online survey instrument primarily in order to check data already recorded centrally by the University. The latter information is used throughout the analysis; the former is not used other than for the main purpose for which it was intended (Chapter 6). It also transpired that the responses to oq48 were not required in the remainder of the study.

Three other questions that were posed for purely administrative reasons, with no expectation that they would be relevant to the study:

oq14 Peer mentoring useful; *oq21* Teaching study skills desirable; and *oq36* Discourage absenteeism.

The scores shown in Appendix 7.7 have been reversed where indicated with the intention of ensuring that high scores are associated with favourable responses. It can be seen that for the most part responses were, indeed, positive, suggesting that most students were content with the various issues upon which they were invited to indicate a view. In particular, respondents indicated that they were enjoying their experiences of university life and were making new friends. Their families were very supportive. They appear to have been content with their choice of institution and were committed to receiving a university education. The proportion of students in paid employment and levels of anticipated debt are, of course, of considerable general interest, but are not discussed here.

Of the matriculation questions, the highest mean response (4.76 on a scale of 1 to 5) related to the extent to which respondents felt that their families were supportive of their coming to university (mq02). The lowest mean score (still slightly positive at 3.45) was associated with the proposition that, "I'm coming to university because I have a clear idea of my future career" (mq06).

The question relating to the extent of family support (oq02) again attracted the highest mean score (4.69) in the online questionnaire. A slight decrease in the mean score was evident not just for this question, but also for various others. This is considered in more detail below.

At the other extreme, the lowest mean score (2.32) for the online questionnaire concerned the unexpected expense of being at university (oq57). A listing of pressure points, provisionally identified as those items having mean scores of less than three on 'Standard' scoring systems, is shown in Appendix 7.8. A variety of issues causing concern to students becomes evident: they are not associated with any particular construct. It would be unwise, however, to place too much importance on this listing: some questions (oq19, oq31) require respondents to express a preference for one of two different alternatives and, perhaps inevitably, reactions were rather mixed. Additionally, the wording of some

questions may have provoked stronger negative responses than others, even through the strength of feeling behind the responses may not have been any different.

A scoring system for the responses is a necessary prerequisite for the statistical analyses that follow. The raw scores for the individual items are of interest in their own right, but the purpose of this study is to analyse and interpret them at a more conceptual level. Before this could be attempted, though, it was necessary first to investigate some apparent changes over time in the responses to the online questionnaire, because this might be a further source of response bias. This matter is considered in the next section.

Changes in Responses over Time and Reliability

It has already been explained that the online questionnaire was, by necessity, administered over a period of nine months. It is conceivable that students' attitudes and perceptions will have changed as a consequence of the many new stimuli and events which took place in their lives over that lengthy transitional period, and this will have caused the pattern of responses to the online questionnaire to have changed, too. For similar reasons, the answers to the online questionnaire are likely to have differed from the earlier, equivalent matriculation responses. Some evidence of the existence of these phenomena becomes apparent from a closer examination of the data.

Both of these points at issue are exemplified by the responses to questions mql6 and oq09. Their wordings are identical: "Generally I put a lot of effort into being well prepared for exams and assessments". Answers are in each case skewed towards the positive end of the scale, which is typical of many of the answers to the different items. The issue being explored – that of academic self-esteem – is fairly central to the academic experience and, interestingly, it appears that respondents' initial self-confidence had been eroded somewhat by the time they answered the online questionnaire. Furthermore, it appears at least superficially that the average monthly score for question oq09 decreased as the session progressed, as may be seen from Appendix 7.9.

Question oq09 is typical in this respect of many of the online questions. A gradual deterioration in the mean scores of many of the online responses is apparent. Appendix 7.10 shows the overall picture. The online questions are listed in the order in which they appeared in the questionnaire. If a particular online question has an equivalent

matriculation version, the wording of which is either directly or approximately comparable, then the matriculation question precedes the online question. Pairs of online and matriculation questions are bracketed together. The mean scores for each question are shown in columns. For the matriculation questions these averages are the same as those shown in Appendix 7.7. The figures for the online questions are disaggregated according to the calendar month in which the responses were made. It will be seen that the monthly number of online responses peaked at 935 in January 2000. At the other extreme, there were only seven responses in July 2000. Simple linear regression analyses were performed, not on the monthly averages shown, but on the underlying data, in order to estimate the monthly rate of change in the responses to each online question. Only data for the period from October 1999 to June 2000 were used; the seven responses made in July 2000 were disregarded. The estimated monthly changes are shown, along with the corresponding p -values. Only linear relationships were investigated. Although more complex patterns are conceivable, they would be difficult to model, and difficult to discern, with only nine values of the independent variable available.

In such a large number of simultaneous hypothesis tests it is likely that a certain proportion will contain Type I errors. The proportion of false positives might be kept low by using a relatively wide acceptance region ($\alpha = .01$, say) for each test. Relaxing this to $p = .05$ or even $p = .10$ is likely to overstate the number of slopes declared as a result of the tests to be significantly different from zero (H_0 rejected). At this exploratory phase of the investigation, this seems preferable to the alternative of understating the true proportion of non-zero slopes (false negatives, or Type II errors). If there was, indeed, a general downward trend in responses, it seems preferable slightly to exaggerate the evidence for its existence rather than to downplay it at this stage.

It will be seen that for many items the online score exhibits a negative trend, and that these trends are significant. For those items exhibiting a changing response score, the timing of responses may be relevant to the subsequent analysis. For example, a group of students responding to oq09 in June 2000 with an average score 3.44 would not have been exceptional. But the same average response to mq16 would have identified the group as having a score that was appreciably below average at the time of matriculation.

The results of this analysis are not conclusive, though, because different types of student may have answered the online questionnaire at different times. Some significant changes in

the mean scores may have been masked by such differences, while others might have been artificially exaggerated. The extent to which the apparent changes (or lack thereof) represent genuine changes of attitude, or whether they are simply a consequence of the fact that particular groups of students tended to answer the online questionnaire at different times, is not clear, and requires further investigation. There are also various outstanding issues of reliability that need to be considered.

Appendix 7.11 shows the mean scores for the 18 matriculation questions along with the mean score of the closest equivalent online question. Of the 17 comparisons that might reasonably be made, it can be seen that 15 show a decline in the mean score. The exceptions are mq07 (GU right institution) and mq12 (Know source of personal help). The wording of the two questions is not exactly the same, and the difference between the two means is small.

Because both the matriculation questionnaire and the online questionnaire were non-anonymous, it is possible to segment the data represented by Appendix 7.11 according to the time at which particular respondents answered the online questionnaire. Comparisons of each group's matriculation responses with its subsequent online responses should not then suffer from bias resulting from students with differing baseline perceptions responding at different times.

Administering a paper questionnaire to students standing in a queue waiting to matriculate could, conceivably, elicit different responses to the same questions posed shortly thereafter as part of an online questionnaire administered in a computer laboratory, for example. Additionally, there may be measurement error inherent in the questions, perhaps because they are too vague, for example. Comparisons between the matriculation questionnaire responses and the online responses made in October 1999 by the same students should give an indication of parallel forms reliability.

Trends over time in the difference between matriculation responses and online responses can also be examined. If the gap is widening, then this may be interpreted as a genuine effect occurring with the passage of time, provided it may be assumed that groups responding at different times are equally susceptible to such effects.

The drawback of this approach is that if one errs on the side of caution, and focuses only on those matriculation questions that have a 'comparable' online equivalent, it may be

applied to only 13 of the 60 online questions. The results are shown in Appendices 7.12 and 7.12.1 to 7.12.13.

Each of Appendices 7.12.1 to 7.12.13 shows the wording and other details of the pairs of questions being compared. Respondents are divided into groups according to the calendar month in which they responded to the online questionnaire. Online responses made in each of the nine months from October 1999 to June 2000 are compared separately with the responses to the closest equivalent matriculation questions. The response rate to the matriculation questionnaire was nearly universal, so that the number of matching matriculation responses available for analysis always either corresponds to or marginally falls short of the number of online responses. The mean matriculation score and the mean online score for each of the nine groups of students are shown, along with the means of the differences between the two sets of observations. (By definition, the mean online scores shown are the same as the mean monthly online scores shown in Appendix 7.10.)

Three sets of statistics are shown to compare the two sets of responses. The Spearman's rank correlation coefficients serve as an indication of the extent to which (a) individual students' reported attitudes changed relative to other students who answered the online questionnaire at the same time, (b) the questions are reliable, and (c) (in the case of non-identically-worded questions) the extent to which the questions explore the same issue. Unfortunately, it is difficult to distinguish between these three phenomena. Two significance tests were performed. Paired samples *t*-test procedures were used to test the hypotheses that the mean difference between pairs of matriculation and online responses is zero. The significance levels of these tests are shown. The disadvantage of using *t*-tests in this way is that a test statistic calculated from observations based on a five-point ordinal scale will not have a true *t*-distribution. Tests of marginal homogeneity were therefore also used to test the hypotheses that the marginal distributions of the two sets of responses are the same, and the significance levels of these tests are also shown. One disadvantage of using these nonparametric tests is that they may fail to identify differences when they do, in fact, exist, because the tests ignore some of the information that is available. Blanks or sparse cells (which are common in this data set) can cause tests of marginal homogeneity to produce false positives (i.e. rejection of null hypotheses when they should not be rejected), just in the same way as chi-square tests can produce misleading results. Despite these difficulties, it will be seen that the paired sample *t*-tests and the tests of marginal

homogeneity generally (but not always) lead to the same conclusions. A summary of the significant regression slopes is given in Appendix 7.12.

In order to test whether there was a trend over time in the responses made by different students in different months, simple linear regression analyses were performed using the individual monthly online scores as the dependent variables and months elapsed as the explanatory variable. (These yield the same results as those shown in Appendix 7.10.) The extent to which the different groups of students may have been predisposed to produce online responses exhibiting a trend over time may be gauged from their matriculation responses. It is convenient to explore this by fitting a simple regression model to the matriculation scores. Analogous lines of best fit can also be calculated (either by least squares or by subtraction) for the differences between the matriculation scores and the equivalent online scores. The trend lines of the differences should then be free of any inherent variation among the nine groups of respondents and, if significantly different from zero, provide relatively robust evidence of changes in reported attitudes taking place over the course of the session. The assumption of linearity is, of course, again arbitrary, but at least has the merit of simplicity.

Questions mq01 and oq01 (both worded “I’ve really enjoyed my experience of university so far”) may be taken as an example. The Spearman rank correlation coefficient for this pair of questions starts reasonably but by no means exceptionally well (0.603, comparing the matriculation responses to the online responses made in October 1999) and drops to a rather poor 0.312 by June 2000. The significance of the *t*-tests and the tests of marginal homogeneity, taken as a whole, seem inconclusive, apparently being influenced as much by the number of observations for each of the nine groups as by the passage of time. The slope of the regression line fitted through the matriculation responses is small (+0.003) and is not significantly different from zero, suggesting that there is no relationship within the cohort as a whole between students’ timing in filling up the online questionnaire and the extent to which they had been enjoying their university experiences. The mean monthly online score does decline, as indicated by the negative value (-0.026) of the slope coefficient, which is significant. Adjusting for the very modest trend between groups in the matriculation responses would make this slope slightly more negative (-0.028), which is also significantly different from zero. However, given that there is apparently no significant trend present in the matriculation responses, it seems that it would not be incorrect to accept the estimated slope of -0.026 shown in Appendix 7.10 at face value: it

may be asserted that over a nine-month period students' average reported enjoyment of their university experiences is estimated to have deteriorated by approximately one quarter of one point on the Likert scale. Apart from the assumption of linearity mentioned in the previous paragraph, the main provisos stem from the doubtful realism of interpreting Likert scales in this manner, and the likelihood of false positives inherent in the multiple testing.

The same conclusions are true of oq44 (GU right institution) and mq07 (GU right institution): the coefficient of -0.029 in Appendix 7.10 seems plausible.

The correlation coefficients for some of the pairs of questions seem so poor that it is unsafe to use this analysis to form a view concerning reasonableness of the coefficients shown in Appendix 7.10. The individual matriculation responses do not seem to be sufficiently well matched to the corresponding online responses to be able to add any useful information. This is particularly true of those items shown in Appendix 7.13.

For oq06 (New friendships) there is no significant change over time apparent in the unadjusted online responses, and this conclusion is not altered by this analysis.

For five pairs of questions, a significant trend is evident in the matriculation responses, leading to the conclusion that although there was a general deterioration over time in the online responses, it was not as pronounced as suggested by the unadjusted slopes shown in Appendix 7.10. This is true of those items shown in Appendix 7.14. For example, it appears that the deterioration in oq09 (Well prepared for exams, etc) illustrated at the beginning of this section was not so marked as might first have been supposed: the unadjusted slope of the online responses is -0.079 , but this reduces to -0.044 after allowing for differences in the matriculation responses. It may be supposed that the change in the coefficient is due to the fact that students who felt better prepared for examinations tended to complete the online questionnaire relatively early in the academic session, and this does not seem implausible.

The unadjusted downwards trend in responses to question oq53 (Career clear) seems on the basis of this analysis to have been due entirely to variation among respondents: it seems unsafe to accept the coefficient of -0.054 in Appendix 7.10.

Although the unadjusted version of oq03 (Lost friends) has no significant slope, it becomes significant after adjustment for response bias.

The results of this parallel forms analysis are summarised in Appendix 7.15.

In short, while the conclusions are tentative and incomplete, as well as varying among items, it seems that it would be unwise simply to accept the results shown in Appendix 7.10 without considerable caution.

Further evidence concerning the effects of the passage of time may be adduced from the test-retest results in respect of the 319 students who answered the online questionnaire twice. These respondents initially answered the questionnaire at some point during the first term and then again, mainly in the following May, as a consequence of their having been specifically requested to do so. Those second responses that were analysed were made at different times at least 42 days (six weeks) but not more than 237 days (c. 34 weeks) after the first responses. It therefore seems unlikely that the second set of responses would have been influenced by a recollection of the first set. The 319 respondents were reasonably representative of the whole cohort, including 131 from the Professional Faculties, 124 from the General Faculties and 64 from the Other Faculties, as well as 9 (2.8%) dropouts. The advantages of analysing the responses of these 319 individuals are that all 60 online items were answered, and that any possible incongruities between the matriculation questionnaire responses and the online questionnaire responses are avoided. The shortcomings of this analysis are that it is not possible to say with certainty whether the changes in the scores arose as a result of genuine changes in attitude, or as a result of shortcomings in the questionnaire having amplified the inevitable stochastic variation in individuals' responses. Nor is it necessarily safe to extrapolate changes taking place over the test-retest period to the full length of the academic session.

The results are summarised in Appendix 7.16. High values of Spearman's rank correlation coefficient tend to be associated with either facts or views that have not changed greatly between test and retest. For example, the results shown in Appendix 7.17 seem plausible, and the items concerned seem relatively reliable.

Some caution is required in drawing conclusions from these raw correlation coefficients, however: at least three of the items concerned (oq28, oq41 and oq60) were worded in such a way that a large proportion of respondents all gave the same answers to them, as may be

seen from Appendix 7.7 (continued), thereby producing correlation coefficients which, in all likelihood, are deceptively high.

At the other extreme, low correlations may be due to genuine changes in views and perceptions over time. However, low correlations, when associated with non-significant changes in the mean responses, provide evidence of poor reliability. Changes have taken place, but with no discernible pattern. Using a relatively low correlation coefficient of 0.45 as the cut-off value combined with a paired sample *t*-test significance level of $p = 0.10$ causes 10 items to be identified as being not reliable. These are identified in Appendix 7.16.

It will be observed that the number of significant changes in the mean responses in Appendix 7.16 is much fewer than in Appendix 7.10. This again suggests that the unadjusted scores for the cohort as a whole are being exaggerated in some cases by response bias.

The conclusions of this three-fold examination of changes over time in the online responses are summarised in Appendix 7.18, which shows those monthly changes in responses which are statistically significant ($p < .10$) carried forward from Appendices 7.10, 7.12 and 7.16. Almost all of the unadjusted figures from Appendix 7.10 show a significant downward trend over time. Although the parallel forms analysis covers only thirteen items, it does throw doubt on the wisdom of unquestioningly accepting the unadjusted slopes at face value, suggesting in particular that at least some of them are too steep and that different questions are more susceptible than others to response bias. Those slopes which are significant and which are judged to be the most meaningful to be derived from the parallel forms analysis are shown in Appendix 7.18. The test-retest analysis generated a third set of results. All significant slopes derived are negative. There are fewer of them than for the cohort as a whole, but those that are statistically significant are generally steeper.

It has already been remarked that on the whole the responses to the online questionnaire were positive. However, it is difficult to escape the conclusion that views and perceptions concerning at least some aspects of the first-year student experience were deteriorating in the course of the year. While it therefore seems advisable in the subsequent analysis to take into account the time at which online responses were made, it is not possible to form a definitive view as to precisely how this might be done: the incomplete parallel forms

analysis suggests that the unadjusted slopes should be reduced but, on the other hand, the test-retest results suggest that while many of the unadjusted slopes may safely be ignored, others should actually be magnified.

It is of interest to contrast the appropriate changes to the unadjusted slopes implicit in the parallel forms and test-retest analyses. This is done in Appendix 7.19.

The implied changes are contradictory in only two out of ten instances, which is modestly reassuring, but the actual scale of the adjustments required to the individual items is very uncertain. It is not inconceivable that these contradictions are the result of Type I errors, particularly in view of the use of $p < .10$ as the criterion of statistical significance. However, this exercise may be thought of as exploratory research, rather than theory testing; it may be conceptualised as a search for plausible declining trends in the online responses rather than a convincing demonstration that no such trends exist. It then seems best, as a practical expedient, to approach the later stages of the analysis using two extreme interpretations of the online data: on the one hand, using the unadjusted scores and, on the other, detrending the scores by using the slopes suggested by the test-retest analysis, because these exhibit the greatest variation among items. If these two sets of data produce reasonably similar results, then it may be concluded that steering a middle course would also produce similar results.

In conclusion, the analysis of the non-responses has been of pivotal importance to the project, because it leads to the exclusion from the subsequent logistic regression and path analyses of the Pre-Summer Leavers. A coherent scoring system has been established, and the basic characteristics of the questionnaire responses have been described. Difficulties caused by apparent trends over time in the responses to the online questionnaire have been identified and, while there is no easy panacea, a practical way forward has been found.

Chapter 8 – Summer and Pre-Summer Leavers

It was observed in the previous chapter that the timing of leavers' departure had a dramatic effect on their online response rates. In particular, only a small proportion of Pre-Summer Leavers responded. The analysis that will follow in Chapters 10 and 11 will therefore focus on the Summer Leavers. The much larger number of persisters will be used as a control group, and the Pre-Summer Leavers will be removed from the analysis. Before this is done, however, it is appropriate to formulate logistic regression models of Summer Leavers and Pre-Summer Leavers separately. The main purpose is to explore the extent to which the models of overall persistence established in Chapter 5 remain robust when applied only to the Summer Leavers. Applying these models also to Pre-Summer Leavers allows a picture to emerge of the types of students that were more likely to leave early in the session compared to those who were more inclined to postpone their departure until the summer months. This distinction is of subsidiary relevance to this study, however, and is not explored in any great detail.

In Chapter 5 three multiple logistic regression models – Models Four, Five and Six – were established as a platform of basic results upon which subsequent elaborations could be built. The coefficients in these three models, along with equivalent figures relating specifically to Summer Leavers and to Pre-Summer Leavers are shown in Appendices 8.2, 8.3 and 8.4. Appendix 8.1 contains the significance values of the Hosmer and Lemeshow Goodness-of-Fit Tests for the nine relevant calculations, as well as the percentages of cases correctly classified using the stated cut values.

Throughout this chapter, the results presented are derived from the same sample of students as that used for Models Four, Five and Six in Chapter 5.

The dependent variables for the new models in this chapter were taken as being dichotomous, with either Pre-Summer Leavers or Summer Leavers being contrasted with Persisters. One variant would have been to contrast the characteristics of Pre-Summer Leavers with those of all students who did not depart until the summer of the year 2000 or later (i.e. Summer Leavers plus Persisters), but it seems likely that this approach would obfuscate rather than clarify the differences between leavers and persisters. Other options might have included nominal or ordinal logistic regression analysis but, in the interests of simplicity and consistency, these were not pursued.

As a means of demonstrating model calibration, the *p*-values for the Hosmer and Lemeshow Goodness-of-Fit Tests are shown in Appendix 8.1. All are statistically significant. Model Six produces a particularly good fit for all types of leavers. All three models achieve a closer fit for Summer Leavers than for Pre-Summer Leavers. This suggests that there are additional influences affecting early departure, in particular, which are not associated with the explanatory variables in the models. There is little difference among the nine results in the percentages of cases correctly classified, using cut values equal to the corresponding ratios of leavers to persisters in the sample; in all cases model discrimination is moderately good.

Most of the odds ratios in Model Four are statistically significant for Summer Leavers and Pre-Summer Leavers as well as for all leavers combined. Being in the Professional Faculty Category strongly improves the likelihood of a student's persistence, particularly during the pre-summer period. Entry Point Score and Entry Qualification Category are also important variables. Exceptionally, three coefficients in Model Four are not statistically significant, and these are worthy of special comment.

First, although the persistence rate for students in the General Faculties is higher than that of students in the Other Faculties, this difference manifests itself mainly among the Summer Leavers. This appears to be associated particularly with a front-loading in the dropout rate from the General Faculties. A simple analysis of the numbers leaving (Appendix 8.5) indicates that the dropout rate for the Other Faculties increased slightly from 9% for Pre-Summer Leavers to 10.2% for Summer Leavers (making a total dropout rate of 19.2%), whereas the General Faculty Category experienced a relatively pronounced decrease in its dropout rate from 6.9% for Pre-Summer Leavers to 5.0% for Summer Leavers (total 11.9%). It is a matter of speculation as to why this front-loading should have been experienced only in the General Faculty Category. Conceivably there is less academic cohesion in faculties such as these, where students are generally not associated primarily with one academic department, and this leads relatively quickly to the withdrawal of those most affected. This issue will be considered in further detail in Chapter 13.

Secondly, although younger students appear to experience higher persistence rates than older students overall, this differential is significant only with respect to Summer Leavers. It appeared from the focus group meetings that older students are more strongly motivated, and it is therefore possible that they are less inclined to withdraw until forced to do so as a consequence of protracted lack of academic success only later in the session.

Thirdly, students living in University accommodation are more likely to persist than other students, although the difference is only significant with respect to Pre-Summer Leavers. There are various reasons why this may be so. Of considerable relevance may be the fact that students living in halls of residence are financially committed from the outset to pay a full session's rent. This could imply that those living in University accommodation may be more inclined to stay on for primarily social reasons even after the point when academic success has slipped from their grasp. In the summer months those who had been living in University accommodation would have returned to their parents' or guardians' homes, thereby losing any day-to-day advantages that living in University accommodation might afford them. More fundamentally, those living in University accommodation will have made a positive decision to change their lifestyle very appreciably in order to attend the University and therefore may have been more strongly motivated to persist, at least initially. Conversely, those not living in University accommodation may have faced commuting problems or other extraneous difficulties during term-time. They may also have failed to integrate into the academic and social life of the University. Social class may also be relevant: those from the lower Social Group tended to drop out earlier (Appendix 8.6), and University accommodation tended to be occupied predominantly by students from the higher Social Group (Appendix 8.7). Issues such as these will be further explored in subsequent chapters.

In Models Five and Six the significance of those main effects that are associated with interaction terms is not shown and, instead, a '†' is shown. This is because the statistical significance of the corresponding interaction terms is more important; the coefficients of the main effects may be no more than an artefact of the calculation, with no practical relevance on their own.

Some of the odds ratios in Models Five and Six are unduly large, and the corresponding confidence intervals (which are not shown) are very wide. This seems to be due largely to paucity of data. For example, in Model Five, the interaction between Faculty Category and Age Category appears to be particularly prone to this problem. An inspection of the data, which are shown in Appendix 8.8, reveals that there are four cells containing less than ten observations, for example.

In conclusion, it appears that Model Four may prove to be the most useful of the three models developed in Chapter 5 when elaborating the analysis to incorporate the results of

the questionnaires, because of its simplicity. Nevertheless, it still seems appropriate also to carry forward Models Five and Six for further investigation.

Model discrimination is moderately good (Appendix 8.1), even when Pre-Summer Leavers and Summer Leavers are analysed separately. There are no indications at this stage that the logistic function cannot be used for model building, even when the average observed probability of departure is as low as 0.05.

It was reported in the previous chapter that most of the Pre-Summer Leavers did not respond to the online questionnaire. Consequently, these attitudinal data are not available to build a model that better explains why such individuals departed. The remainder of this thesis will focus on the Summer Leavers, with Pre-Summer Leavers excluded, other than in the principal components analysis (Chapter 9) and as respondents in the telephone exit interviews described in Chapter 12. The loss from the sample of the Pre-Summer Leavers might have been foreseen. However, to have obtained their responses to a sufficiently detailed questionnaire would have required such a survey instrument to have been administered to all students soon after matriculation. It is unlikely that this could have been achieved in practice without substantially reducing the overall response rate, thereby introducing scope for further non-response bias. Dividing those students who withdrew into Pre-Summer Leavers and Summer Leavers at least facilitates the type of comparisons between these two groups described above.

Chapter 9 – Principal Components Analysis

In Chapter 6 it was described how students' perceptions and opinions were tested by means of asking groups of related questions. It was hypothesised that there are underlying factors (or constructs, or components) that these different sets of questions can explore. If such a group of questions measures an underlying construct, then combining the responses produces a more general measure of the construct. This approach can simplify the interpretation of the results and increase reliability, in the sense that the measurement of the constructs could then be repeated with more stable results.

In Chapter 7 initial consideration was given to the questionnaire responses, and particular attention was drawn to the general apparent decline over time in students' attitudes and perceptions, as reflected in the answers to the online questionnaire. This issue was examined from three different perspectives. It became apparent, however, that no firm conclusions could be drawn concerning the underlying reality of this apparent deterioration. In the end, it was concluded that two sets of responses should be used for the purposes of further analysis: one based on the unadjusted, non-detrended responses and, at the other extreme, one using detrended responses adduced from the relatively steep rates of decline observed for certain items in the test-retest sample.

The questionnaires used for the purpose of this study were designed with specific factorial structures in mind. This now leaves open two distinct avenues to be followed with a view to achieving data reduction. On the one hand, exploratory factor analysis (or, in this case, principal components analysis) may be used, thereby allowing the factors most appropriate for characterising the variables to emerge from the analysis in a manner that is relatively free of any preconceived structure. On the other hand, confirmatory factor analysis may be used as a means of testing the extent to which the data conform to the expectations articulated in Chapter 6 concerning which factors are likely to load on which variables. This chapter is concerned only with the former analysis.

It may be observed from the summary statistics relating to the questionnaire responses presented in Chapter 7 that there was slight variation in the number of responses received to each question. On closer inspection of the data, it appears that a significant minority of respondents failed to answer a few of the questions asked of them. No obvious patterns are evident, and these missing values are of little consequence when analysing each item

separately. However, the problem is more serious when one seeks to create scales based on a combination of several different items. Rejecting several responses just because a further, related response is missing would cause a significant loss of data. It was therefore concluded that the gaps should be filled by inserting average response values derived from the cohort as a whole. Taking the matriculation questionnaire and the online questionnaire separately, missing values were replaced by averages in those cases where students had supplied answers to at least some of the other questions. This allowed almost 500 cases to be analysed that would otherwise have been lost.

In theory, factor analysis requires interval-level data, but ordinal variables are routinely used in this type of research, as is the case in this and the following chapters. Factor (or component) extraction was first undertaken here with a view to establishing the minimum number of factors necessary to represent the data. Factor (or component) rotation was then performed in order to make the factors more interpretable.

All items from both the matriculation questionnaire and the online questionnaire were included in the analysis, other than oq26 (accommodation type) and oq48 (information source), because these use nominal scales. Item oq28 (accommodation/not enough help) was also omitted, because responses to this item are conditional on responses to oq26. The four items intended to explore University policy issues (oq14, oq16, oq21 and oq36) were also excluded. Items from the matriculation questionnaire and the online questionnaire were combined in order to improve reliability. (Other things being equal, reliability is improved by including more items in a particular scale.)

An initial inspection of the correlation matrix of the 71 variables included in the analysis suggested that it might be difficult to identify common factors; only 5.6% of the coefficients based on the unadjusted, non-detrended data were greater than 0.3 in absolute value, and the equivalent percentage for the detrended responses was 5.2%. Nine of the 71 variables did not have any correlations greater than 0.3 in absolute value with any of the other variables, whether detrended or not. These are listed in Appendix 9.1.

The communalities of each of the 71 variables were also calculated. These are shown in Appendix 9.2 for both the unadjusted (non-detrended) and detrended responses. Communality is defined as the squared multiple correlation coefficient between a given variable and all other variables. Those variables having high communality are more likely to be explained by common factors, and it may under some circumstances be preferable to

eliminate those having low values. The right-hand column in Appendix 9.2 shows that the communalities for the detrended responses are very similar to those of the equivalent non-detrended items. It can be seen that none of the communalities are particularly high and, at the other extreme, those having low communalities correspond reasonably closely with those identified above as having poor correlation with the other variables. It was decided not to exclude any of the 71 variables at this stage, but to use them all for the purposes of the exploratory factor analysis, recognising that it might subsequently be necessary to revise the model in the light of these and subsequent findings.

The presence of common factors associated with a multiplicity of observed variables should have the effect of reducing the partial correlation coefficients between particular pairs of variables, once the effect of the other variables has been eliminated. The partial correlation coefficients and the observed correlation coefficients can be compared to produce the Kaiser-Meyer-Olkin (KMO) measure of overall sampling adequacy. Values of this statistic close to one are strongly indicative of the existence of common factors. At the other extreme, values below 0.5 are regarded as “unacceptable” (Kaiser, 1974). Unfortunately, little importance can be placed on the Kaiser-Meyer-Olkin statistic in this particular application (0.901 for the non-detrended data, and 0.896 for the detrended data), because the large number of observations involved may be producing misleadingly high values.

Having nevertheless obtained some evidence to suggest the existence of common factors, principal components analysis was then used for the extraction phase. Principal components analysis creates from the observed variables a set of new, uncorrelated variables which between them account for all of the variance in the observed variables. The new variables are linear functions of the observed variables. Principal components analysis may be regarded as a special case of factor analysis, in that the resultant communality of each observed variable is one, and there are no unique factors present. The first principal component is taken as the one explaining the most variance in the observed variables, and the second component is that which explains the second most variance, and so on. Only those components that explain a relatively high proportion of the variance in the observed variables are retained. Data reduction is thus achieved by limiting the number of components included in the subsequent analysis rather than through the imposition of a hypothetical model, as is the case when using factor analysis. The calculation is performed using standardised variables, so those components having a variance of less than one

explain less variance than the average for an observed variable and, as a rule of thumb, such components may be excluded from further analysis.

In choosing to use principal components analysis one is, in effect, insisting on using underlying factors that are uncorrelated. This may be unduly restrictive, because it seems unlikely that respondents would have regarded the components as each being a separate, independent issue. It can be argued, though, that the hypothesised existence of unique factors is an unnecessary complication and, for this reason, principal components analysis is to be preferred to factor analysis in exploratory work. The trade-off involved has been summarised by Kim and Mueller (1978, p. 20): “The mathematical representation of the linear combination of observed data [by the use of principal components analysis] does not require imposing what some may consider a questionable causal model, but it does not reveal any underlying causal structure if such a structure exists.”

In this case 17 principal components were identified as having a percentage variance explained (or eigenvalue) of greater than one. These are shown in Appendices 9.3, 9.4, 9.5 and 9.6. They explain 54.2% of the variance in the non-detrended variables. Repeating this step using the detrended online responses reduced the explained variance slightly to 54.1%. These percentages are quite low, suggesting that there is a relatively large amount of random disturbance present.

Varimax rotation was then performed in order to simplify the component structure. The simplest structure is one in which all observed variables each have a non-zero loading on only one component. Varimax rotation achieves this objective so far as is possible by maximising the variance of the squared loadings for each component (Kim and Mueller, 1978). The rotated components should be largely uncorrelated, making interpretation of the results more straightforward.

The rotated component matrices are shown in Appendices 9.7 and 9.8. The former is based on unadjusted (non-detrended) online responses, whereas the latter is based on detrended data. Each tabulation shows loadings that are at least equal to 0.25 in absolute value. Each item was mapped to a particular component, based on these loadings, and these mappings are denoted by the shading of the boxes containing the relevant values. For the purposes of the subsequent exploratory analysis it was decided not to retain the individual component loadings but, instead, simply to assume that a variable either loads or does not load on a particular component. It was further assumed that no item should load on more than one

component. This may be justified on the ground that the results of the principal components analysis may safely be regarded as being only indicative of the structure of the data, which could be subject to other random or relatively unimportant influences. A further advantage of not using the weightings is ease of interpretation; it is then not necessary to speculate why particular items should have different loadings from others, although this argument is more difficult to sustain when the loadings of different variables are substantially different from one another.

Reassuringly, all of the components produced in this largely mechanistic fashion seem to consist of items that are conceptually coherent, albeit not precisely as originally intended. It can also be seen that the component matrix for the detrended data is very similar to that for the non-detrended data and, for this reason, it was concluded that the mappings between individual items and components could be taken as being the same for both sets of data. The relationships between the fourteen factors originally hypothesised in Chapter 6 and the new ones to emerge from this exploratory analysis are shown in Appendix 9.9. This interpretation of the data is crucial for the further development of the thesis. The new set of components corresponds only partially to the initially hypothesised constructs, because they also depend now on the patterns emerging in the responses to the survey instruments.

The first component was named ‘Commitment’, consisting of three items drawn from ‘Institutional Commitment 2’, along with the one item in ‘Goal Commitment 2’ and the single item in ‘Intention to Persist’. Three other items – one from each of ‘Frame of Mind’, ‘Social Integration’ and ‘Finances and Paid Work’ also load on this component. ‘Commitment’ appears to be a more diffuse construct than the more precise formulations hypothesised by Tinto. None of the items originally expected to load on Initial Goal Commitment or Initial Institutional Commitment seem to be relevant in practice.

‘Academic Integration’ is a further component, and consists of all of the eight items which make up ‘Academic Integration’, as originally conceived, as well as an additional item from ‘Goal Commitment 2’.

The extracted version of ‘Social Integration’ consists of six of the thirteen items in the original version of ‘Social Integration’. Three of the four items that make up ‘Loss of friends and homesickness’ form a distinct construct within the broadly constituted concept of ‘Social Integration’ originally devised for the purposes of this study.

‘Expectations for the future’ consists of a mixture of two items in the matriculation questionnaire and two items in the online questionnaire, originally classified as ‘Goal Commitment 1’ and ‘Goal Commitment 2’, respectively. This partial amalgamation of two of Tinto’s original constructs seems plausible, if not what had been originally intended for the purposes of this study.

‘Financial concerns’ picks up five of the original ‘Finances and Paid Work’. The latter is a relatively disparate grouping of different items, and it is not surprising that they did not come together to form just one component. It is of particular interest that those items having a clear temporal aspect (oq41 – Paid work limiting, and oq60 – Paid work time) appear not to have been equated by respondents with ‘Financial concerns’, even though they might reasonably be described as coming under the heading of ‘Financial matters’.

‘Perspicacity at matriculation’, ‘Self-assuredness at matriculation’, ‘Help anticipated at matriculation’, and ‘Last-minute decision’ are four components derived exclusively from the matriculation questionnaire. The first two of these groupings are relatively fragmented in terms of their original conception, and have moderate alpha statistics of 0.66 and 0.58, respectively. ‘Help anticipated at matriculation’ consists of two of the original three matriculation questionnaire items concerning ‘Expectations’. ‘Last-minute decision’ is made up of only one item – an item that did not load on any of the seventeen rotated components having an eigenvalue greater than one. These are not constructs that were originally hypothesised to exist; they arise simply as a matter of empirical expediency.

‘Help and feedback’ maps to all four of the original items making up the original version of this factor plus one item in ‘Social Integration’. This construct is primarily academic in character.

‘Time constraints’ consists of three items: two relating to paid work, and the other relating to commuting time. This grouping of two ostensibly distinct constructs is, however, consistent with Yorke *et al.*’s (1997) findings.

‘Academic self-concept’ contains two of the five items contained within the original factor of the same name. In this instance items contained within the matriculation questionnaire and the online questionnaire are not coalescing to form one construct.

‘Extraneous problems’ are four of the original six items under this heading. As noted above, one item originally included under this heading (oq39 – Daily travel limiting) becomes a manifest variable for ‘Time constraints’, instead. Responses to another item (oq28 – Accommodation/not enough help) were contingent on the type of accommodation occupied (oq26), and were dropped from the analysis.

‘Academic effort’ consists of two ‘Study time’ items, plus one ‘Academic self-concept’ item, which seems plausible. The mapping between the original ‘Study time’ and the new ‘Academic effort’ is less than perfect.

‘Loss of friends and homesickness’ is made up of one matriculation questionnaire item concerning ‘Family and friends support’ and three online ‘Social integration’ items, as noted above.

‘Family support’ transpires to be a distinct construct, being made up of two identical items – one in the matriculation questionnaire, and one in the online questionnaire.

‘Transfer awareness’ consists of two items within ‘Institutional commitment 2’. Although they were originally intended to test respondents’ reactions to two contrasting propositions, it seems from the correlation between the two sets of responses that only one issue was being identified by respondents, namely the possibility of any form of transfer, rather than the two distinct possibilities of transferring either within the University or to another institution.

‘Friends studying same subject’ is the second item that does not combine with any of the other items to any appreciable extent to form a component.

The outcome of the exploratory principal components analysis is summarised in Appendix 9.10.

It will be seen that four of the components consist of combinations of items drawn from the matriculation questionnaire and the online questionnaire. Combining the two questionnaires in this way may be justified on the basis that it improves reliability. The fact that the components derived using this approach seem to be based on broadly similar questions offers some reassurance that this is indeed the case.

Cronbach's alpha statistics were calculated for each of the 16 relevant components using both the detrended and the non-detrended data, and the results are shown immediately under the component names in Appendices 9.7 and 9.8. Cronbach's alpha is a measure of the internal consistency of the different items being used to measure a particular construct, and is based on the average correlation of the items making up a given scale.

It can be seen that the values of alpha for any given construct are almost the same for the detrended data as for the non-detrended data, with the former sometimes being very slightly lower (but never higher) than the latter. Commitment has the highest value (0.81 for both the detrended and non-detrended data), which suggests good but not exceptionally good internal consistency. Those constructs having values of less than 0.6 are more questionable, and tend to be associated with relatively short scales.

Following the line of argument described above, scales were then constructed for the purposes of the subsequent exploratory analyses using the mean score for each respondent derived from all variables having substantial loadings on a given construct while ignoring the rest, as indicated by the shaded areas in Appendices 9.7 and 9.8.

It was decided that it would be sufficient for this purpose to retain only the unadjusted, non-detrended data set. The detrending of certain items contained within the online questionnaire appears to make the formation of factors slightly more difficult, as evidenced by the correlations within the two data sets, the KMO statistics, the percentages of variation explained by principal components analysis, and the alpha statistics, all of which are marginally better for the unadjusted data than for the detrended data. The fact that the same components emerge from both data sets is a further reason in favour of not duplicating the exploratory analysis any further. Finally, it seems likely that even though the eventual regression coefficients would be different, such differences would only be slight.

Various difficulties have been identified, and various simplifying assumptions have been made. For example, it has already been remarked that to assume that the underlying constructs are uncorrelated may be unrealistic. From a factor analytic point of view, it is conceivable that there may also be other latent variables present. Principal components analysis has been used to avoid the complexities of such an interpretation, at least for the time being. Some of the observed variables appear legitimately to load on more than one construct, and this may need to be taken into account. Furthermore, the loadings of

different variables on certain constructs differ quite appreciably. These points are taken up again in Chapter 11, in which structural equation models are constructed.

The analysis is successful to the extent that it transpires to be relatively easy to interpret the rotated component matrix, and the number of factors that emerge from the analysis is by no means excessive. The results are used for the purposes of the exploratory logistic regression analyses described in the following chapters. It has been observed that in some respects the constructs to be utilised are different from those devised in Chapter 6. This is likely to influence the end results of the study to an appreciable extent.

Chapter 10 – Logistic Regression Models of Summer Persistence Using Attitudinal Constructs

Introduction

In Chapter 5 three multiple logistic regression models were developed to explain first-year attrition in terms of students' background characteristics and academic achievements prior to admission. In Chapter 8 this work was further developed, with a distinction being drawn between Pre-Summer Leavers and Summer Leavers. Only the latter were retained for further analysis. Chapter 9 contains a description of how principal components analysis was used to derive attitudinal constructs hypothesised to underlie the observed responses to the matriculation questionnaire and the online questionnaire. In this chapter various logistic regression models of summer persistence are first presented using only the attitudinal constructs as explanatory variables. These are then combined with the student characteristics previously used in an attempt to produce a more comprehensive model of summer retention.

In this chapter persistence is defined in terms of the relative numbers of Summer Leavers and Persisters. Pre-Summer Leavers are relevant only to the extent that their responses to the questionnaires may have influenced the formulation of constructs in Chapter 9. The summer dropout rate is taken as the ratio of the number of Summer Leavers to the number of students exposed to the risk of departure over the summer months. The summer retention (or persistence) rate is then defined simply as $(1 - \text{summer dropout rate})$.

Three univariate analyses of the attitudinal data were undertaken in preparation for developing the multiple logistic regression models of summer persistence. First, a simple visual representation of the effect on summer retention of each of the 18 perceptual scales was produced. The linearity of the logit function for these constructs was then examined. Thirdly, simple logistic regression analyses were undertaken using summer retention as the dependent variable and each of the 18 constructs in turn as the independent variable.

Cumulative Frequency Polygons

Cumulative frequency polygons for each of the 18 relevant scales are shown in Appendix 10.1. In each case, the values are shown separately for Summer Leavers and for Persisters, in order to demonstrate visually the differences between these two groups. Summer Leavers typically have lower scores than Persisters, causing the plots of their scores to be distributed more to the left of the diagrams.

It can be seen that separation between the polygons for the Summer Leavers and for the Persisters is greatest for the Commitment construct. It is large for Academic Integration, Time Constraints, Academic Self-Concept, Extraneous Problems and Academic Effort. The differences also seem unequivocal for Social Integration, Financial Concerns and Family Support. There seem to be discernible differences in respect of Expectations for the Future and Self-Assuredness at Matriculation. There are virtually no differences for Perspicacity at Matriculation, Help and Feedback, Lost Friends & Homesickness, Transfer Awareness, Help Anticipated at Matriculation, Friends [Studying the] Same Subject and Last-Minute Decision [to come to University].

The fact that Self-Assuredness at Matriculation and Lost Friends & Homesickness exert little, if any, influence on rates of departure during the summer months is not surprising. These factors would be expected to be of greater relevance to Pre-Summer Leavers. The modest relationship between expectations and summer retention is slightly surprising, and is possibly explained by the fact that two of the four underlying observed variables were derived from the matriculation questionnaire rather than from the online questionnaire. Views and perceptions expressed at matriculation may have worn off by the following summer, and this perhaps also explains why Perspicacity at Matriculation, Help Anticipated at Matriculation and Last-Minute Decision have no appreciable association with summer retention rates. Transfer Awareness and Friends [Studying the] Same Subject are constructs which, on their own, seem unlikely to have an appreciable effect on retention, and this appears indeed to be the case. That Help and Feedback also appears not to be associated with attrition is surprising, however, given the nature of the student feedback and staff comments made at the focus group meetings. This suggests that there may be an additional variable involved. For example, the reported step-change in levels of support from school to university might be expected to affect leavers and persisters in equal measure. Alternatively, high levels of anxiety might cause even those students who

are making good progress academically to feel that they are being unduly neglected. Conversely, some of those who are performing poorly may be indifferent to the fact that they are not receiving the levels of help which they would need in order to succeed. This will subsequently be examined in more detail in Chapter 11.

Overall, this preliminary inspection of the data is encouraging. It appears that most of the constructs derived from the questionnaires do indeed have an association with persistence rates, as originally hypothesised.

Examination of the Logits

One of the assumptions underlying logistic regression is that the logits of the dependent variable should be linear over the range of the explanatory variables. Sample deciles for each of the 18 factors were constructed, and the logit of summer persistence for each of these deciles was calculated. For some constructs, there were fewer than ten groupings available to which roughly equal numbers of cases could be assigned; for these, it was necessary to work with less than ten categories (or “n-tiles”). Unweighted linear trendlines were also fitted, and the results are shown in Appendix 10.2. It can be seen that in most cases the assumption of linearity of the logit appears reasonably to be met.

This conclusion was subsequently explored more thoroughly using Box-Tidwell tests of non-linearity. The linearity of an explanatory variable, x , may be tested by running a model having an additional term in the form $x \cdot \ln(x)$. Non-linearity of the logit of the dependent variable is then indicated if this additional term has a significant, non-zero coefficient (Box and Tidwell, 1962). From these tests it was concluded that in all models other than Transfer Awareness (fl5) the logit of summer persistence may be adequately described by a linear function. In the case of Transfer Awareness it appears from inspection that a better fit might be obtained using either a quadratic or, preferably, a cubic function. (A cubic function is illustrated in the relevant diagram in Appendix 10.2.) However, it transpires that neither of these transformations reduces the deviance to any marked extent, and the relevant beta coefficients are not significant. It was therefore decided not to pursue this line of investigation any further.

The distributions of the scales for Family Support and for Last-Minute Decision are particularly attenuated and, in order to obtain reasonable numbers of observations in each

cell, it was decided to dichotomise each of these variables. This would minimise the possibility of unduly high standard errors and implausible point estimates in the logistic regression analysis. The raw data and the regrouped, binary data for these two constructs are shown in Appendices 10.3 and 10.4. For these two variables the issue of linearity of the logit is clearly no longer relevant. For Family Support the new groups have significantly different leaving rates (chi-square = 11.73; df = 1; sig. = 0.001). For Last-Minute Decision the new groups do not have significantly different rates of withdrawal (chi-square = 1.91; df = 1; sig. = 0.167), but no other regrouping produces a better solution. The one shown at least has the merit of having the same cut value as for Family Support.

It can also be seen in Appendix 10.2 that for most of the other constructs the logit of summer persistence is an increasing function of the attitudinal scores. However, for some constructs, the slope is more or less flat, suggesting that there is little correlation present. In such cases any influence which the variables in question might have on summer persistence would exist only after the effects of other variables had been removed, or as part of an explicit interaction with one or more other variables. Those variables exhibiting a clear positive relationship are:

- f01 Commitment
- f02 Academic Integration
- f03 Social Integration
- f04 Expectations For Future
- f05 Financial Concerns
- f08 Time Constraints
- f09 Academic Self-Concept
- f10 Self-Assuredness At Matric
- f11 Extraneous Problems
- f12 Academic Effort
- f14 Family support

On the other hand, those variables exhibiting little or no relationship are:

- f06 Perspicacity At Matric
- f07 Help And Feedback
- f13 Lost Friends; Homesickness
- f15 Transfer Awareness

f16 Help Anticipated At Matric

f17 Friends Same Subject

f18 Last-minute decision

It can also be seen in Appendix 10.2 that the range of the scores for some variables is short and, for this reason, they are likely to produce relatively inefficient estimates. These are:

f06 Perspicacity At Matric

f07 Help And Feedback

f10 Self-Assuredness At Matric

f14 Family Support (but dichotomised – see above)

Simple Logistic Regression Analyses

Eighteen simple logistic regression models were fitted, all having summer persistence as the dependent variable, and using in turn each of the perceptual constructs as the explanatory variable. The results are shown in Appendix 10.5. In 16 of the models the explanatory variable was treated as continuous; for Family Support and for Last-Minute Decision binary variables were used, instead, for the reasons described above.

A model which fits the data well has a low value of $-2 \times (\log \text{likelihood})$, or $-2LL$. From Appendix 10.5 it may be seen that the model using Commitment as the independent variable has the lowest value of $-2LL$. Perceptions and opinions expressed at the time of matriculation appear to have worn off in relative terms by the following summer, as previously surmised: the highest values of $-2LL$ relate to the four models based exclusively on the matriculation questionnaire: Perspicacity at Matriculation (f06), Self-Assuredness at Matriculation (f10), Help Anticipated at Matriculation (f16) and Last-Minute Decision (f18).

The Goodness of Fit statistics shown also give a relative indication of how well each of the 18 models fit the data. Being based on the sum of the squared differences between the observed and predicted probabilities, a small value indicates a good fit, overall. It can again be seen that the models based on the matriculation questionnaire do not fit the data as well as the others.

The Cox & Snell and the Nagelkerke measures of goodness of fit are shown, but in all cases the high number of observation is distorting the values, and they are consequently of little usefulness.

The Likelihood Ratio Chi-Square is the difference between -2LL for a model containing only a constant term and a model containing also the independent variable. The hypothesis that the coefficient of the independent variable is zero may be rejected at the 5% level in the following models:

- f01 Commitment
- f02 Academic Integration
- f03 Social Integration
- f05 Financial Concerns
- f08 Time Constraints
- f09 Academic Self-Concept
- f10 Self-Assuredness at Matriculation
- f11 Extraneous Problems
- f12 Academic Effort
- f14 Family Support

On the other hand, there is not sufficient evidence to reject this hypothesis in the following models at the 5% level; it will be observed that this list includes three of the four constructs derived exclusively from the matriculation questionnaire. Of some note is the fact that Help and Feedback is also not significantly related to summer attrition rates, and this has already been remarked upon above.

- f04 Expectations for the Future
- f06 Perspicacity at Matriculation
- f07 Help and Feedback
- f13 Lost Friends & Homesickness
- f15 Transfer Awareness
- f16 Help Anticipated at Matriculation
- f17 Friends [Studying the] Same Subject
- f18 Last-Minute Decision [to come to University]

Model discrimination is illustrated in Appendix 10.5 by the percentage of Summer Persisters correctly predicted by each model. For those eleven models in which the slope coefficient is significantly (or almost significantly) different from zero, a cut value of 0.95 was used, this being the probability of persistence over the summer months for the cohort as a whole. The Commitment model yields most correct predictions (68.69%), followed by Family Support (67.17%), Academic Integration (63.90%), Academic Self-Concept (62.40%), Extraneous Problems (61.99%) and Time Constraints (60.12%). Each of these models on its own apparently has predictive power which is as least as good (or almost as good) as the models of summer persistence based on background characteristics and pre-university academic achievements described in Chapter 8. This is discussed in more detail below.

Three constructs are of slight usefulness in predicting persistence: Academic Effort (55.78%), Social Integration (54.58%), and Financial Concerns (51.59%). The model using Self-Assuredness at Matriculation achieves correct predications in only 45.16% of cases.

Whereas model discrimination can be illustrated by the percentage of cases correctly classified for a given cut value, the Hosmer & Lemeshow goodness-of-fit test can be used to examine the extent to which observed and predicted values match over the full range of relevant probability values. Statistics relating to this test of model calibration are also shown in Appendix 10.5. For each of the models examined it appears that there is no reason to reject the fitted model. For Family Support it is not possible to produce a meaningful chi-square value because the independent variable has been dichotomised. The high *p*-value for Self-Assuredness at Matriculation (.8853) may be a consequence of the high number of observations, coupled with the low number of degrees of freedom, and it would be unwise to place much weight on the Hosmer and Lemeshow test for this model.

Information is also shown in Appendix 10.5 concerning the slope coefficients in each of the eleven significant models. The slopes (betas) and the odds ratios quantify the extent to which the dependent variables are associated with each of the explanatory variables. The standard errors are also shown, but the Wald statistics and their associated levels of significance are not shown, because in the case of simple logistic regression models these are the same as the Likelihood Ratio Chi-Square test values. The *R* statistics show the correlations between the dependent and explanatory variables in each model.

It may be seen that the relationship between Commitment and summer persistence is particularly strong: the estimated odds ratio is 4.80. Academic Integration (odds ratio 2.78), Academic Self-Concept (odds ratio 2.14), and Academic Effort (odds ratio 2.05) are also very important. Family Support (odds ratio 1.84), Social Integration (odds ratio 1.63), Extraneous Problems (or, more precisely, the absence of such problems) (odds ratio 1.62) are important. Financial Concerns (odds ratio 1.48), and Time Constraints (odds ratio 1.36) are clearly relevant. Self-Assuredness at Matriculation appears to be important (odds ratio 1.65), but there may be difficulties with this model, as remarked above.

Overall, the analysis has identified a number of variables that are associated with summer persistence rates. One of these associations – for Commitment – is particularly strong, but none of them on its own is strikingly successful at predicting persistence or departure in individual cases. All 18 variables were carried forward to the subsequent multiple regression models, albeit tentatively in the case of the seven constructs in respect of which the hypothesis of a zero slope cannot be conclusively rejected.

Collinearity

The extent of the linear relationships among the 18 factors and Entry Point Score (all of them being treated as continuous for this purpose) was examined by using a standard multiple linear regression procedure to produce tolerance statistics. The results are reproduced in Appendix 10.6. Tolerance is defined as the proportion of the variability in variables that is not explained by linear relationships with other explanatory variables; if all tolerance values are close to one, then it is possible to conclude that there is little multicollinearity present among the variables. It will be seen that Entry Point Score is relatively independent, although there is a little multicollinearity present in the data set, with Commitment, Social Integration and Academic Integration, in particular, being affected.

The Pearson correlation coefficients between pairs of these 19 variables are shown in Appendix 10.7. Although these are measures of association rather than multicollinearity, they do yield useful clues that assist the understanding of the multiple regression models.

Conclusions stemming thus far from these univariate investigations are summarised in Appendix 10.8.

Multiple Logistic Regression Model Incorporating Attitudinal Variables

Multiple logistic regression was then attempted, using summer persistence as the dependent variable, and the attitudinal constructs as explanatory variables. The forward inclusion method of selecting variables for the regression equations was used. The criterion for inclusion in the model was set at $p(\text{in}) = .10$, and the criterion for subsequent removal was $p(\text{out}) = .15$. This is essentially an exploratory analysis in which the use of these relatively high statistical significance criteria can be justified on the ground that it reduces the risk of failing to discover relationships that truly exist. However, this approach is also open to the criticism that it may identify relationships which are spurious, and which are caused only by random variation in the data.

It quickly became apparent that the technique was unsatisfactory in various ways. It failed to capture some variables judged relevant on theoretical grounds or which had been found to be important by other researchers. Additionally, some variables that seem important in the simple logistic regression analyses ceased to be significant when combined with others and, for some, the beta coefficients changed dramatically. Furthermore, uncritically specifying all 18 constructs for possible inclusion in the model resulted in the inclusion of some variables which might on prior grounds have been expected to have been of much lesser relevance than some of those variables that were excluded. In short, the values and the statistical significance of certain coefficients are interdependent with the other variables present in the model at any given step in the procedure. These are the classic signs of multicollinearity. Under these circumstances it can be expected that a variety of models will fit the data equally well and be equally useful for prediction. If one's primary purpose is prediction, then it is of little consequence which model is adopted. On the other hand, one's comprehension of the processes underlying retention may be influenced to an undue extent by the choice of the variables selected mechanically for inclusion in the model by the software, and the substantive interpretation of the results may be correspondingly haphazard unless due care is exercised.

The most convincing model to emerge was obtained by discarding from the outset those variables for which the simple logistic regression models were not supported by the data:

f06 Perspicacity at matric

- f13 Lost friends; homesickness
- f15 Transfer Awareness
- f16 Help Anticipated at matric
- f17 Friends Same Subject
- f18 Last-Minute Decision

Self-assuredness at matric (f10) was also excluded from this model, on the supposition previously advanced that views expressed at the time of matriculation would carry relatively little weight by the following summer, even though the simple logistic regression model seems meaningful.

The outcome of this approach is shown in Appendix 10.9. Those variables that were included are:

f01 Commitment: This was the first variable to be included in the model as part of the stepwise procedure (Step 1), confirming that it is statistically the most significant of all the attitudinal variables in determining retention. This is an important finding, and is consistent with Tinto's model of retention and much of the empirical work that has been carried out in this field.

f03 Social Integration: This was the second variable to be included (Step 2). Quite unexpectedly, its coefficient becomes negative (-0.57) in an equation that also includes Commitment. The coefficient of Commitment increases and the standard error of each variable is also higher, by comparison to the corresponding univariate models. These phenomena, along with the correlation coefficient of 0.507 shown in Appendix 10.7, are suggestive of the presence of collinearity, despite the reassurance provided by the tolerance statistics shown in Appendix 10.6. Collinearity causes estimates to be inefficient rather than biased. One straightforward interpretation of the result is therefore that better Social Integration is actually detrimental to persistence, once Commitment is controlled. This seems consistent with the earlier suggestion that too much "clubbing" harms one's prospects of retention. The combined effects of Commitment and Social Integration on the probability of persistence, derived from Step 2 of the model, are illustrated in the form of a CHAID decision tree in Appendix 10.10.

It may be inferred that the negative impact of high Social Integration is strongest for those students having relatively low Commitment. This serves to emphasise the point that those

who are less than fully committed seem to be more susceptible to the effects of an over-active social life (or, alternatively, low Commitment can cause some students to cultivate their social lives to the exclusion of academic objectives). The CHAID diagram also allows these effects to be quantified. It also implicitly allows for an interaction term between Commitment and Social Integration, whereas the logistic regression model does not. In the particular decision tree illustrated, Social Integration significantly affects retention in the case of 274 students (10.3%) out of 2,673 sampled. Within this group, which has the lowest Commitment, it is possible to discern two quite distinct subgroups: 120 students having higher Social Integration and a dropout rate of 27.50%, and 134 with lower Social Integration and a dropout rate of 12.99%. The former group contains 33 dropouts, who make up almost a quarter of the 135 dropouts analysed. This is in itself a noteworthy discovery, and it seems important to recognise that the overall results are in large measure due to the behaviour of this rather exceptional minority of students, rather than to the traits of the student cohort as a whole.

The correlation and the change of sign alluded to above are also suggestive of the proposition that the sort of commitment being measured should (as the wording of the underlying questions indeed suggests) be interpreted as having a component that reflects a relatively short-term sense of community or, at the opposite extreme, social alienation, as well as a less transitory resolve to achieve particular academic objectives. This is relevant in the context of the causal model developed in Chapter 11.

f02 Academic Integration: The coefficient of this third core construct in Tinto's model is smaller when Commitment is controlled. There is also a moderate correlation between these two constructs (0.487). Assuming that Commitment has both a social and an academic dimension, and given its undoubted importance as a predictor of retention, this suggests that, in causal terms, summer retention might be shown as being influenced by Commitment which, in turn, is influenced both by Academic Integration and Social Integration. This, too, is a helpful, albeit tentative result, and is incorporated in the subsequent development of a fuller causal model. Apart from Academic Integration's close relationship with Commitment, it seems also that there are various suppressor effects in operation that cause Academic Integration not to become significant until Steps 9 and 10 of the model. There appears to be a relationship with Academic Self-Concept, in particular, insofar as Academic Integration's statistical significance is much improved when Academic Self-Concept is removed from the model in Step 10.

The correlation matrix in Appendix 10.7 suggests that Academic Integration is mildly associated with Expectations For The Future ($r = .447$), Help And Feedback ($r = .397$), Academic Self-Concept ($r = .495$) and, to a lesser degree, Academic Effort ($r = .319$). The manner in which these variables affect each other's influence on retention appears to be complicated, and is not easily rationalised at this stage. The fact that Academic Integration is also correlated with Commitment ($r = .487$) and Social Integration ($r = .372$) perhaps explains why it is difficult to find a model of persistence which incorporates all of these three covariates simultaneously; in practice, the model is being affected by multicollinearity.

f05 Financial Concerns: This variable enters into the model at a relatively early stage (Step 3), and both the value of its coefficient and its standard error remain relatively stable thereafter. Its presence in the model is therefore relatively convincing.

f08 Time Constraints: Restrictions on the time available for university life, imposed either by external employment or by commuting, are also a relatively stable and convincing explanatory variable in the model.

f12 Academic Effort: This appears to be a relatively stable and convincing variable.

f07 Help And Feedback: Surprisingly, the simple logistic regression model was not significant, although this construct was retained for further analysis. Although the corresponding coefficient in the multiple logistic regression model is significant, it also is negative in value. At this stage, it is difficult to rationalise this phenomenon as being anything other than a quirk of the data.

f09 Academic Self-Concept: This variable is correlated with Academic Integration, as noted above. There appears to be room in the model for one of these variables, but not both.

f04 Expectations For The Future: The simple regression model is not quite significant ($p = .055$). Its coefficient in the final step of the multiple logistic regression model is negative, which was not anticipated. This again points to the rather unsatisfactory nature of the model.

f11 Extraneous Problems: Although the simple logistic regression equation is significant, this variable was excluded from the model at all times in the stepwise procedure. The inclusion of Time Constraints (Step 4), in particular, causes the significance of Extraneous Problems to decrease.

f14 Family Support: Having been dichotomised, this produced a highly significant simple logistic regression model. It was therefore retained for further analysis. This variable is potentially highly significant, as evidenced by the score test in the null model (Step 0). However, as soon as Commitment is entered into the regression equation (Step 1), it ceases to be significant.

The predictive accuracy of the model described above is good, with 73.08%, 73.39%, 73.66% and 74.53% of cases correctly classified at Steps 4, 5, 6 and 10, respectively.

Given the results of the CHAID analysis described above, the model was run again to include an interaction between Commitment and Social Integration. However, this term was not significant when forced into the equation.

The first conclusion from this analysis is that the data available are such that it is not possible to produce a comprehensive and dependable model of retention using all or almost all of the attitudinal constructs derived from them in a multiple logistic regression equation. It appears that the relationship between at least some of the explanatory variables is multiplicative or interactive, rather than additive. The results seem convincing only up to Step 5 (at best) of the stepwise procedure. Thereafter, some of the coefficients cease to be significant at the 5% level, and some have negative values where positive values would have been expected. Quite apart from these statistical difficulties, there is no prior body of knowledge that might have made it possible to anticipate the inclusion of particular variables in the final version of the equation. Those variables actually chosen seem to form a rather incoherent group. Under these circumstances, the stepwise procedure amounts to no more than what McKeown, Macdonell, and Bowman (1993) would describe as a strategy of “wandering variable selection”. Its usefulness as a guide to the causes of student attrition is therefore somewhat limited.

On the other hand, the model has good predictive power, being superior to that of the models based only on students’ background characteristics and pre-entry academic

qualifications. (Previously the best models of summer persistence were correct in about 65% of cases, at best.)

Multiple Logistic Regression Model Incorporating Attitudinal and Background Variables

In earlier chapters multiple logistic regression models were developed for Summer Leavers and for all leavers incorporating various different combinations of background characteristics and pre-entry academic qualifications. Given the rather disappointing results achieved with the attitudinal variables described above, it was decided to adopt a cautious approach when combining the two sets of variables in a hybrid model of summer persistence. Only those main effects in Model Four described in Chapter 8 were included, along with only those eleven attitudinal variables that had been included at some stage in the stepwise procedure described above. Again, a forward stepwise procedure was adopted, using $p(\text{in}) = .10$ and $p(\text{out}) = .15$. The results of this calculation are shown in Appendix 10.11.

It may be seen from Appendix 10.11 that Commitment continues to exert a very strong influence on summer retention. In Step 2 the odds ratio is 4.75, but this increases to 7.12 in Step 3, when Social Integration is introduced into the equation.

Entry Point Score also remains very important; its estimated odds ratio (1.05 or 1.06 for one point) is similar to those obtained in the earlier models described in Chapters 5 and 8.

Social Integration continues to have a negative impact on retention (odds ratio varying between -0.76 and -0.86) for a given level of Commitment and Entry Point Score, and there appears to be some form of interaction, albeit not significant, with Commitment.

The fact that both Academic Effort (odds ratio either 1.51 or 1.53) and Time Constraints (odds ratio = 1.25) appear in this model provides evidence that Astin's concept of "time-on-task" (1984, p. 298) is relevant. Strong Social Integration might then be conceptualised as detracting from "time-on-task", so that it could be argued that these three variables all represent different aspects of the same phenomenon, which might be said to be more behavioural than perceptual. Put simply, the model demonstrates that time spent studying is rewarded.

Younger students (aged below 19.5 years on entry) appear to have a significantly better chance of persistence than their older counterparts (odds ratio varying between 2.81 and 3.13). This is consistent with the results described in earlier chapters. There are now a few hints as to why age is such an important variable: it perhaps acts as a surrogate for one or more of the variables included in the previous model but which are excluded from this one, such as Academic Integration, Academic Self-Concept, Help and Feedback, and Financial Concerns. This would be broadly consistent with the focus group outcomes reported in Chapter 6.

Faculty Category also appears in the seventh and final step of the new model. The persistence rate for the General Faculty Category remains significantly higher than that for the Other Faculty Category (odds ratio = 2.07), although the persistence rate for the Professional Faculty Category is no longer significantly different. It can be seen from Steps 0, 1, and 2 that once Commitment and Entry Point Score, in particular, have entered the equation, the score for Professional Faculty Category is greatly reduced. It may be inferred that students in the Professional Faculty Category have markedly high Commitment and Entry Point Scores. Presumably, however, the same cannot be said of students in the General Faculty Category, since otherwise the Faculty Category variable would not have been included in the equation. It then becomes a matter of speculation as to why it was included. Again, issues of Academic Integration, Academic Self-Concept, Help and Feedback, and Financial Concerns may be relevant. Alternatively, the differences between the General and the Other Faculty Categories may be attributable to the academic environment rather than to the students, themselves. Because of this uncertainty, the results at Step 6 of the procedure may be preferred to those at Step 7.

Residential Category and Entry Qualification Route were not selected for inclusion in the equation, even though the latter, at least, was found to be statistically significant for Summer Leavers in Chapter 8.

Step 6 of the new model is by a slight margin the best of the predictive models to be discussed, with 75.84% of all students correctly classified, using the usual cut value of 0.95. This is a good outcome. The equation also seems reasonably convincing as an explanatory model. Commitment is demonstrated to be a powerful determinant of retention. Prior academic achievements are also important. Although the analysis does not in itself demonstrate why this is so, it is easy (and very common) to argue that academic ability, as measured by school examinations, is associated with subsequent academic

performance, in particular, at university. Academic Effort, Time Constraints and excessive Social Integration can be interpreted as mutually confirmatory manifestations of the importance of time spent studying. The effect of Age Category has to be regarded as a more empirical artefact, however; the analysis offered thus far can say little as to why this variable is important. Evidence can be adduced from the literature to explain why older students are less likely to persist (Chapter 2: Lenning, 1982, for example). The omission from the equation of variables such as Academic Integration, Academic Self-Concept, Help and Feedback, and Financial Concerns has already been alluded to. The unusually low cut value (19.5 years on entry) used for the purposes of this study points to the possibility that taking a break from the full-time education process after school may be detrimental.

In order to ascertain the relative importance of the different variables, the stepwise procedure was rerun to incorporate standardised versions of the continuous variables. The variables selected for inclusion, and the sequence of their introduction into the logistic regression equation was the same as for the non-standardised model. In Step 6 Age Category, which is the sole categorical variable in this model, exerts the greatest influence on the odds ratio (2.99). The confidence interval for this estimate is quite wide, though (from 1.61 to 5.57). A difference of one standard deviation in Commitment alters the odds ratio by a factor of 2.65. The standard deviation of the Entry Point Score variable is 7.6 points for the sample under consideration, and this changes the odds ratio by a comparatively small factor of 1.49. The other variables have lesser influence, but are important, nonetheless: Academic Effort: 1.34; Time Constraints: 1.32; and Social Integration: 0.60.

This model has the merit of parsimony. However, the sign of the coefficient for Social Integration is unexpected. It is also unfortunate that the variable having the strongest effect on retention (Age Category) is the most difficult to rationalise. It was considered that it would not be productive to extend Models Five and Six from Chapters 5 and 8 to include attitudinal variables. Conclusions such as those above concerning the mechanisms by which Entry Point Score and other entry characteristics combine with students' attitudes and perceptions to affect summer persistence rates could be advanced with more conviction if these mechanisms were more fully explored. In particular, it was felt that it would be of interest to examine the temporal dimension of these phenomena. It was

therefore decided to proceed in a manner more conventional in the literature on student retention to develop a causal model of attrition, and this is done in the following chapter.

Chapter 11 – Structural Equation Models

In this chapter structural equation modelling is used to develop and test some more sophisticated models of summer retention. Structural equation modelling is a useful technique capable of representing large numbers of associations found in complex data sets, such as the one under consideration in this study. The relationships among the latent variables may be conceptualised as a series of multiple regressions overlapping in their independent and dependent variables. This allows the researcher to structure and empirically validate linkages among the variables according to theory and causal logic, leading to a clearer understanding of the network of forces in operation. In addition, because variables are arranged in such a way as to be dependent on some constructs while at the same time explaining others, it is possible to assess the overall importance of each variable in the model as a whole as well as determining its local effects. For example, it is of interest in this study to examine not just the direct effect of family support on self-confidence, but also its indirect effects on other variables in the models. The technique used also allows multiple indicators of each latent variable to be used. The models demonstrated make allowance for measurement error in the observed variables, and this permits the relationships between the latent variables to be modelled without being masked by these errors.

Structural equation modelling has become one of the most common statistical techniques used in the USA for quantitative studies of student attrition. It owes its popularity at least in part to its ability to analyse complex series of interactions occurring over a period of time. Typically students' background characteristics are treated as exogenous variables, and various attitudinal constructs are taken as endogenous. Persistence may then be taken as the end point in the causal structure, depending on the precise nature of the investigation. Bean's articles on the Work Turnover Model of Student Attrition (1980, 1982a, 1983) provide early examples of causal models. At about the same time, Pascarella and Terenzini (1983) published the first major attempt to validate Tinto's Student Integration Models using path analysis. Other contributions using path analytic techniques have included those of Pascarella, Smart, and Ethington (1986), Stage (1989b), Braxton and Brier (1989), Braxton, Vesper, and Hossler (1995), Hurtado and Carter (1997), Berger (1997), Berger and Braxton (1998), and Braxton, Milem, and Sullivan (2000). The approaches taken have become increasingly sophisticated as new techniques and the enabling software have become available. For example, the use of PRELIS software in

conjunction with LISREL has much improved the analysis of dichotomous and ordinal data, as evidenced, for example, in the work of Cabrera, Nora, and Castañeda (1992, 1993) and Allen (1999).

The approach described in this chapter is more flexible than those previously used in this study. By choice, each observed variable is used in Chapter 9 as an indicator of only one of the constructs derived from the principal components analysis. Algebraically, it is possible when using structural equation modelling to relax this assumption by allowing individual items to be associated with more than one latent variable, and this possibility is explored in some detail in this chapter. Factor scores have hitherto been obtained using the simple average scores of the relevant observed variables; in structural equation modelling each observed variable is expressed as a distinct linear function of the relevant latent variable (or variables), and the slope coefficients, their statistical significance and the goodness of fit (usually interpreted as the reliability of the observed variable) are available separately for each observed variable in the system. Structural equation modelling makes it possible also to allow for correlations in the errors associated with the different variables, where appropriate, and this also is explored in this chapter. The assumption that the logit of persistence can be expressed as the sum of the various attitudinal constructs was found in Chapter 10 to be difficult to substantiate. In this chapter a linear structure replaces the logistic model, and summer persistence is postulated to depend on the sum of various direct and indirect linear associations with other constructs in the system.

LISREL software was used for the analysis, mainly because of its superior handling of ordinal data and, in particular, the ability of its pre-processor software, PRELIS, to compute an asymptotic correlation matrix and thereby to use a relatively distribution-free method of estimation, as described below. The approach taken was essentially the same as that taken by Cabrera, Nora, and Castañeda (1992, 1993) and Allen (1999).

Model Specification – A Tentative Causal Model Based on the Anti-Image Correlation Matrix

The loose causal framework shown in Appendix 6.9 presages the structural equation models developed in this chapter.

In practice, an anti-image correlation matrix, readily available for diagnostic purposes when conducting factor analysis, was used as the starting point for the formulation of a causal model, which could then be estimated and tested using structural equation modelling. The matrix used for this application is reproduced in Appendix 11.1. The off-diagonal elements represent the negative of the values of the partial correlation coefficients between particular pairs of variables, holding constant all other variables represented in the matrix. The diagonal elements are interpreted as measures of sampling adequacy, but these are not relevant here.

All of the 18 attitudinal constructs identified in Chapter 9 were included, as well as indicator variables for Gender, Age Category, Social Group, Residential Category, Entry Qualification Route, Faculty Category, and Summer Persistence. (Indicator variables were used for two of the three Faculty Categories; to have included all three would have rendered the matrix non-positive-definite and, consequently, not capable of computation.) Having been originally based on a Varimax rotation of principal components, the correlations among the 18 attitudinal variables are generally low. The inclusion of extra variables in the matrix will, in any event, almost inevitably have the effect of reducing the value of any given partial correlation coefficient. Those partial correlations considered to be of particular relevance are shown in boxes in the table. They are all statistically significant.

In essence, the approach taken was to hypothesise the existence of paths where the partial correlations are relatively high (although none of them are, in fact, particularly strong) while at the same time allowing for the fact that there is a temporal dimension to at least some aspects of the model. The advantage of this approach is that not only does the anti-image correlation matrix identify those variables that are likely to be related to one another, having controlled for all other variables in the system, but at the same time it reduces the possibility of the existence of other paths, apart from those that might exist in the context of structures that encompass only relatively small subsets of the variables.

It has already been observed in Chapter 9 that some but not all of the variables are those used by Tinto and others who have elaborated upon his theory, so the content of the putative model and the causal paths within it begin either to refute or to lend support to various aspects of work already carried out by others. This matter is analysed in more detail in the final chapter. Using constructs that have already been demonstrated to be relevant to retention helps considerably when it comes to assessing the fit of the models.

As noted by Bollen and Long (1993, p. 6), “ ... the best guide to assessing model fit is strong substantive theory ... structural equation modeling without the benefit of substantive expertise is a hazardous business”. However, the arguments concerning cause and effect developed below are by necessity derived more from an intuitive interpretation of the data rather than any strong substantive theory.

The data suggest that Family Support may be taken as the starting point in the causal chain shown in Appendix 11.4.1. This choice may also be justified on the basis of the work of Nora and Cabrera (1996), for example. It is also argued here that Family Support is relatively stable over a period of time. A supportive family background is conducive to Self-Assuredness, which is also presumed to be a relatively enduring personal characteristic. One particular manifestation is in Last-Minute Decision-making: those who are more resolute and self-assured are less likely to make their decision to come to University at the last minute. However, it is argued that last-minute decision-making does not in itself have either positive or negative consequences in this context. In other words, it is simply a dead end, in causal terms. On the other hand, those who are self-assured will tend to take the trouble to find out about their intended academic career and, having decided upon it, be more committed to its attainment. There are therefore paths leading from Self-Assuredness at Matriculation both to Perspicacity at Matriculation and to Commitment.

The path leading from Perspicacity at Matriculation to Help Anticipated at Matriculation is again a dead end; levels of help anticipated are interpreted as simply one manifestation of a more general awareness of what university life will be like. Those who arrive at university with their eyes open are more likely to work hard, and this explains the path from Perspicacity at Matriculation to Academic Effort. Such perspicacity also has a longer-term dimension: there is also a path from Perspicacity at Matriculation to Expectations for the Future. Again, such expectations might be interpreted as being simply one dimension of that general perceptiveness. Interestingly, Expectations for the Future seem to be significantly bleaker for those students in the General Faculty Category and so this, too, is shown in the diagram.

Entry Point Score appears not to occupy a crucial role in this model. Its main influence is, in fact, on Academic Self-Concept. Not surprisingly, having a high Entry Point Score is associated with entry into the Professional Faculty Category, but the latter variable appears not to play an important part in this model.

Academic Self-Concept is shown as being influenced not just by Entry Point Score, but also Academic Effort and Help and Feedback. Thus working hard engenders a feeling of self-satisfaction with one's academic endeavours, as does the feeling of having sufficient Help and Feedback. (The direction of causality is discussed in greater detail in the context of the path analysis results described below.)

Academic Integration is then shown as being affected by Expectations for the Future, on the assumption that those who can foresee the possibility of a good job after graduation will feel a greater affinity with their academic studies. It is also suggested that Help and Feedback and Academic Self-Concept have similarly positive effects on Academic Integration.

Extraneous Problems and Residential Category (illustrated as the 'University Accommodation' indicator) are both treated as exogenous variables in the model. They are correlated with various other variables in such a way that it is more difficult to form a view concerning the direction of causation for some of the paths. The Loss of Friends & Homesickness are no doubt strongly influenced by living away from one's own home. It also seems plausible that living in University accommodation should have a positive impact on Social Integration and Time Constraints (reverse-scored). It is perhaps also not surprising that it has a negative association with Friends [Studying the] Same Subject; shared accommodation appears to act as a stronger integrating force than the classroom, although this, too, seems to be another *cul de sac* in causal terms. Living in University accommodation seems also to have a negative association with Financial Concerns (again, reverse-scored, so those in University accommodation express greater worries). This may be because home-based students find it easier to secure paid work than those living in the Glasgow area only during term time. It might also be due to the greater cost to those in University accommodation of financing their day-to-day living expenses on top of their already expensive housing. In causal terms, it seems more plausible to suppose that University accommodation is the driving force rather than Financial Concerns. Why Extraneous Problems should be associated with Financial Concerns is less obvious, and it seems probable that this is simply an association rather than a causation; perceived problems with accommodation and one's health, for example, perhaps go hand-in-hand with financial worries, although the principal components analysis suggests that the two constructs are, nevertheless, quite distinct. There is similarly some doubt concerning the relationship between Financial Concerns and Help & Feedback; again, it is not apparent

which of these two constructs represents cause and which is effect. This may be evidence of some form of negative affectivity (Watson and Pennebaker, 1989); those individuals concerned about one of these various issues may be predisposed also to have negative feelings about the others.

The Loss of Friends & Homesickness is associated mainly with students living in University accommodation, but it appears also that such feelings can be alleviated by Social Integration in one's new environment. Extraneous problems appear to affect Social Integration most acutely, rather than any of the academic-related constructs, which is a potentially important observation, and which is picked up again later.

Commitment appears to be most clearly associated with four variables: Social Integration, Academic Integration, Academic Self-Concept, and Self-Assuredness at Matriculation. This latter construct seems on this analysis to be more enduring than was previously supposed.

Finally, Summer Retention seems to be most closely associated with Commitment.

Having first developed this model which includes all of the variables in the anti-image correlation matrix having associations (albeit modest) with at least one other variable, it is then possible to simplify the path diagram by removing redundant variables. The result is shown in Appendix 11.4.2.

It has already been suggested that Last-Minute Decision, Help Anticipated at Matriculation, and Friends Same Subject are no more than the consequences of other, more powerful effects present in the causal system and have, for this reason, been excluded.

A contrast may be drawn between the roles of the General Faculties Category indicator and the Professional Faculties Category indicator, as shown in the initial postulated path model (Appendix 11.4.1). A high Entry Point Score is a prerequisite for entry into the Professional Faculties Category but, otherwise, the effects of being a student in one of the Professional Faculties appears to have been partialled out by the other variables in the system. On the other hand, students in the General Faculties appear to have relatively poor Expectations for the Future, even after having made allowance for other variables. It therefore seems appropriate to drop the Professional Faculties Category indicator from the model, but to retain the General Faculties Category indicator as an exogenous variable.

Whereas it seems reasonable to suppose that Time Constraints are affected by living in University accommodation, it seems more difficult to argue that their relationship with Extraneous Problems is anything more than a straightforward association rather than a causation. For this reason Time Constraints are excluded from the main causal model. Loss of Friends & Homesickness appear to be both caused (directly) and cured (indirectly, through Social Integration) by living in University accommodation. As such, this construct may be excluded from the model. If it had an appreciable effect on other, more pivotal variables in the system, such as Academic Self-Concept, then it would be appropriate to revise this assertion. Roughly the same line of reasoning applies to Financial Concerns. Were Financial Concerns to have a direct impact on any of the key attitudinal constructs, there would be reason to believe that they are a significant motivating force for the cohort as a whole. However, this appears not to be the case: Financial Concerns are affected by living in University accommodation, but seem to be associated only with Extraneous Problems and views concerning Help and Feedback. There is therefore no convincing line of causation leading from Financial Concerns to Summer Persistence, taking into account the experience of the cohort as a whole. Financial Concerns were therefore excluded from the main models, although this issue is explored in more detail in a subsequent, subsidiary analysis at the end of this chapter.

In summary, the variables thus removed are: Last-Minute Decision; Help Anticipated at Matriculation; Professional Faculty Category indicator; Time Constraints; Financial Concerns; Loss of Friends & Homesickness; and Friends Same Subject. The resultant path model (Appendix 11.4.2) is then the first to be estimated using structural equation modelling.

Preliminary Data Screening

Three issues were considered before proceeding to the estimation stage of the modelling process: missing values, outliers and the distributional assumptions.

Missing Values

It was decided for the sake of simplicity to continue to replace missing values with average response values, as described in Chapter 7. The cost of this approach by comparison to the

alternatives is likely to be a small reduction in the variance of the response values, making them marginally less efficient as predictors of other variables, such as retention.

Filling in missing values rather than simply dropping the relevant cases allowed a total of 2,471 cases to be analysed. In essence, these are the traditional entrants analysed in Chapter 5, excluding the Pre-Summer Leavers described in Chapter 8.

Outliers

Of the original 78 questionnaire items, 65 were initially considered to be of potential relevance to the structural equations. Finding outliers in such a complex data set is clearly not straightforward. For example, the use of unidimensional stem-and-leaf plots, which is a common approach, would not yield useful results, at least when analysing responses to particular questionnaire items.

An alternative, suggested by Bollen (1989), is to construct an $N \times p$ matrix, Z , which contains all of the observed variables expressed as deviations from their means. In this example, N = number of observations = 2,471, and p = number of observed variables = 65, if one is simply to consider outliers amongst the questionnaire responses without subdividing respondents according to their background characteristics, such as gender and residence.

One then computes an $N \times N$ matrix, A , where

$$A = Z (Z' Z)^{-1} Z'.$$

A typical element of the main diagonal of A may be referred to as a_{ii} . It gives the distance of the i th case from the means of all of the variables. It has a range of between zero and one, such that the closer to one the more distant it is, while the closer to zero it is, the nearer is the case to the means. The trace of A is equal to p , the number of observed variables. This implies that the average value of a_{ii} is simply p/N , or 0.0263 in this example, and each a_{ii} can be compared to this average value as a method of judging its relative distance from the means. One can also look at the univariate distribution of a_{ii} in order to form a view concerning which values are substantially different from the others and, in this context, a stem-and-leaf plot would be informative.

Clearly, the computation of the 2,471 elements of the main diagonal of A is non-trivial and it was not attempted. It therefore remains an open question as to what the distribution of a_{ii} actually looks like. It seems likely, though, that discarding outliers using this method would amount to no more than excluding from the sample those students holding either universally positive or universally negative perceptions, and there is no *a priori* reason for doing this. Failure to remove outliers, thus defined, is unlikely to detract from validity of the results.

Distributional Assumptions

Jöreskog and Sörbom (1993, p. xxv) point out that:

“the essential statistical assumption of LISREL analysis is that random quantities within the model are distributed in a form belonging to the family of elliptical distributions, the most prominent member of which is the multivariate normal distribution. In applications where it is reasonable to assume multivariate normality, the maximum likelihood method of estimating unknowns in the model is justified and usually preferred. Where the requirements of maximum likelihood estimation are not met, as when the data are ordinal rather than measured, the various least squares estimation methods are available.”

The latter are generally large-sample estimation procedures, and it is fortunate that in this study the number of observations is sufficiently large as to make this approach possible.

Jöreskog and Sörbom suggest that where the observed data are collected through the use of Likert scales on a questionnaire, as in this study, it is appropriate to treat the ordinal responses as measures of an underlying continuous variable. This underlying variable is commonly assumed to have a standard normal distribution, and it is assumed that the threshold values of this distribution represented by the observed, ordinal variable then have an inverse normal distribution. They recommend that, where the observed variables are either all ordinal or are of mixed, ordinal and continuous types, the use of ordinary product-moment correlations based on the raw scores should not be used. They recommend instead that the estimated polychoric and polyserial correlations should be computed and then analysed using a weighted method. The weights used in the estimation procedure are obtained from a matrix that is the inverse of the estimated asymptotic correlation matrix of the polychoric and polyserial correlations. Asymptotic correlation matrices can be produced by PRELIS using arbitrary non-normal distributions (Browne, 1982; 1984). This approach permits the use of a weighted least squares estimation

procedure that uses continuous variables that need satisfy only relatively mild distributional assumptions (Jöreskog and Sörbom, 1996-2001). Following Jöreskog and Sörbom’s advice, an asymptotic correlation matrix was created, using a combination of questionnaire responses, the Entry Point Scores and various dichotomised variables to represent student characteristics, such as Faculty Category Group, Residential Category and Summer Persistence.

The use of an asymptotic correlation matrix rather than the raw questionnaire responses appears to be beneficial in this particular application in at least one respect. The effect of using the asymptotic correlation matrix may be demonstrated by comparing the correlation matrices of those items relevant to the Academic Integration construct, as originally described in Chapter 6. The correlation matrix calculated from the raw data is shown in Table 11.1. The equivalent correlation matrix derived by LISREL from the asymptotic covariance matrix is shown in Table 11.2. It will be seen that the coefficients in Table 11.2 are generally somewhat higher than the equivalent figures in Table 11.1.

	OQ12 RSBJ	OQ23P REP	OQ24 CBIG	OQ34 BORE	OQ37 EXPN	OQ49 PKNO	OQ50 PDIF	OQ51 MORE
OQ12RSBJ	1							
OQ23PREP	0.215	1						
OQ24CBIG	0.220	0.196	1					
OQ34BORE	0.541	0.229	0.204	1				
OQ37EXPN	0.414	0.220	0.178	0.470	1			
OQ49PKNO	0.317	0.233	0.204	0.314	0.305	1		
OQ50PDIF	0.272	0.310	0.210	0.240	0.247	0.465	1	
OQ51MORE	0.433	0.286	0.241	0.371	0.350	0.516	0.458	1

Key:

OQ12RSBJ	I made the right choice of subjects to study
OQ23PREP	Nothing I’d done before prepared me properly for university life
OQ24CBIG	My classes are too big
OQ34BORE	Most of the content of my subjects doesn’t interest me
OQ37EXPN	The subject content of my studies is meeting my original expectations
OQ49PKNO	Before I decided to come to University, I did not know what the subject content of my course would be
OQ50PDIF	Before I decided to come to University, I did not know how difficult my course would be
OQ51MORE	I should have found out more about my course before deciding to come to university

Table 11.1 Academic Integration - Correlation Matrix

	OQ12 RSBJ	OQ23P REP	OQ24 CBIG	OQ34 BORE	OQ37 EXPN	OQ49 PKNO	OQ50 PDIF	OQ51 MORE
OQ12RSBJ	1							
OQ23PREP	0.237	1						
OQ24CBIG	0.263	0.220	1					
OQ34BORE	0.610	0.253	0.239	1				
OQ37EXPN	0.477	0.245	0.208	0.535	1			
OQ49PKNO	0.372	0.251	0.232	0.362	0.348	1		
OQ50PDIF	0.319	0.356	0.232	0.284	0.284	0.533	1	
OQ51MORE	0.493	0.315	0.273	0.424	0.399	0.579	0.525	1

Table 11.2 LISREL - Correlation Matrix Derived from Asymptotic Covariance Matrix of Correlations

One difficulty that is perhaps not fully resolved by this approach, however, stems from the fact that the responses to many of the questions are skewed, as may be seen from Appendix 7.7 and Appendix 10.1. This might have been addressed by transforming the data, perhaps using a log transformation, for example, but, given the considerable extra effort that would have been entailed in establishing the most appropriate transformation to be used for each variable, this particular line of thought was not pursued. In extreme situations, there will in any case be no remedy available if all (or almost all) respondents have selected the same response to a particular question. It is to be assumed that using a weighted least squares method of estimation (as recommended) rather than a maximum likelihood technique, for example, will be more effective in dealing with less than ideally distributed data, but the differences between these two different approaches were not explored. One implication is, however, that less reliance can be placed on parametrically based tests of goodness of fit than might otherwise have been the case.

The full correlation matrix of the raw observations are shown in Appendix 11.2.1; equivalent correlations derived from the asymptotic covariance matrix are shown in Appendix 11.2.2.

Measurement Equations

The measurement equations owe their genesis primarily to the principal components analysis described in Chapter 9. Two alternative approaches were adopted in relation to the measurement models, as part of a strategy to demonstrate the robustness of the proposed structural equation models as a whole.

On the one hand each of the observed variables was constrained in such a way as to load on only one latent variable. The rationale for doing this is to ensure that the structural equations are the only representation of the associations between the different constructs within the system. On the other hand, relaxing this position acknowledges that particular items may, indeed, load on more than one of the factors derived from survey instruments that may be less than perfect in terms of their discriminant validity. The overall goodness of fit of the models is demonstrated in this application to be improved when this second strategy is adopted. A further effect is generally to reduce the value of the path coefficients in the corresponding structural equations. This trade-off between the overall fit of a model and the values of R^2 for particular structural equations within it is also exemplified in the two sets of models developed here.

The development of the measurement models was conducted on a largely iterative basis, guided (but not dictated) by LISREL's modification indices, and resulted in two sets of measurement equations that were subsequently incorporated in the various different path models described below. The coefficients and test statistics relating to each of these equations vary slightly according to the structure of the overall models of which they form a part. Two typical series of measurement equations are shown in Appendices 11.5.1 and 11.5.2. For convenience, the full wording of the original questionnaire item is shown above each of the measurement equations. The slope coefficients are all significant – often strongly so. The value of R^2 (being the square of the slope) can in some cases be rather unexceptional, suggesting that the observed variables are only modestly reliable, and that possibly other, non-random effects are present. It will be observed that for some equations the standard errors and t -values for the coefficients are missing. This is a consequence of the scaling of the endogenous latent variables performed automatically by the software, and which is described in more detail in the Addendum at the end of this chapter.

Appendix 11.3.1 shows which of the questionnaire items load on the different latent variables used in all of the structural equation models developed under what might be described as the relatively 'relaxed' assumption that it is permissible to allow items to load on more than one factor where the loadings are justified both substantively and statistically. The values shown are the loadings obtained from the 'relaxed' version of Model C (incorporating error covariances) described below. This appendix also shows for comparative purposes the equivalent mappings between observed and latent variables derived previously from the principal components analysis described in Chapter 9. It can

be seen that altogether seven items were allowed to load on more than one factor in the structural equation models, while six others were dropped altogether in the interests of goodness of fit. Two other items appear now to load more appropriately on factors other than those identified in the principal components analysis. In summary the two analyses produce similar but not identical outcomes.

Appendix 11.3.1 also shows at the top of the relevant columns Cronbach's alpha statistics for each of the new measurement models, as well as the percentage of the total variation explained by the first principal component. It can be seen that the measures of reliability are broadly satisfactory, being based on the average inter-item correlation. However, the first principal components tend to account for only modest percentages of the total variance in some of the models, implying that it is not always possible to obtain a single linear combination of the observed variables that explains a particularly high percentage of overall variation. This implies that the goodness of fit of some of the measurement models is rather mediocre and, even though the fit of the other measurement models is good, the overall fit of the complete system may not be wholly satisfactory. However, it should be borne in mind that these summary statistics are based on the raw data, rather than the asymptotic correlation matrix, so these remarks should not be taken as conclusive.

Appendix 11.3.2 again uses the outcome of the earlier principal components analysis as the baseline, but this time also shows mappings for items that are constrained to load uniquely on the different latent variables in all of the so-called 'constrained' structural equation models, each of which corresponds to one of the 'relaxed' models. The values shown are the coefficients in the measurement equations that make up the 'constrained' version of Model C (incorporating error covariances) discussed below. It will be seen that the same general comments apply to the 'constrained' models as to the 'relaxed' models: their measurement equations resemble closely the outcome of the original principal components analysis, although the mappings between indicator and latent variables are again not quite identical. Again, the alpha statistics appear broadly satisfactory, but the percentage of total variation explained by the first principal component seems low in some of the measurement models.

By comparing Appendices 11.3.1 and 11.3.2 it is possible also to detect minor differences between the 'relaxed' and the 'constrained' path models. By definition, those items that load on more than one latent variable in the 'relaxed' models only load on one latent variable in the 'constrained' models. Apart from this, item oq23 ("Nothing I'd done before

prepared me properly for university life”) and oq40 (“My family responsibilities limit the amount of effort I can put into my studies”) were removed in order to improve the fit of the ‘constrained’ models; on the other hand, mq01 (“I’ve really enjoyed my experience of university so far”) was retained as an indicator variable for Self-Assuredness at Matriculation only in the ‘constrained’ models. It will be seen that the measurement equations underlying the ‘constrained’ models resemble more closely the original principal components analysis than do the ‘relaxed’ models.

Overall, it appears that these further analyses bear out the conclusions of the earlier principal components analysis. The same underlying constructs emerge, using more or less the same indicator variables. The analysis is now more precise, insofar as different weights are placed on different observed variables, and in the ‘relaxed’ models some observed variables now load in a plausible manner on more than one latent variable. The relationships between the latent variables can subsequently be analysed without being obscured by measurement errors in the observed variables, as remarked above.

The four variables in the system that are not derived from the questionnaires are represented in the structural equation models by latent variables. These are Summer Persistence, Living in University Accommodation, the General Faculties Category and Entry Point Score (capped). The relationships with the corresponding observed variables are established using the following LISREL code:

```
SMR_PERS = PERSIST
UNI_ACC = RES_CAT
FAC_GEN = GEN_FACS
EPS = SCORE
```

In each case the left-hand, observed variable is being declared as a function of the right-hand, latent variable. SMR_PERS, UNI_ACC, and FAC_GEN are all (0, 1) variables, where 1 represents a summer persister, a student living in University-controlled accommodation, and a student in the General Faculties Category, respectively. EPS is the standardised equivalent of the capped Entry Point Score, as introduced in Chapter 5. In each case, the error variance of the observed variable was set to zero. This has the effect of forcing the latent variables to assume the same values as the corresponding observed variables, and R^2 for each of the corresponding measurement equations is 1.00, by definition.

Error Covariances

Brief reference was made above to LISREL's so-called modification indices. In effect, these constitute a series of hints as to how the fit of a model may be improved through the introduction of new paths or error covariances. The estimated value of each suggested new parameter is given, along with an indication of the extent by which the fit of the model, as measured by the reduction in the value of chi-square, would be improved by its inclusion. These indices were used as an aid to the construction of both the individual measurement models and the full structural system. In both of these model-generating processes the crucial point is that the new parameters should be capable of substantive justification; statistical significance on its own is not sufficient. For example, selectively relaxing the assumption that the measurement errors are independent may be legitimate where the error term in a particular measurement equation represents variability in the observed variable that is attributable in part to the influence of an extraneous variable that similarly affects other observed variables. This may be the case where such additional influences are not of any immediate interest, and which are therefore not being modelled explicitly in the structural equation system.

This process of 'specification search' has been criticised (MacCallum, Roznowski, and Necowitz, 1992, for example) on the grounds that it capitalises on the idiosyncrasies of particular data sets, so that replication across repeated samples may not be achievable, and the results may not be capable of generalisation to a wider population. A data-driven approach may be justified in exploratory research, but final conclusions should depend only minimally on parameters entered into a model specifically to improve its goodness of fit.

Bearing this in mind, two sets of error covariances in the measurement equations were developed for use, with minor adjustments, in all of the path models fitted, other than those from which they were explicitly excluded. One set of error covariances was used for the 'constrained' models; the other was used for the 'relaxed' models. The error covariances are therefore the second feature that distinguishes the 'constrained' models from the 'relaxed' models, the first being in the measurement equations, as described above. Examples of the error covariances used are listed for the 'relaxed' and for the 'constrained' models in Appendices 11.6.1 and 11.6.2, respectively. It will be seen that all of the error covariances are statistically significant.

Rather than inserting into the models all of the error covariances suggested by the software, various criteria were applied, so that there is some consistent rationale for their inclusion. Suggested error covariances were considered for inclusion only where the estimated reduction in chi-square was high, and where the estimated values of the new parameters was relatively large (at least 0.05), in order to screen out trivial and potentially non-significant new parameters. In addition, at least one of the following criteria was also always applied:

- The items concerned are consecutive, or nearly so, in the online questionnaire, on the grounds that respondents will tend naturally to tick the response directly below or close to the one they have just selected (applied both to the ‘relaxed’ models and to the ‘constrained’ models);
- The items are both in the matriculation questionnaire, justified because this constitutes a relatively homogeneous subset of responses within the total data set, having been administered in a different fashion and at a different time from the main online questionnaire (applied both to the ‘relaxed’ models and to the ‘constrained’ models);
- The items constitute pairs of identically worded or very similarly worded items in the matriculation questionnaire on the one hand and the online questionnaire on the other (applied by default in the ‘relaxed’ models, but only in the ‘constrained’ models where the two items load on different constructs);
- The items are worded in such a way that it is reasonable to suppose that the measurement errors could be correlated. Even though they do not form part of the same construct, it is plausible to suppose, for example, that the following pairs of responses could be related:

(	OQ40FAML	My family responsibilities limit the amount of effort I can put
(		into my studies
(	OQ59STIM	The average weekly amount of time that I spend during term on
(		study outside lectures, tutorials, labs, etc. is:
(	OQ05ACAD	I’m confident that I’m doing well academically
(	OQ22FEED	I have not received enough feedback about my academic
		progress
(	MQ11STDY	I feel confident that I shall be able to study effectively
(	OQ17DSTU	I have been having difficulties with my studies

In the first of these pairs of items, the common factor is time; the second and third pairs have in common a sense of general academic well-being. This idea can be extended to

encompass negative or positive affectivity generally, although the survey instruments were not designed specifically to measure these scales. Other putative constructs of a general nature used in this context included the fulfilment of previous expectations, and evidence of respondents being motivated by a noticeably focused and instrumental approach to being at university. (These considerations were applied by default in the ‘relaxed’ models, but only in the ‘constrained’ models where pairs of relevant items load on different constructs.)

- The items are indicator variables for the same construct, because measurement error in one item could conceivably be associated, for whatever reasons, with error measurements in another, related item (‘relaxed’ models only, the ‘constrained’ view being that all variation in observed variables should be attributable to the underlying latent variable);

The introduction of error covariances in the observed variables undoubtedly improves the fit of the structural equation models. The danger is that one produces a model which fits the data, but which is both unparsimonious and unlikely to be capable of generalisation and subsequent replication, as noted above. Both the ‘constrained’ and ‘relaxed’ versions of Model C were therefore run both with and without error covariance terms in the observed questionnaire items. The results are described below.

There seems to be no substantive justification for including error covariances among the latent variables, although this is technically possible, using LISREL, and this was not attempted.

Structural Equations

Four different systems of structural equations were fitted. The first – represented by Model 0 – corresponds to the model postulated above. Whereas Appendix 11.4.2 shows a pictorial representation of the partial correlation coefficients for this model, Appendices 11.4.3 and 11.4.4 show the equivalent path coefficients estimated for the same structure, using ‘relaxed’ and ‘constrained’ assumptions, respectively. Model 0 was modified in such a way as to produce successive refinements in Models A, B and C. All of these models are similar. The differences between them are described here, and they are evaluated in more detail at the end of this chapter.

Two of the paths in Model 0 have relatively small path coefficients that were for this reason dropped in order to produce Model A; these are:

COMMIT = SLF_ASSR (i.e. Commitment depends on Self-Assuredness at Matriculation)

AI = HLP_FEED (i.e. Academic Integration depends on Help and Feedback)

On the other hand, it appeared from the modification indices that a new path, which seems quite acceptable on substantive grounds, could usefully be added:

AC Effort = EXPTN (i.e. Academic Effort depends on Expectations for the Future)

Model A is the simplest of the models that were developed, and is shown in Appendices 11.4.5 and 11.4.6. Model B is the same as Model A, except that it illustrates the positive effect of Social Integration on Commitment, coupled with its negative direct effect on Summer Persistence, as first detected in the logistic regression analysis and CHAID described in the previous chapter. The additional equation added was:

PERSIST = SI (i.e. Summer Persistence depends on Social Integration)

The resultant Model B is shown in Appendices 11.4.7 and 11.4.8. Two further elaborations were made to produce Model C. First, Social Integration was ‘anchored’ in Self-Assuredness at Matriculation by the equation

SI = SLF_ASSR (i.e. Social Integration depends on Self-Assuredness at Matriculation)

Social Integration otherwise goes largely unexplained in this system of equations. Model C also incorporates a reciprocal relationship between Academic Integration and Social Integration, in a manner consistent with Tinto’s contention that these two constructs can be mutually reinforcing:

AI = SI

SI = AI

Model C (Appendices 11.4.9 to 11.4.12) is the most interesting and, as will be demonstrated, the best fitting, at least by a slight margin. It is discussed below. It requires a partial revision and elaboration of the chain of causation initially inferred from the anti-image correlation matrix.

Each of the models consists of fifteen latent variables. Four of these – PERSIST, RES_CAT, GEN_FACS and SCORE – are described in the context of the description of the measurement equations above.

Six of the latent variables are hypothesised to be exogenous to the structural equation system. They have paths leading from them, but not to them. These are Family Support (FAMILY), General Faculty Category (GEN_FACS), Entry Point Score (SCORE), Help and Feedback (HLP_FEED), Extraneous Problems (EXTRAN), and University Accommodation (RES_CAT). These are the catalysts which combine at different stages to influence the development of a student's attitudes and perceptions in such a way as to cause her or him ultimately to persist or withdraw in the closing months of the first academic session.

The nine endogenous variables in the system are Self-Assuredness at Matriculation (SLF_ASSR), Perspicacity at Matriculation (PERSPIC), Expectations for the Future (EXPTN), Academic Effort (AC_EFFRT), Academic Self-Concept (AC_SCONC), Social Integration (SI), Academic Integration (AI), Commitment (COMMIT), and Summer Persistence (PERSIST).

The structural equations upon which the different models are based are contrasted in Table 11.3.

Structural Equation		Model 0	Model A	Model B	Model C
1.1	PERSIST = COMMIT	Y	Y	–	–
1.2	PERSIST = COMMIT SI	–	–	Y	Y
2.1	COMMIT = AI SI AC_SCONC SLF_ASSR	Y	–	–	–
2.2	COMMIT = AI SI AC_SCONC	–	Y	Y	Y
3.1	AI = EXPTN AC_SCONC HLP_FEED	Y	–	–	–
3.2	AI = EXPTN AC_SCONC	–	Y	Y	–
3.3	AI = EXPTN AC_SCONC SI	–	–	–	Y
4.1	SI = EXTRAN RES_CAT	Y	Y	Y	–
4.2	SI = EXTRAN RES_CAT SLF_ASSR	–	–	–	Y
5	AC_SCONC = SCORE AC_EFFRT HLP_FEED	Y	Y	Y	Y
6.1	AC_EFFRT = PERSPIC	Y	–	–	–
6.2	AC_EFFRT = PERSPIC EXPTN	–	Y	Y	Y
7	EXPTN = PERSPIC GEN_FACS	Y	Y	Y	Y
8	PERSPIC = SLF_ASSR	Y	Y	Y	Y
9	SLF_ASSR = FAMILY	Y	Y	Y	Y

Table 11.3 Summary of Structural Equations Used in Each Model

It can be seen from Appendices 11.7.1 to 11.7.10 that in purely statistical terms they appear to be broadly satisfactory and that there is little to choose between the different models, overall. The values of R^2 are generally but not universally high; all but one of the coefficients in Appendix 11.7.10 (discussed below) are statistically significant, and have the expected sign (positive or negative). To differentiate among these models it is necessary to consider their goodness of fit, and then their substantive interpretation. These matters are considered below.

Reduced Form Equations

LISREL generates reduced form equations that express each of the endogenous latent variables as the sum of the linear associations with the exogenous latent variables upon which it depends, either directly or indirectly. As in the structural equations, both dependent and independent variables are standardised in these equations. Two examples are given. Appendix 11.8.1 shows the reduced form equations for the ‘relaxed’ version of Model A, with error covariances included. It shows, as might be expected, the positive effect on Summer Persistence of living in University accommodation and the detrimental effects of Extraneous Problems. The second example (Appendix 11.8.2) relates to the ‘constrained’ version of Model C, with error covariance excluded. This is one of the models that incorporates the interaction effect between Social Integration and Commitment. It illustrates that structural equation modelling does not always handle such effects successfully. In this case, living in University accommodation is shown to be harmful to Summer Persistence, and that Extraneous Problems appear to be significantly

beneficial. The latter result, at least, is clearly nonsensical, and the former is inconsistent with the findings described elsewhere in this thesis. With these exceptions, the results seem plausible.

Overall Goodness of Fit

Assessing the goodness of fit of a model is one of the more contentious aspects of structural equation modelling. There are, nevertheless, some points about which there is general agreement, according to Bollen and Long (1993). They highlight first and foremost the importance of a model's consistency with strong substantive theory. Results that are statistically significant but which have little practical meaning are difficult to justify. It seems also to be generally accepted that to rely solely on the chi-square statistic as a measure of goodness of fit is not appropriate. Additional points of general consensus, according to Bollen and Long, are that it is appropriate to consider a range of different overall measures of goodness of fit, rather than depending on only a single measure and that, furthermore, the different parts of the model, such as the values of R^2 and the values and signs of the coefficients, should also be taken into account. Finally, it is the consensus view that several alternative models should be considered rather than just one. In this section attention is focused on different statistical measures of overall goodness of fit.

For each of the four structural models described above, four variants are available: each could be fitted either with or without error covariance terms included and, for each of these, either a 'relaxed' or 'constrained' set of measurement equations, as described above, could be adopted. Not all of these sixteen different possibilities were explored, though. In practice, it was found helpful to fit ten of them in order to be able to contextualize and compare them. Those chosen for detailed consideration are apparent from Appendix 11.9.

From LISREL's complete listings of goodness of fit statistics, five were selected for the purposes of assessing goodness of fit in this application. These are discussed below and are summarised in Appendix 11.9.

Minimum Fit Function Chi-Square

The particularly large values of chi-square in this application are, no doubt, due in part to the large sample size. As noted above, it would be inappropriate to place much importance on the chi-square statistics. This is indeed fortunate because to do so would cause all of the

models in this study to be rejected. Bollen and Long (1993, p. 6) give three reasons why one should not place much credence on chi-square statistics:

“First, the null hypothesis underlying the test statistic is overly rigid in most cases. It assumes that the hypothesized model leads to an implied covariance matrix that exactly reproduces the covariance matrix of the observed variables in the population. There is no allowance made for the approximate nature of virtually all social science models. A second reason is that the chi-square test statistic as usually applied ignores the statistical power of the test. Tests with excessive power can lead to the rejection of good models, or low statistical power can mislead us into retaining poor models. Third, failure of the variables to satisfy the distributional assumptions of the test statistic can lead to the rejection of correct models or the failure to reject incorrect models.”

Root Mean Square Error of Approximation (RMSEA)

The root mean square error of approximation may be abbreviated to RMS (Steiger and Lind, 1980) or to RMSEA (Browne and Cudeck, 1993). As a rule of thumb, Browne and Cudeck (1993, p. 144) say:

“Practical experience has made us feel that a value of RMSEA of about 0.05 or less would indicate a close fit of the model in relation to the degrees of freedom. This figure is based on subjective judgement. It cannot be regarded as infallible or correct, but it is more reasonable than the requirement of exact fit with the $RMSEA = 0.0$. We are also of the opinion that at a value of about 0.08 or less for the RMSEA would indicate a reasonable error of approximation and would not want to employ a model with a RMSEA greater than 0.1.”

By referring to Appendix 11.9, it may be seen that according to these criteria only those structures that include error covariances and which are based on ‘relaxed’ measurement models may be described as having a ‘close’ fit; all of the others are ‘reasonable’.

Normed Fit Index (NFI) (a.k.a. Bentler-Bonett NFI) and Non-Normed Fit Index (NNFI) (a.k.a. Bentler-Bonett NNFI)

The Normed Fit Index (NFI) is based on the ratio of the minimum discrepancy function of the model being evaluated and the minimum discrepancy function of a badly fitting baseline model such as the independence model. The Non-Normed Fit Index (otherwise known as the Tucker-Lewis coefficient) is a further variation on this ratio. Commenting on the NFI and the NNFI, Bentler and Bonett (1980, p. 600) say:

“Since the scale of the fit indices is not necessarily easy to interpret (e.g. the indices are not squared multiple correlations), experience will be required to establish values of the indices that are associated with various degrees of meaningfulness of results. In our experience, models with overall fit indices of less than .9 can usually be improved substantially. These indices, and the general hierarchical comparisons described previously, are best understood by examples.”

It will be inferred from the values of the NFI and NNFI shown in Appendix 11.9 that broadly the same conclusions emerge as from the RMSEA. Only those models containing error covariances and being based on the ‘relaxed’ measurement models have an NFI and an NNFI greater than .9; the others all have values slightly below this.

Comparative Fit Index (CFI)

The Comparative Fit Index (CFI) is based on the ratio of the Non-Centrality Parameter (NCP) for the model being assessed to the NCP for a baseline model. Under suitable conditions, The NCP has a non-central chi-square distribution with the same number of degrees of freedom as the minimum fit function chi-square statistic. Whereas the minimum fit function chi-square is a sample statistic, the NCP is an estimated population statistic. Values of the CFI close to 1 all represent a very good fit. The results in this application are again consistent with the conclusions articulated above.

Tanaka (1993) has characterised various indices of fit according to six criteria. His summary, as it relates to the NFI, NNFI and the CFI, is reproduced in Table 11.4.

	NFI	NNFI	CFI
Population Based?			Y
Favouring Simple Models?		Y	
Normed to Approximate (0, 1) Interval?	Y	Y	Y
Relative?		Y	Y
Estimation Method Specific	Y		
Sample Size Dependent?	Y		Y

Table 11.4 Characteristics of Goodness of Fit Indices (from Tanaka, 1993, p. 32)

The manner in which Table 11.4 is to be interpreted is as follows.

Population Based: Some measures of goodness of fit estimate a population measure, while others assess the fit between a specific model and the observed data. The former involve making inferences about the underlying population, based on the non-central chi-square

distribution, and may therefore be of interest when one wishes to consider in particular the cross-validity and generalisability of one's results.

Favouring Simple Models: Different indices penalise models having large numbers of parameters to differing extents. It may be judged appropriate to down-rate models that owe their apparent good fit to an excessive number of parameters.

Measures that are normed, at least approximately, to a (0, 1) interval may be preferred, on the grounds of simplicity, to those that are not. (The NNFI is normed approximately, but not precisely, to the (0, 1) interval.)

Relative: Some indices depend on comparisons with some form of baseline model, such as one that posits no correlations between the observed variables.

Estimation Method Specific: Some assessments of fit vary explicitly as a function of the estimation method adopted, whereas others do not.

Sample Size Dependency: Indices that take into account sample size seem preferable to those that do not.

It can be seen that the NFI, the NNFI, and the CFI encompass between them all of Tanaka's six different characteristics of indices of fit. This provided some additional reassurance that the results reported are dependable; their acceptability does not depend on the analysis having focused on particular types of indices to the exclusion of others.

It is possible to conclude that all of the models fit the data at least reasonably well. Their fit is noticeably improved by the inclusion of error covariances. This course of action is justifiable because it can be rationalised substantively. Even without error covariances, the fit is moderately good. The similarities between the models in terms of goodness of fit are much more striking than their dissimilarities. There is no compelling reason for preferring one model to the others on statistical grounds, although a more conservative approach would give preference to the 'constrained' version of Model C, with error covariances excluded. The data set is sufficiently robust to be capable of a variety of slightly different interpretations. Choosing between them is therefore largely a matter of judging the usefulness of the insights that they afford and the extent to which they are consistent with other research findings.

Interpretation

The initially hypothesised chain of causation leading to summer attrition may now be refined in the light of the statistical results. The interpretation offered is couched mainly but not exclusively in terms of the 'relaxed' models because they offer more substantive insights than do the statistically more conservative 'constrained' models.

Family Support: A strikingly large proportion of students scored very highly on two survey items, one at matriculation and one thereafter, asking specifically about levels of family support. While the principal components analysis brought these two items together to form one construct (Chapter 9), with family responsibilities forming part of the Extraneous Problems construct, the LISREL modification indices provided some evidence to suggest that it could, in fact, be more appropriate to redefine Family Support more broadly to incorporate family responsibilities, so that this construct might alternatively be interpreted as family background, thereby encompassing both its negative and positive aspects. The construction of the 'constrained' models follows that of the original principal components analysis; the 'relaxed' models allow for the wider definition of 'Family Support'.

Although Family Support or, perhaps more generally, the effects of family background, are ongoing in this model, their influence manifests itself most clearly in Self-Assuredness at Matriculation. This self-assuredness is reflected in positive attitudes towards a wide range of issues. Not feeling pressurised to come to university by someone else, feeling that one's choice of university has been the right one, and feeling confident both socially and academically are all relevant.

It is hypothesised that self-assuredness is a trait that is acquired relatively early in a young person's development, and that it is associated with an inquisitiveness that manifests itself in greater Perspicacity at Matriculation. Perspicacious students are those who have taken the trouble to find out about the subject material of their university courses, who claim to understand how much effort will be required of them and who have thought through the financial implications of coming to university. There may also be some overlap with other constructs: believing that Glasgow is the right choice of university and feeling confident academically both load on Self-Assuredness at Matriculation as well as Perspicacity in the 'relaxed' models.

Expectations for the Future form a distinct aspect of Perspicacity at Matriculation. Coming to university with a clear perception of what one is going to study and because one has a clear idea of one's future career form part of the former construct. It also encompasses items included later in the online questionnaire. Having a clear idea of one's future career loads on Academic Integration as well as on Expectations for the Future, suggesting that the two constructs are closely related; feelings of affinity with one's chosen subject are at least in part engendered by the expectation of a fruitful outcome. There may also be an association between Commitment and Expectations for the Future, as evidenced by the fact that the proposition that one's course will lead to a good job loads on both of these constructs; in other words, one is 'committed' not least because it appears that one's course will prove worthwhile.

It appears that students in the General Faculties Category tend to hold significantly poorer Expectations for the Future than those in other Faculty Categories. This is no doubt because the subject material is generally not tailored to the requirements of any specific profession. The convincing inclusion of objective variables such as this in the causal system adds to its overall persuasiveness.

Academic Effort is the result of two effects. Greater Perspicacity at Matriculation and better Expectations for the Future both encourage students to work harder. Academic Effort is measured by the estimated number of hours studied, along with the relative amount of effort that students reckoned they devoted to being well prepared for exams and assessments. One item – "Most of the content of my subjects doesn't interest me" – loads on three constructs in the 'relaxed' models: Commitment, Academic Integration, and Academic Effort – suggesting, not surprisingly, that there is a relationship between the attractiveness of subject material and the amount of effort expended on it.

Help and Feedback is an exogenous construct that is ascertained using three online questionnaire items concerned specifically with levels of academic assistance, rather than with more general difficulties. The contrast between the relevant path coefficients in Model 0, in particular, demonstrate that Help and Feedback are associated first and foremost with Academic Self-Concept rather than with Academic Integration.

Academic Self-Concept is a pivotal construct in these models. It is evidenced mainly by students' views of their academic progress, and also to a lesser extent by the (absence of) general feelings of having been unprepared for university life. The data support the

hypothesis that Academic Self-Concept is associated with three constructs: Entry Point Score, Academic Effort and Help and Feedback. Chronology alone is sufficient to prove that Entry Point Score influences Academic Self-Concept, rather than the other way round. The fact that Entry Point Score is associated most closely with Academic Self-Concept, rather than any of the other constructs in the model, is a useful finding because it goes some way to explaining how the associations between Entry Point Score and persistence identified in earlier chapters actually come about in practice. Furthermore, if it is accepted that Help and Feedback also influences Academic Self-Concept, it then seems reasonable to suppose that extra academic assistance, particularly if aimed at boosting academic self-esteem, can mitigate the effects of relatively low Entry Point Scores. Unfortunately, though, the direction of causation is not beyond dispute: it could be argued that those students having high Academic Self-Concept are, by nature, least likely to exhibit concern about levels of academic support when answering the online questionnaire. However, the evidence to down-play this possibility comes from the focus group meetings: both staff and students emphasised the importance of Help and Feedback in influencing academic outcomes. It is argued that Academic Self-Concept is also influenced by levels of Academic Effort. Again, the direction of causation is not self-evident, and the modelled direction of causation has to be determined by the context of the overall model of which this path is a part. It will be seen from Appendix 11.4.5, for example, that to reverse the direction of this path would make Academic Effort dependent on both Academic Self-Concept and Perspicacity at Matriculation. It seems extremely probable that Academic Effort is relevant to persistence, but the only way that this could then be modelled would be by postulating that Academic Effort influences Academic Integration via Expectations for the Future rather than via Academic Self-Concept, which seems less plausible. The link from Perspicacity at Matriculation to Academic Self-Concept (via Academic Effort) would also be lost. Put more simply, what is being proposed is that hard work engenders a feeling of academic well-being. If this is so, then extra Help and Feedback can to some extent mitigate the effects of lack of academic study. More generally, this part of the model is consistent with the intuitively appealing proposition that there are trade-offs between Entry Point Score, Academic Effort and academic Help and Feedback.

Academic Integration represents the end-point of the various constructs on the academic side of the model. It is a core construct in Tinto's theory, although most authors assume that it incorporates not just attitudes and perceptions, but also academic performance. In this study, academic performance is excluded because for the purposes of the earlier

chapters it was interpreted as a dependent variable rather than as an explanatory variable. Academic Integration is therefore measured in this study simply by online responses to questions designed to explore the extent to which subject content, in particular, is interesting and matches respondents' previous expectations. The path analysis bears out the contention that Academic Integration may be interpreted as being affected by Expectations for the Future and by Academic Self-Concept. However, it seems that the path from Help and Feedback to Academic Integration is unnecessary; it is preferable for this connection to be established through Academic Self-Concept. If the existence of the posited causal paths is accepted, it follows that relatively few students withdraw simply because they have chosen the wrong subject. Such a statement is an over-simplification, and implies a level of inevitability that is perhaps misleading. The models suggest that there may be a variety of causes of low levels of Academic Integration and point to the existence of various policy levers that may be applied to improve students' perception of their Academic Integration.

The 'Extraneous Problems' construct is focused mainly on the rather nebulous concept of 'personal problems', although difficulties with accommodation and with health (either one's own, or that of other family members) also seem relevant. It is treated as an exogenous latent variable in the model. Its influence on retention appears to be exerted via the social dimension of students' integration into university life, rather than via the academic dimension, as noted previously.

Social Integration is a construct borrowed directly from Tinto's theory, and is measured primarily by students' attitudes towards their fellow students. The purpose of this study is not to seek to explore the psychological dimensions of Social Integration. However, it seems clear that Extraneous Problems are associated first and foremost with students' Social Integration, rather than with any of the other constructs in the model. The direction of causality is not beyond doubt. For example, it is not inconceivable that there is in play a further variable which promotes within individuals both a feeling of better social cohesion and resilience in the face of personal problems. However, the fact that the association between Extraneous Problems and any of the academic dimensions of university life is not substantiated by the models gives a strong signal that help and support of a general, pastoral nature would be likely to improve retention. It can also be seen that those living in University-controlled accommodation experience better Social Integration than other students, which is perhaps to be expected, although it has to be remembered that those

represented as not in University accommodation are, in fact, relatively heterogeneous in terms of their living arrangements. As an attempt to anchor down Social Integration in some way, Model C includes also a causal path leading from Self-Assuredness at Matriculation to Social Integration. While the path coefficient is relatively low, the implication that Social Integration is to some extent embedded in Self-Assuredness at Matriculation and, through it, rooted in Family Support, seems intuitively correct.

The reciprocal relationship between Academic Integration and Social Integration incorporated in Model C is weak. In the 'constrained' version of Model C, excluding error covariance terms, the path leading from Social Integration to Academic Integration is not significant. Nonetheless, the positive signs of the two path coefficients in other models suggest that weaker Academic Integration can perhaps be ameliorated to a limited extent by better Social Integration, and *vice versa*, as originally posited by Tinto.

Commitment is represented by a total of nine questionnaire items, combining Tinto's concepts of commitment to the institution and commitment to higher education, and overlapping with manifestations of Expectations for the Future, Academic Effort, Academic Self-Concept, and Academic Integration. Academic Integration and Social Integration are the dominant influences on Commitment, which is in consonance with Tinto's model. It transpires also that Academic Self-Concept also has a direct effect on Commitment. The values of the path coefficients suggest that Commitment is influenced in roughly equal measures by the social and academic aspects of university life. It appeared initially from the anti-image correlation matrix that there should also be a path in the model leading directly from Self-Assuredness at Matriculation to Commitment. In practice, it seems preferable in the interests of parsimony not to include this path in the final structural equation model, because it demonstrates in any case the route by which this linkage is hypothesised to operate in practice.

The decision actually to withdraw, or perhaps the absence of will to return to university at the appropriate time, leads to the final measured event on the timeline being explored. Summer Persistence is modelled as being dependent only on Commitment in Model A, and on both Commitment and Social Integration in Models B and C. Model A follows Tinto's theory more closely, but Models B and C reflect more accurately the discovery reported in Chapter 10 that high Social Integration, coupled with low Commitment, noticeably increases the probability of summer dropout. The relevant structural equations are shown in Appendices 11.4.5 to 11.4.10. It can be seen that when Summer Persistence is modelled

as being dependent only on Social Integration, R^2 for the relevant 'relaxed' structural equation is 0.39 (Appendix 11.7.3). On the other hand, when Summer Persistence is expressed as a function of both Social Integration and Commitment, R^2 increases to 0.55 (Appendix 11.4.5) or 0.58 (Appendix 11.4.7), suggesting that Models B and C explain more variation in Summer Persistence than Model A, and are therefore to be preferred. It has already been commented that the interaction effect between Commitment and Social Integration has misleading consequences for the coefficients of RES_CAT and EXTRAN in the reduced form equations. A truer indication of the likely importance of RES_CAT and EXTRAN is given by the equivalent equations for Model A; here both seem to have a significant, positive effect on summer persistence rates.

Well-Being as a Second-Order Construct

It will be appreciated that some of the constructs originally supposed to be relevant to retention have not been included in any of the structural equation models described thus far. Some constructs were dropped as part of the practical interpretation of the anti-image correlation matrix described above. Other issues were left partially unresolved. In particular, there is no immediately convincing explanation as to why Financial Concerns might cause concern about academic Help and Feedback, or *vice versa*, and it was therefore concluded that Financial Concerns should not be incorporated in the structural equation models. This is not to say that they are irrelevant, but rather that for first-year undergraduates, at least, worry about money is not a prime cause of attrition during the summer months. It seems more likely that Financial Concerns can be combined with other constructs such as Help and Feedback, Extraneous Problems, Academic Self-Concept, Social Integration, Family Support and Loss of Friends & Homesickness to form a second-order factor to represent a general well-being or "feel good" construct, perhaps akin to the construct recognised by psychologists as positive affectivity (Watson and Pennebaker, 1989). The structural equations and measures of goodness-of-fit for this model are shown in Appendix 11.10. If the existence of a well-being construct is accepted, then it will be seen from the relative size of the path coefficients that Financial Concerns are marginally less relevant to it than other issues such as Social Integration, Academic Self-Concept, Extraneous Problems, and Help and Feedback, which are already incorporated in the main models.

Conclusion on Structural Equation Models

The main models may be seen as relatively parsimonious expositions of the withdrawal process. The demonstration of the existence of what is described here as a “well-being” construct serves as a reminder that there are, in all probability, many other factors in operation that influence attrition. The usefulness of any particular model therefore depends in no small measure not just on the testable propositions that may be derived from it, but also on the practical policy prescriptions that it generates. These wider, contextual aspects of the models devised in this chapter are considered in Chapter 13.

Addendum to Chapter 11 – Overview of Structural Equation Modelling and LISREL

This addendum is intended to give a brief overview of some of the more important features of how LISREL can be used to perform structural equation modelling, and how the output is to be interpreted.

For convenience, the distinction drawn between measurement equations and structural equations follows that made by Jöreskog and Sörbom in the LISREL documentation. Measurement equations are akin to the equations underlying a factor analysis; they describe the relationships between a latent variable and its various indicator variables, whereas structural equations describe the paths that link together the latent variables in a wider causal model.

Covariance Structures

Structural equation modelling is concerned with the fitting of the covariances predicted from observed data to the sample covariance structures. Rather than minimising the difference between predicted and actual values in individual cases, as in traditional regression analysis, the purpose is to minimise the difference between the covariances in the sample and the covariances estimated from the model.

In its most general form, the hypothesis to be tested is usually written as:

$$\Sigma = \Sigma(\theta)$$

where

Σ = the population covariance matrix of observed variables

θ = a vector of model parameters

$\Sigma(\theta)$ = the covariance matrix, expressed as a function of θ

Measurement Equations

The LISREL model distinguishes between dependent (or endogenous) latent variables and non-dependent (or exogenous) latent variables. Each latent variable is represented by one or more observed, indicator or manifest variables. The measurement models for these two types of latent variables are written as:

$$\mathbf{y} = \Lambda_y \boldsymbol{\eta} + \boldsymbol{\varepsilon}$$

and $\mathbf{x} = \Lambda_x \boldsymbol{\xi} + \boldsymbol{\delta}$

where

\mathbf{y} = a vector of observed response or outcome variables

Λ_y = a matrix of coefficients of the regression of \mathbf{y} on $\boldsymbol{\eta}$

$\boldsymbol{\eta}$ = a vector of dependent latent variables

$\boldsymbol{\varepsilon}$ = a vector of measurement errors in \mathbf{y}

and, similarly,

\mathbf{x} = a vector of observed response or outcome variables

Λ_x = a matrix of coefficients of the regression of \mathbf{x} on $\boldsymbol{\xi}$

$\boldsymbol{\xi}$ = a vector of non-dependent latent variables

$\boldsymbol{\delta}$ = a vector of measurement errors in \mathbf{x}

The assumptions are:

$$E(\boldsymbol{\eta}) = E(\boldsymbol{\xi}) = E(\boldsymbol{\varepsilon}) = E(\boldsymbol{\delta}) = \mathbf{0}$$

$\boldsymbol{\varepsilon}$ is uncorrelated with $\boldsymbol{\eta}$, $\boldsymbol{\xi}$ and $\boldsymbol{\delta}$

$\boldsymbol{\delta}$ is uncorrelated with $\boldsymbol{\xi}$, $\boldsymbol{\eta}$ and $\boldsymbol{\varepsilon}$

The relationships are thus all linear. The LISREL model allows for multiple dependent variables, whereas in multiple linear regression there is only one. Each variable in \mathbf{y} and \mathbf{x} can depend on more than one variable in $\boldsymbol{\eta}$ and $\boldsymbol{\xi}$, as specified by the non-zero elements in Λ_y and Λ_x . Allowance is made for random measurement error in the observed variables. Three additional matrices are used to represent the covariance matrices of the error terms.

By convention, these are Θ_ϵ , Θ_δ and $\Theta_{\delta\epsilon}$. The diagonal elements in Θ_ϵ and Θ_δ represent the error variances in each of the measurement equations for the x and y variables, respectively. The third matrix, $\Theta_{\delta\epsilon}$, where it is needed, contains the covariances of observed variables that are used as indicator variables both of dependent and of non-dependent latent variables. By default, the off-diagonal elements in each of these three matrices are set to zero, implying that there is no correlation between the corresponding measurement error terms. However, it is one of the features of the LISREL software that these assumptions can selectively be relaxed. Estimating non-zero off-diagonal terms in these matrices can have the effect of appreciably improving the fit of a measurement model and of the structural model of which is it a part. This implies a loss of parsimony, and it is of some importance to be able to justify substantively the existence of these correlations. As a simple example, it may seem reasonable to suppose that there could be a positive correlation between the errors in repeated measurements of the same questionnaire item.

Structural Equations

At a higher level of abstraction, LISREL also permits the existence of causal paths between the latent variables to be postulated and tested. The full structural equation system is:

$$\eta = B\eta + \Gamma\xi + \zeta$$

where

B = a coefficient matrix for dependent latent variables

Γ = a coefficient matrix for non-dependent latent variables

ζ = a vector of error terms in the structural equations

Neither B nor Γ need be triangular, so there is no reason in principle why some paths should not be recursive. Their main diagonals are, however, always zero. The assumptions are:

$$E(\eta) = E(\xi) = E(\zeta) = 0$$

ξ is uncorrelated with ζ

$(I - B)$ is non-singular (where I is an identity matrix)

The structural equations, using LISREL terminology, are therefore a set of linear equations by which each endogenous latent variable is expressed as a function of other latent variables in the system, as defined in the B and Γ matrices. The covariances between the non-dependent latent variables are represented by the elements of Φ . Corresponding to each path leading to a dependent latent variable in a structural model there is a measurement error term, and LISREL provides a further covariance matrix, Ψ , of the error covariances for the structural equations, mirroring the Θ matrices for the measurement equations. Again, the off-diagonal elements of Ψ are assumed to be zero, although these assumptions may be overridden where appropriate.

Reduced Form Equations

LISREL also produces reduced form equations, in which only exogenous latent variables appear on the right-hand side. Algebraically, these are:

$$\eta = (\mathbf{I} - \mathbf{B})^{-1} (\mathbf{\Gamma}\xi + \zeta)$$

The requirement shown above that $(\mathbf{I} - \mathbf{B})^{-1}$ should exist permits the evaluation of the reduced form equations. They are useful in assessing the relative influence and significance of the exogenous latent variables in explaining each of the endogenous latent variables.

Second-Order Factor Analysis

It is possible to use LISREL to model two tiers of factors, by using a special case of the more general structural equation model described above. We have:

$$\mathbf{y} = \mathbf{\Lambda}_y \eta + \varepsilon$$

and

$$\eta = \mathbf{B}\eta + \mathbf{\Gamma}\xi + \zeta$$

Setting $\mathbf{B} = \mathbf{0}$ then simplifies the general structural equation model to:

$$\eta = \mathbf{\Gamma}\xi + \zeta$$

It is then possible to express the observed variables associated with the dependent latent variables as:

$$y = \Lambda_y (\Gamma \xi + \zeta) + \varepsilon$$

The other expressions in this equation may now be expressed in the terminology of factor analysis rather than structural equation modelling:

Λ_y = a matrix of the first-order factor loadings

Γ = a matrix of second-order factor loadings

ξ = a vector of second-order factors

ζ = a vector of second-order unique components

ε = a vector of first-order unique components

An example of a second-order factor, representing students' feelings of general well-being, is described in the main text, and is represented by some of the factors previously described in this study. It can be demonstrated that a model containing a second-order factor has the same fit as a single-order factor analysis in which the factors have correlated measurement terms. However, to be able to postulate the existence of a second-order factor may be more informative.

Scaling

Constant terms do not appear in the analysis of covariance structures, other than in special circumstances. Instead, all variables are expressed as deviations from their means. The fact that they are also standardised implies that one can gain an impression of the relative importance of different variables in the system, even though most of the observed variables are either ordinal or binary in this study. All coefficients represent the mean response, measured in standard deviations, of the dependent variable to a one standard deviation change in a explanatory variable, holding constant the other variables in a model (Bollen, 1989, pp. 124-5). As such, these coefficients are not the same as the standardised regression coefficients (beta weights) commonly used in regression analysis, where only the independent variables are expressed in standardised form.

In the LISREL model, one path in the measurement model for each endogenous latent variable is taken as fixed. The selection of this path is, by default, arbitrary. This fixes the scale of each of these latent variables with respect to one of the observed variables. No standard errors or *t*-values are calculated for these path coefficients. Having defined a unit of measurement in each of these latent variables, LISREL works backwards, in effect, to scale the exogenous latent variables, so that all other paths in the model are treated as estimated.

Output

The SIMPLIS format for the output was used, being easier to understand than the full LISREL output. Each equation and each non-zero element of the relevant moment matrices are shown on separate lines. The standard error of each estimated path coefficient appears along with the corresponding *t*-value, which is the ratio between the estimate and its standard error. In accordance with common practice, *t*-values in excess of 1.96 in absolute terms (representing 95% confidence limits) may be interpreted as implying that the corresponding parameters are statistically significant.

The error term in each equation represents the combined influence of all variables influencing the dependant variable but which are not included explicitly in the relationship. LISREL shows the error variance, which may be compared to the total variance in the dependent variable (which is one in all cases in this study, so that the error variance = $1 - R^2$ in all equations). If the error variance is small by comparison to the total variance, then it may be assumed that the explanatory variables in the model adequately account for most of the variance in the dependant variable. The standard error of the variance is also shown, along with its *t*-value.

The squared multiple correlation, R^2 , is also given for each equation. R^2 is the proportion of variation explained. In measurement equations R^2 is usually interpreted as the reliability of the observed variable on the left-hand side of the equation (Jöreskog and Sörbom, 1993).

Chapter 12 – Telephone Interviews with Early Leavers

A total of 454 first-time, first-year, full-time undergraduates who started at the beginning of the 1999-2000 session were identified as not having returned by December in the following session. This represents 12% of the cohort. It was decided to contact as many of these leavers as practical.

Introductory letters were sent to those whose last known home address was in the UK, explaining that they would shortly be contacted by telephone, and asking for their co-operation in talking about the reasons for their departure. Seven older students were employed to conduct the interviews, which were loosely structured to explore the same broad themes as had been covered by the matriculation and online questionnaires, and which are described in Chapter 6. The questions to be followed by the interviewers are shown below in italics after a ‘–’ sign. The interviews were conducted over the period from December 2000 to March 2001. In practice, it proved difficult to make contact with the leavers, but 75 (16.5%) hand-written accounts of completed interviews were obtained. The majority of interviews were conducted with the leavers themselves. A few were conducted with members of their families – generally parents – although this had to be done with sensitivity, given the need to protect the confidentiality of the leavers.

No claim can be made for the external or internal validity of the conclusions drawn. They should be seen as a qualitative aid to a deeper understanding of the dropout phenomenon. The methodological issues are considered in greater detail in the following chapter.

Overview of Reasons Given for Leaving

Respondents were encouraged at the beginning of the interview to offer relatively spontaneous reasons for leaving:

- *What were the immediate causes of your leaving? (lost interest/ money/ family problems/ prolonged illness, etc.)*

Towards the end of the interview, respondents were asked to reflect again on the reasons for their departure:

- *Is there anything that the University could have done which might have resulted in you staying on?*
- *Is there anything that you regret? Was there anything you yourself could have done which might have resulted in your staying on?*
- *Any other comments/ views?*

The two main points that arise from these parts of the interviews are:

- By far the most common reasons cited for having left were having selected the wrong subjects, and not having liked the course (or certain parts of the course).
- Student finance is relevant, but not nearly as much as these and other academic issues.

Each respondent's answers were categorised in terms of the dominant reasons for departure in order to obtain a broad impression of the relative frequency of the various difficulties cited. The results are summarised in Table 12.1. Some students mentioned more than one of problem, and these have been counted more than once. This should not invalidate the general picture, however.

Main Cause of Leaving (n = 75)		
		(*)
1	Wrong choice of subject(s); didn't like the course	45 60.0%
2	Physical illness/ accident/ physical attack	10 13.3%
3	Staff unapproachable	8 10.7%
4	Could / should have worked harder	7 9.3%
5	University not for me/ University impersonal/ atmosphere cold	6 8.0%
6	Finance	6 8.0%
7	Personal problems/ pressure/ bereavement	6 8.0%
8	Not passing examination(s)	5 6.7%
9	Missing/ lacking friends	5 6.7%
10	Needed a break/ year out	4 5.3%
11	No clear reason for being at the University in the first place	3 4.0%
12	Daily travel	3 4.0%
13	Could not/ did not transfer to another course/ Faculty	3 4.0%
14	Childcare facilities lacking/ too expensive	1 1.3%

(*) *The percentages sum to more than 100% because some respondents cited more than one main reason for leaving.*

Table 12.1 Main Reasons for Leaving Cited

It is a matter of conjecture as to the extent to which those who found themselves on the wrong course might have fared better had they made a different choice. Given the clear correlation between Entry Point Scores and attrition, it is also a matter of speculation as to the extent to which “wrong” in the words of leavers should really be interpreted as “too difficult”. At least some felt that the University should have taken steps to avert the situation; one respondent commented:

“I really didn’t like the course to the extent I feel the University should never have admitted me in first place.”

Those who fell ill or who were incapacitated for a prolonged period of time appear to have faced an uphill and sometimes impossible struggle in order to regain ground lost academically.

A few respondents cited difficulties with the staff as being the main reason for leaving. While some spoke very highly of the staff (particularly their advisors of studies), two sorts of problem are evident. First, it appears that there can be a mismatch of expectations concerning the level of support that is due. It was perhaps best summarised by one leaver’s mother, who happened to work in another university in the Glasgow conurbation:

“It was impossible to get help and no-one noticed difficulties... In order to get help from staff I [S’s mother] ended up phoning his tutor so that S could get help ... He got to see his tutor. If I had a child in my department who became withdrawn when he was formerly bright and enthusiastic, I would hope one of my members of staff would notice.”

The second problem relates to the unapproachability of certain members of staff (especially tutors) and, more generally, to the apparently austere atmosphere of the University as a whole.

“Some of the staff seemed helpful; some were a bit unapproachable and seemed very old-fashioned.”

“The lecturer was very dull and very fast; not helpful; some people were very pompous ... I was proud to get into Glasgow, but even happier to get out.”

“Tutors not approachable; Advisor of Studies fine...”

“I really didn’t like the University – stuffy – the lecturer still wore a gown.”

Looking back, a few respondents regretted not having tried harder. Others spoke of the need for a break or a year out, while others indicated that they had come to University almost more by accident than by design. Most respondents appeared to externalise their difficulties rather than to admit to what might be perceived as personal shortcomings, in the form of a lack of motivation or lack of preparedness for academic life, or perhaps university life more generally.

Six respondents cited financial difficulties as their main reason for leaving. A seventh was unable to afford the cost of childcare.

A few found daily travel very tiring. Some commented on the fact that living further afield from the University inhibits one from socialising with other students.

It appears that some students may not have been aware that at least in some circumstances it is possible to change one’s course. Some said that it had not been possible for them to change course.

The nature of the personal problems to which respondents referred was generally not elaborated upon. Some appear to have suffered from pressure of work or bereavement.

Other outcomes of the interviews are considered below.

The Latent Period

This particular issue was not otherwise addressed in this study.

- *When did you first consider leaving the University? When did you first feel that there was a problem?*
- *When did you actually stop attending classes, etc?*

Some students considered leaving at the beginning of the first term, and actually did so. Others may also have developed reservations very early on, but had delayed their

departure, in some cases even until the following summer. There appears usually to be a latent period – which can start at any point during the session – between the time of first considering leaving and actually doing so. This point was borne out by a second-year focus group [not part of this study] in talking about “watching people slide away”, perhaps as a result of the “realisation that you hated your course”. The existence of a latent period is also consistent with the proposition that in some cases withdrawal is the consequence of a prolonged and passive ‘non-decision’, rather than a positive choice made at a particular point in time.

There was not always a good correspondence between the centrally recorded date of leaving and the subject’s reported date of cessation of attending classes. Centrally recorded dates of leaving were missing particularly for those who claimed to have continued to attend classes until relatively late on in the session – from Easter onwards, in particular. If the University’s central records are incorrect then, inevitably, the Higher Education Statistics Agency’s records will be wrong, too.

Prior Decision-Making

– *Was coming to the University a last-minute decision?*

The vast majority of respondents claimed that coming to University had been planned in advance. Only a very few said that it had been a last-minute decision. This does not have the appearance of having been a pivotal issue. Its exclusion from the structural equation models therefore seems to be justified.

– *Was the decision to come to University pretty much your own, or were you being pressured by someone else?*

The vast majority indicated that the decision to come to the University had been their own. Only a small minority felt that they had come under pressure, either from their parents or from their schools.

Prior Academic Expectations

- *Do you think that you knew enough about the subject content of your course before you came to University?*

Two-thirds of respondents felt that they had not known enough about their chosen subjects beforehand. Many made the distinction between subjects taught in schools and those that were not, pointing out that the latter were less familiar. Some had been taken unawares by the fast pace of the course; others had not appreciated that certain subjects (e.g. Statistics and Chemistry) would form a major part of their curriculum. The perceived disjunction in academic provision between schools and the University is best represented in the structural equation models by the concept of Perspicacity at Matriculation.

Academic Perceptions

- *What subjects were you studying?*
- *Do you think that you made the right choice of subjects to study?*
- *Did you find the course interesting?*

Two-thirds of respondents found one or more of their subjects uninteresting. Some commented on the difficulty of their subjects:

“Easy at school but a big step up at Uni.”

Other reactions included:

“boring”, “irrelevant” and “stressful”.

These comments exemplify the importance of Academic Integration, as defined for the purposes of this study.

Academic Self-Esteem

- *Did you study hard? Did you put a lot of effort into preparing for exams and assessments?*
- *Did you get into difficulties with your studies?*

These questions were intended to explore the relevance of Academic Effort and Academic Self-Concept.

Some leavers maintained that they had worked hard, while others said that they had not. Some said that they could have tried harder. Their reasons for not working hard included mainly a lack of interest in the subject material. Some pointed out that they had, in fact, passed either all or most of their examinations.

“Lost interest; only did enough to pass...”

Integration

The various aspects of integration were explored initially using an open question:

- *Did you feel ‘at home’ at the University, or had nothing you’d done before really prepared you for it?*

Responses were often negative:

“I enjoyed it, but it wasn’t what I expected; I felt there wasn’t anyone you could talk to if you had a problem.”

“Everyone bar me seemed to know everyone; very cliquey.”

“Cold, old-fashioned and stuffy...”

Others were apparently less intimidated:

“It was OK; I didn’t see it as the big scary university.”

Others commented on their own lack of academic preparedness:

“[I was] unprepared; I had to teach in schools but had only just left school myself.”

“[I was] not well prepared for workload [or] deadlines.”

Social Integration

Then the issue of Social Integration was probed more specifically:

- *How was your social life? Did you get to know anyone while you were here? Did you feel that you had lost friends as a result of coming to the University? Did you feel excluded from other students' social activities?*

The logistic regression analysis (Chapter 5) shows that living in a University hall of residence is associated with retention rates significantly higher than for other students. The odds of persistence for those first-year undergraduates living in University accommodation are better than those for other students by a factor of about 1.6.

The structural equation models (Chapter 11) demonstrate the positive association between Social Integration and living in University accommodation. They also demonstrate that roughly half of the variation in the Commitment construct can be attributed to Social Integration rather than academic factors.

It is therefore surprising that most (but not all) leavers indicated that they had experienced no problems socially. Some commented on the extent to which they had maintained old school friendships; it is conceivable that such contact may have precluded the formation of more valuable University-orientated friendships.

Integration with Staff

- *Did you find that the academic staff were helpful? Was it difficult to ask the staff for help with your studies?*

Attitudes towards the staff were mixed. Specific comments about Advisor of Studies were generally positive; they were generally perceived as being helpful or very helpful. Some commented adversely on the size of lecture audiences; this had been used as one of several indicator variables for Academic Integration:

“Lectures were impersonal; no-one really noticed if you didn't go into a lecture because there were so many people there.”

“I know it's not practical, but smaller classes would have helped; my girlfriend goes to the Caledonian and the classes are made up of 30-40 people, so you get to know people quite well and have contact with the lecturer.”

Others felt that the staff were unapproachable, as already described above:

“Tutors not that helpful; too formal.”

“I enjoyed it, but it wasn’t what I expected; I felt there wasn’t anyone you could talk to if you had a problem; I mean, I saw my Adviser once for five minutes at the beginning of term; then my Adviser changed.”

“Most [staff] unhelpful; all unapproachable.”

“I found it difficult to know who to ask, and staff weren’t always helpful.”

“Didn’t speak to anyone; too embarrassed to say was I was having difficulties.”

The overall impression is that breakdowns of communication seemed more real to students at the departmental or academic subject level, rather than with the advising system.

It will be recollected that interaction with faculty is considered to be an important part of Academic Integration in Tinto’s model. However, in order to maximise response rates and improve validity, this particular subject was not explored in the questionnaires. It may be supposed from the exit interviews that, while the reasoning behind the questionnaire design might or might not have been justified, the quality and frequency of students’ interaction with academic staff is probably a significant component of Academic Integration, but one which is not present in the structural equation models.

Commitment to the University

- *Do you think that it would have been better to have gone to a different university or college?*

Most respondents appeared not to regret their decision to come to the University of Glasgow. Only a few felt that they should have gone to a different institution. These results are surprising, in view of the pivotal importance ascribed to Commitment in the structural equation models.

Financial Worry

- *Was money a problem? Did you worry a lot about money?*

Most leavers appear not to have been unduly concerned about their financial position. A few did experience some level of financial difficulty. Some pointed out that having a student loan had alleviated their position somewhat. One – an asylum-seeker – had been asked to pay a tuition fee of £8,800, which he could not afford. Another was unable to afford the cost of childcare. A total of six of the students interviewed had left for predominantly financial reasons. These findings seem consistent with the decision to exclude Financial Concerns from the structural equation model results.

Intrusion of Paid Work

- *Did you have an outside job during term-time? If so, did you find that the time you were spending working was eating into the time that you might have been studying?*

Roughly half of the respondents had paid employment, which is typical of the cohort as a whole. Some but not all felt it intruded into their study time. For a few, it was extremely disruptive.

Expectations for the Future

- *Did you have a clear goal in mind, like a particular career or job?*

A few respondents mentioned their hopes of pursuing a career specifically related to the subjects they had been studying (in Computing and Psychology, for example) but, apart from this, very few articulated any clear career ambitions. This seems to bear out the structural equation model results.

Pursuits since Leaving

- *What have you been doing since you left the University?*
- *In particular, have you transferred to another university or college? If so, which one?*

Many respondents had already transferred to another institution of post-secondary education, or were planning to do so. Others were in employment. Some were overseas. A few hoped to return to the University of Glasgow. Generally, the impression is not so much that they have “dropped out”, but rather that they have “moved on”. Dropping out had been a cataclysmic event for some but by no means all of those concerned.

Conclusion on Telephone Interviews

In reviewing and summarising the transcripts of the interviews, one is reminded of Krueger’s comments on focus group work (1994): the results seem almost too convincing, and it would be very easy to prescribe corrective actions based on the narrative supplied above. It is, however, one of the tenets being advanced in this thesis that to formulate any general policy prescriptions based solely on evidence such as this would be premature. The inconsistencies with the structural equation models reinforce the need for caution. Other perspectives must also be taken into account. The most apposite appraisal of the significance of the telephone interview is to regard them as a valuable adjunct to the quantitative analyses, but by no means a substitute for them in the development of a broad-ranging explanation of attrition. This and other methodological issues are considered in the following chapter.

Chapter 13 – Conclusions

The final conclusions may be drawn together under four headings: methodological issues, substantive findings, practical policy implications, and reflections on the literature and recommendations for future research.

Methodological Issues

In Chapter 3 the objective was set of combining quantitative and qualitative techniques sequentially in such a manner as to produce a description of the dropout process that is both generalisable and comprehensive. The research process is reviewed below but, first, it is appropriate to make some comments of a general nature concerning this type of research.

General Comments

Instrumental Rationality: One general limitation on the usefulness of theories of student attrition stems from the presumption that it is a phenomenon capable of rational explanation. This may not be wholly so, particularly if it cannot be assumed that students and university staff tend always to act rationally and consistently. The assumption that individuals and organisations do, indeed, behave rationally and with perfect information at their disposal in such a way as to optimise their own self-interest has been one of the hallmarks of classical economics. However, increasingly, this view has come to be challenged generally in the social sciences. Such scepticism may be particularly apposite in the study of student attrition. Tinto was moved to remark (1982, p. 5):

“A surprisingly large percentage of students entering college have little clear idea of why they are there, nor have they given any serious thought to the choice of institution. For many high school graduates, the process of choosing a college is shockingly haphazard, often based on the scantiest of information.”

Thus it may be said that for many students the reasons for entering higher education are far from self-evident, at least at the time the decision to do so is made. If students' motivations can be inchoate and hard to discern at the time of entry, it is perhaps not surprising that for some the motivations for leaving are equally difficult to rationalise. The absence of observable instrumental rationality makes model-making tenuous and, at the extreme, any

set of phenomena not linked by some form of identifiable relationships will defy theoretical formulation. Perhaps even more dangerous is the presumption of the existence of rationality where, in truth, there is none. The possibility of over-interpreting empirical associations must therefore be guarded against, particularly in studies such as this.

Experimental Design: A further limitation that pervades much of this study (as well as others) is its *ex post facto* experimental design. The disadvantages of this approach, as well as its inevitability, were anticipated in Chapter 3. Even the descriptive statistics presented in Chapter 4 are not entirely free from the consequences of a lack of experimental control. For example, it was observed that there could have been an element of self-selection present in Hardship Fund Awards, and this is one reason why this particular variable was not included in the subsequent logistic regression analysis. Certain data fields in the University's central records were incomplete. It is not clear whether the data were missing at random, or whether there was some systematic bias present. It has also been recognised that some apparently objective variables, such as Faculty Category and Residential Category, might also have been influenced to an appreciable extent by self-selection, and this has made their interpretation problematic, both in the context of the logistic regression analysis and in the structural equation modelling. Randomisation is seldom practical in studies such as this. The logistic regression analysis using only background variables (Chapters 5 and 8) was constrained to use only historical data that happened to be available. As well as having perhaps omitted potentially relevant variables, this makes it more difficult to interpret the final models. The extent to which the relationships described in these models should be taken simply at face value and the extent to which they may be representative of other, related causal relationships which are being measured only by proxy is not always apparent. For example, it is relatively easy to understand why Entry Point Score should be associated with retention rates. On the other hand, it has been much more difficult to explain why Age Category is important. When interpreting the structural equations, it was not always possible to be sure which variables were dependent, and which were antecedent. The qualitative work was also constrained by the retrospective nature of the design. In the focus group work and in the telephone interviews the research depended on individuals' reconstructions of past situations, without the researcher being able to validate their assertions fully. Difficulties that owe their origin to a lack of experimental control have been resolved partly by reference to the work of others, and partly by triangulation between the different strands of the primary research undertaken for the purposes of this study. The absence of attitudinal data relating to Pre-Summer Leavers

significantly constrained the scope of the study, but was unavoidable in practice. Perhaps the most helpful aspects of the design have been the inclusion of persisters as controls and the very high response rates to the questionnaires. These have made it possible to adduce with relative confidence which of the attitudinal constructs are important in differentiating between persisters and Summer Leavers, to determine their relative importance, and to propose a causal framework as a means of explaining the dropout phenomenon.

Questionnaires: The dependence on questionnaires to form the foundation upon which to base the empirical analyses was discussed in Chapter 3. It is possible that it may have biased or constrained the conclusions, despite efforts to avoid this happening. The use of questionnaires presupposes the existence of a single legitimate interpretation of reality whereas, in fact, the context surrounding individuals' responses and their perceptions of that context have been stripped away. The loss of this additional information will have been partially but not wholly anticipated through reliance on prior theory outlined in Chapter 2 and the qualitative research with students and staff described in Chapter 6.

Qualitative Research: Qualitative techniques were used both to instigate and to complete the study of the effects of students' attitudes and perceptions on retention rates. The initial focus groups transpired to be useful not just as an aid to the framing of the questionnaires, but also in interpreting the subsequent quantitative models. The final telephone interviews had a similar duality of purpose. They firstly confirm some of the earlier results and, at the same time, they broaden the focus by making it possible to exemplify and elaborate upon the other findings. The qualitative research therefore constitutes a valuable adjunct to the main quantitative analyses.

The Scope of the Research and The Nature of a Theory: As a generalisation, it might be said that the study takes most institutional factors as given, and treats only the attributes of students as variable. This is an important, albeit hitherto implicit, *ceteris paribus* assumption that is unlikely to have been borne out in practice. It has been described how critical theorists might prefer to tackle the issue from the opposite perspective, examining different aspects of institutional behaviours and attitudes towards students and treating these as the prime determinants of retention. The work of Tierney and Bourdieu, for example, was cited in Chapter 2. There is, in addition, a substantial body of more mainstream literature which, in effect, serves both to reinforce this perspective and to serve as a reminder of the limitations of a study which focuses almost exclusively on student variables. For example Tinto argues for the adoption of "Classrooms as Communities"

(1997), and demonstrates their beneficial effects on retention as well as on other academic objectives. Gabelnick *et al.* also make the case for the adoption of learning communities, which they define as “[the purposeful restructuring of] the curriculum to link together courses or course work so that students find greater coherence in what they are learning as well as increased intellectual interaction with faculty and fellow students” (1990, p. 5). Others, such as Yorke *et al.* (1997), also place greater emphasis on the quality of teaching and the learning experience. Having acknowledged that the scope of the study is limited, it is, however, important to bear in mind that a theory need not be all-encompassing in order to be useful. In writing about his own theory, Tinto remarked (1982, p. 688) “current theory cannot do or explain everything. One must make often difficult choices as to what is to be explained.” A model need not be judged by the realism of its assumptions but, rather, by the extent to which it may be tested, its consistency with empirical data and previously validated theories, as well as the simplicity being advocated here by Tinto. To this list of desiderata may be added the desirability of a theory’s ability to produce explanations and predictions that are useful in practice. Judged against these criteria, this study may be said to have generated a useful theory of student retention, notwithstanding the absence of institutional or more general “supply-side” variables.

Generalisability of the Findings: It is relevant to consider the extent to which the findings in this study may legitimately be assumed to apply to institutions other than the University of Glasgow, as well as to cohorts of students other than the one under investigation at the University itself. There is a tendency in the literature to issue a general warning concerning generalisations of the first kind, and for the second sort to be ignored altogether. Usually the position is more subtle than this. Clearly, if one’s model-making and explanations include variables that are unique to a particular institution, then it would be dangerous to assume that the results are directly transferable to others. On the other hand, there is no reason why the quantitative relationships involving psychological variables, demographic variables such as Occupational Class, and national measures of prior academic achievement, for example, should not be capable of wider application. The danger is that there may be other exogenous variables in play that do not appear explicitly in the analysis but which may, nevertheless, invalidate general inferences. In this study, Faculty Category is the only variable that is likely to be unique to the University of Glasgow and other universities having similar subject compositions, so there are grounds for optimism that the results may be more broadly generalisable across institutions. Additionally, so long as one’s models depend both explicitly and implicitly on variables that change only slowly

over time (as in this study), then extrapolations from one cohort of students to future cohorts should be relatively sound. There are, nonetheless, certain classes of extrapolation that would be insecure. The extension of the conclusions in such a way as to comment explicitly on the difficulties that might be encountered by atypical or non-traditional students, such as first-generation, older, lower-income or part-time students seems unwarranted by the data. Similarly, nothing can be said specifically about disabled students or those in ethnic minorities. Whether Pre-Summer Leavers are motivated by the same factors as the Summer Leavers remains largely a matter of conjecture. There are *a priori* reasons for supposing that financial matters are likely to be more troublesome to students in their later years of study, but this cannot be inferred from the current study. The qualitative conclusions of this study represent a further category of results that are not easy to generalise, except where corroborated by the quantitative analysis.

The Research Process

Descriptive Statistics (Chapter 4)

The descriptive statistics shown in Chapter 4 are no more than simple concomitances. The quantification of these empirical relationships is informative and makes this an appropriate starting point for the primary research.

However, the aetiology of student attrition is by no means apparent. Generalisations relating to all members of a particular ecological grouping do not necessarily apply to particular individuals within it. Evidence is presented to demonstrate that attrition was higher amongst males and amongst students from lower occupational classes, for example, but, unless one chooses to believe that such individuals possess intrinsic characteristics which are in themselves both necessary and sufficient to cause higher withdrawal rates, one is obliged to conclude that there are other forces in operation that are not immediately apparent from this mainly unidimensional analysis. Furthermore, without bringing multivariate statistical techniques to bear, it is not possible to assess the effects of the different observed variables either separately or in specific combinations. The main function of this particular part of the research is to allow the raw data to be scrutinised for the first time, and for informed choices to be made concerning the variables to be carried forward for further analysis.

This initial examination of the data is not theory-driven and, as such, it follows in the tradition of the atheoretical research described in Chapter 2. Because of the omission of other potentially relevant variables and the very tenuous nature of the associations described, they should not be used for any practical purposes without the benefit of additional analysis.

Logistic Regression Analysis Based Only on Students' Backgrounds Characteristics and Prior Academic Achievements (Chapter 5)

The logistic regression models are multivariate, and allow the effects of each of the explanatory variables to be quantified. This rectifies one of the shortcomings of the descriptive statistics alluded to above.

The approach is, by necessity, *ex post facto* in design. It is again data-driven rather than theory-driven, which also makes inference tenuous. However, given that the experience of a whole cohort of new undergraduates has been taken into account, and given that the results are broadly similar to those of other studies, it seems probable that the conclusions could be generalisable to apply to other, similar cohorts, too, so long as *ceteris paribus* conditions applied, at least approximately. The models have the merit of being relatively parsimonious, and the analysis is characterised by results that have generally good statistical significance and moderately good predictive power. The main disadvantage of these models is the considerable conceptual gaps that exist between the predictor variables and the dependent variable. As explanatory models, these equations are not especially informative.

Focus Groups (Chapter 6)

For this reason, some focus group work was undertaken in order to ascertain from students and staff at the University what their perceptions were of the academic climate generally and, in particular, what might cause students to withdraw in practice. The qualitative exercise was supplementary to the literature review described in Chapter 2, and the resultant questionnaires are essentially an amalgamation of these two different investigations. A tentative causal model, based on the constructs believed to underlie the questionnaires, was also put forward at this stage.

Introduction of Attitudinal Variables to the Logistic Regression Models (Chapter 10)

The multiple logistic regression analyses shown in Chapter 10 were rendered problematic by difficulties with multicollinearity, and the fact that the logit does not appear to be a linear combination of the explanatory variables. The model of retention using only attitudinal variables is useful, nevertheless, as a means of identifying at least the most salient explanatory variables. The model incorporating both background and attitudinal attributes highlighted the importance of four variables: Commitment, time on task (as evidenced by three different constructs), Entry Point Score, and Age Category. But while the first three of these four variables seem explanatory by nature, Age Category appears to be an ecological variable that, on its own, contributes little to our understanding of the reasons for attrition.

This approach has the advantage of being economical in terms of the number of variables used, but at the cost of not offering a comprehensive account of the way in which the different variables combine and interact to cause attrition. Structural equation modelling was therefore adopted in order to provide a more detailed explanation.

Structural Equation Modelling (Chapter 11)

The structural equation models represent a further fusion of the data concerning students' background and academic characteristics with the questionnaire responses. The resultant causal models fill out to some extent the gaps in the logistic regression analysis that can be filled only by a process of inference. The investigator is nevertheless still obliged to make a further set of causal inferences in order to interpret the structural equation models. It may be claimed, however, that the gaps in the structural equation models are more easy to bridge: the connections between hypothesised cause and effect are conceptually more apparent than in the logistic regression analysis. Viewing the project in this way allows these two steps – the logistic regression analysis and the structural equation modelling – to be conceptualised as different stages in an ongoing cycle of theory testing and refinement. The structural equation models in their turn generate a further set of testable propositions that could be explored in greater detail and from different perspectives in future.

The design of the structural equation models again suffers from being *ex post facto*, with no experimental control over the variables. The analysis is driven not just by the data, but also by earlier research; it confirms some aspects of Tinto's theory in particular and, at the same time, it introduces some innovative propositions. The analysis is multivariate, allowing the effects of each variable to be identified separately. The results are statistically significant and may be expected to be generalisable at least to some extent. The goodness of fit of the models as a whole is satisfactory without being especially good. The models are parsimonious, and eliminate non-significant variables such as Social Group, Gender and Financial Concerns. However, it is entirely conceivable that some potentially relevant issues have been omitted. It has to be acknowledged that the choice of variables to be tested for inclusion and the interpretation of the model and its various component parts have inevitably been influenced by the investigator's judgement; true objectivity is a desirable but unobtainable objective in this area.

The analysis is conducted at the conceptual level rather than attempting to deal with a myriad of more specific, instrumental reasons for departure. It has been demonstrated that the structural equation models represent a network of hypothesised relations and mediating processes within a common structure and, as such, offer a comprehensive account of the dropout phenomenon. They identify a number of areas for practical intervention as well as a series of propositions concerning causal relationships that can be the subject of further testing; such are the hallmarks of a useful theory.

Telephone Interviews (Chapter 12)

Chronologically, this was the last piece of primary research to be undertaken, although it might have taken place earlier, using a different cohort of students, in order to help shape the conduct of the subsequent quantitative research. Instead, its main function is to exemplify and extend the quantitative work. Part of its strength lies in its authenticity. The reasons for withdrawal are expressed at the perceptual rather than the conceptual level, and abstract theorising cannot provide a substitute for participants' interpretation of the withdrawal process. As an example of a qualitative methodology, it increases understanding of how students interpret and rationalise their departure. The list of issues raised by respondents is longer and potentially more fertile than the more parsimonious and more abstract models developed earlier in this study.

The short-term, practical usefulness of the telephone interviews, when considered in the context of Lenning's schema (1982) described in Chapter 1, is that they manifestly demonstrate institutional concern for those who are leaving, although this purpose would have been better served in this instance had the interviews taken place sooner after the students' departure.

The drawbacks of this type of research, as observed in Chapter 3, are considerable. It was noted in Chapter 12 that the external validity of this procedure was low. It would be wrong to assume that the views expressed by interviewees are necessarily representative of all leavers. The sample was small (75 respondents, or 16.5% of leavers) and possibly biased, insofar as the selection of those interviewed was determined solely by their availability and willingness to help. The internal validity of these interviews is also poor. The opportunity to probe and ask more detailed questions was limited, and there is no way of checking the accuracy of what interviewees said, using in-depth interviews with members of staff or friends, for example. There were no corresponding interviews with persisters, so it is not possible to conclude that the problems alluded to were of sufficient severity and relevance actually to sway the decision as to whether to leave or stay. Furthermore, the analysis offered is unidimensional in character, which is inconsistent with the view that attrition is in many cases a multifaceted phenomenon. There was scope for investigator bias at various stages: in the framing of the prompts for the interviewers, in the actual conduct of the interviews, in the written recording of responses, and in the interpretation and summarising of the written material. Interviews such as these may perhaps best be used as a means by which the researcher can be sensitised to the concerns and perspectives of those who leave early. They are potentially useful at two stages in the heuristic spiral of the development of explanations of student departure: in the development and the confirmation of other types of research work. But it would be dangerous to derive practical policy prescriptions based on exit interviews alone. This conclusion is consistent with the methodological concerns expressed in Chapter 3.

Conclusions on Methodology

It was remarked in Chapter 3 that there has been some discussion in the literature about the desirability of educational research being "evidence-based" and some criticism to the effect that generally it is not. This study demonstrates that qualitative and quantitative methodologies can usefully be used together. Being based on the statistical analysis of the

demographic and other recorded characteristics of almost all of a complete cohort of students, as well as questionnaire responses from almost 2,500 persisters and non-persisters, it may be claimed to be “evidence-based”. Given that the research was supplemented by focus group work and telephone interviewing, it may be claimed also to demonstrate a unique and effective combination of quantitative and qualitative techniques. The use of a multiplicity of different, complementary approaches has been demonstrated to be effective in practice.

Substantive Findings

Descriptive Statistics (Chapter 4)

At the simplest level, the descriptive statistics shown in Chapter 4 demonstrate that various variables are associated with retention: Faculty Grouping, Gender, Social Class, Tuition Fee Status, Provenance (i.e. geographical location of home residence), Residential Category, Age, Entry Qualification Route, and Entry Point Score. These variables were subsequently retained for statistical analysis, and others were discarded for a variety of reasons.

In particular, geographically based educational advantage scores and standardised participation ratios were not retained, because it seemed that greater variability in retention rates could be attributed to social class. It was argued that social class is a characteristic that may be associated with particular individuals, whereas the use of any geographically-based measures of social inclusion inevitably introduce an additional source of variation, unless statistically controlled. The avoidance of such ecological variables is in marked contrast to SHEFC’s present-day use of postcode-based allocations to institutions, for example, which are designed to encourage wider participation in higher education (SHEFC, 2003, for example).

Logistic Regression Analysis Based Only on Students’ Background Characteristics and Prior Academic Achievements (Chapter 5)

It has also been demonstrated (Chapter 5) by using multivariate statistical techniques that the univariate associations described above can be misleading. After controlling for the

effects of other variables, it transpired that the following variables have the clearest associations with retention: Faculty Category, Age Category, Residential Category, Entry Qualification Category and Entry Point Score. These variables are included in Model Four in Chapter 5. Models Five and Six in that chapter include gender as a sixth variable, along with various interaction terms.

It is not self-evident why Faculty Categories should be important. It is possible that some Faculty Categories tend to attract students who are more predisposed than others to persist, perhaps because of stronger motivation, greater self-confidence, or more favourable family and financial circumstances. Alternatively, the academic and pastoral support may be better in some Faculty Categories than others, leading to differential retention rates. Unfortunately, the analysis sheds no light on which of these two sorts of explanation, which need not be mutually exclusive, is correct.

The effects of Residential Category are also open to a similar duality of interpretation; it is not known whether a form of self-selection is in operation, or whether the observed effects are, indeed, attributable solely to living in different types of accommodation. Living away from one's parental home in University Accommodation is relatively expensive, so that it could be argued, for example, that strong family support, both moral and financial, are prerequisites for being in this form of accommodation. Such support may also engender in students the characteristics associated with persistence, so that their success is in-built from a relatively early stage. On the other hand, it can be argued that living in University Accommodation insulates students from many of the chores of everyday life, and makes daily commuting easier. It also provides good opportunities for social interaction and making new friends, and perhaps these factors alone are sufficient to ensure higher persistence rates. In short, in this *post-hoc* analysis, it is not possible to control for the possible effects of self-selection, and the results are consequently open to more than one interpretation.

At this stage in the research, it is difficult to explain why Age Category should be relevant (odds ratio 1.62 in Model Four in Chapter 5). Presumably there are included amongst those over 19.5 years at entry none of the direct entrants from school, and relatively few of those who have had a single gap year. Perhaps some form of quasi-permanent disengagement with the educational process immediately after leaving school is damaging to subsequent academic progress. Further research is still required to settle this issue.

The importance of Entry Qualification Category signifies that extra value may be ascribed to entry qualifications obtained relatively early in an individual's school career. This observation is intuitively plausible and potentially useful in practice.

Entry Point Score is shown to be an important variable, although by no means uniquely so. However, the statistical results may be deceptive. Such is the nature of the research design that there is no way of knowing with certainty how individuals who were refused admission because of inferior grades might have fared in practice. If, hypothetically, some such individuals had been admitted and if, hypothetically, a large proportion had subsequently withdrawn, then the importance of this variable would have been seen to be greater than appears to be the case from the experience of those relatively well qualified individuals who were admitted.

It seems that having lower Entry Point Scores may be more detrimental to males than to females. It is, however, possible to construct equally plausible models that either bear out or refute this contention. It seems quite probable that there are additional factors in play that have not been explicitly identified. Model Six, for example, is consistent with Smith and Naylor's (2001) probit analysis, which suggests that males are more prone to drop out than females, and that the marginal effect of school leaving qualifications is greater for males than for females.

The multivariate analysis suggests that, after controlling for the other variables, Social Group *per se* is not relevant to retention, although the univariate analysis suggests that there are some concomitant variables that certainly are.

Introduction of Attitudinal Variables to the Logistic Regression Models (Chapters 8 and 10)

Thereafter, it became necessary for practical reasons to focus the quantitative analysis on Summer Leavers (Chapter 10). Some differences were detected in the multiple logistic regression analyses for Pre-Summer Leavers and Summer Leavers separately (Chapter 8), and these are discussed in the context of the structural equation models below.

Various attitudinal constructs were introduced with a view to improving the predictive power of the models and, in particular, to add an explanatory dimension to the analysis that had hitherto been largely absent (Chapter 10). The main substantive finding arising from

this part of the investigation is the importance of the Commitment construct in influencing summer retention rates. Commitment was measured for the purposes of the logistic regression analysis by responses to the following propositions:

- I’ve really enjoyed my experience of university so far
- I should have gone to a different university or college where the academic work is more relevant to getting a good job afterwards
- I should have gone to a different university or college where the academic work is easier
- I should have gone to another university or college where my friends are
- I’m committed to getting a university education
- Coming to the University of Glasgow rather than another university was the right decision for me
- I am considering leaving the University of Glasgow
- I wouldn’t want to leave the University before graduating, because this would waste the money I’ve already spent on being here

Variation in levels of Commitment was found to have a stronger association with summer retention than variation in Entry Point Score.

The second most important finding is that strong Social Integration, coupled with relatively weak Commitment, is detrimental to persistence. Social Integration was measured for the purposes of the logistic regression analyses by responses to these items:

- There are not enough student societies or clubs for people with my interests
- I have lots of new friendships with other students
- I don’t really feel part of the University of Glasgow
- Few of the students I know would be willing to listen to me and help me if I had a personal problem
- I feel excluded from other students’ social activities
- There is no-one in the University to whom I could turn for help with any personal problems

A third striking observation from this stage of the work is the importance of time spent studying. This was measured both directly, in terms of the number of hours spent studying,

for example, and indirectly, through students' views concerning the constraints on the amount of time available for university work. Academics had criticised a perceived "clubbing" culture. It can be seen that the manifest variables for the Social Integration construct do not include any specific reference to "clubbing" or even directly to one's "social life". It may nevertheless be inferred (although it can only be a matter of conjecture) that the reason why strong Social Integration, when combined with weak Commitment, is so damaging to retention is that it, too, results in relatively little academic work being accomplished, and with minimal enthusiasm.

Other variables that appear from the multiple logistic regression analysis to be relevant are Financial Concerns and Age Category. This is the only point at which Financial Concerns enter into the modelling in this study. It is contended that this is not a prime cause of first-year attrition, although there will be exceptional cases. This would be consistent with the findings from the telephone interviews. The possible significance of the age of 19.5 years has already been mentioned. It is also conceivable that the appearance of Age Category in the second multiple logistic regression equation, coupled with the disappearance of other variables, might point to the fact that older students perhaps have lower Academic Integration and Academic Self-Concept, and are more concerned about academic Help and Feedback, as well as financial matters. This is by no means certain, but it is consistent with the focus group outcomes. The odds ratio for Age Category, when combined with attitudinal constructs, is roughly 3.00, which is much higher than when combined with background characteristics, instead. It seems that it is another ecological variable, akin to gender and Social Group, and is not especially helpful in improving one's understanding of why some students may be more prone to persist than others.

In purely predictive terms, the multiple logistic regression models of summer persistence containing attitudinal attributes are superior to those that contain only background characteristics and prior academic achievements. The latter correctly classify two-thirds of students correctly; the former classify three-quarters correctly, which is a good result.

Structural Equation Models (Chapter 11)

The structural equation models demonstrate firstly that withdrawal during the summer months of the first year of study is unlikely to be an isolated and unpredictable incident in a student's life. Not surprisingly, such an individual is likely to possess a range of views

and perceptions that are measurable beforehand, as well as other attributes, that make her or him more likely to leave. It also appears that social factors and academic factors weigh almost equally in their relevance to attrition. This finding is important, not least because Degree examination performance was not taken into account as an academic factor in this calculation. The descriptive power of the structural equation models is still limited, however, insofar as they do not include any account of the teaching and learning experiences provided. The availability and effectiveness of the University's different support services are also not taken into account.

The structural equation models clarify to some extent why higher Entry Point Scores are associated with higher retention rates. Their association with Academic Self-Concept seems convincing, given that the latter construct appears also to have other antecedents acquired earlier in life and before leaving school. The structural equation models demonstrate that the effect of Entry Point Score on Summer Persistence is not direct, but that there are various other intervening variables. This is both plausible and encouraging, because each of these attitudinal variables represents a potential leverage point for practical intervention. It can also be seen that there are trade-offs between Entry Point Score, Academic Effort, and Help and Feedback in terms of their effect on Academic Self-Concept. The practical implications are that help, including self-help in the form of greater effort, can positively influence Academic Self-Concept as well as compensate for relatively weak Entry Point Scores.

The structural equation models throw light on the idea that attrition can in many cases be attributed to students having chosen the wrong subject (Yorke *et al.*, 1997; Ozga and Sukhnandan, 1997). This proposition would manifest itself in low Academic Integration. But it can be seen that Academic Integration is generally not an isolated, 'standalone' variable; it is the consequence of a rather long causal chain of effects. This is also a useful finding, because it demonstrates that intervention on any of a variety of fronts is likely to have a beneficial effect on Academic Integration. Some students may, indeed, have simply chosen the wrong subject. But more usually this seems to be a perception that can more clearly be viewed using the conceptual framework of the structural equation models. One practical implication is that ensuring that applicants are better informed from the outset is a necessary but not sufficient step towards improving Academic Integration generally.

The lack of clear Expectations for the Future among students in the General Faculty Category is credible, given the generally non-vocational nature of the curricula followed,

and lends plausibility to the model as a whole. It is not known whether self-selection is present, but one policy prescription – better career counselling for the students concerned – could well prove effective whether or not self-selection is present.

The structural equation models demonstrate clearly the importance of the social, non-academic aspects of student life in affecting Summer Persistence. As much as half of students' Commitment is attributable to Social Integration. This is an important new finding, not reported thus far in the literature. This result points to the desirability of much enhanced general, pastoral support for first-year students, and this conclusion is reinforced by the manifest association between Social Integration and Extraneous Problems. The analysis is also novel in that it identifies the highly deleterious effect of high levels of Social Integration on the Summer Persistence rate and, arguably, this further reinforces the need for a more proactive stance on the part of the institution in order to improve retention rates. This issue was first identified in the CHAID (Chapter 10), which identified among the Summer Leavers a significant number of individuals having low Commitment but high Social Integration, suggesting that some students fail to engage with the academic process, and are overly concerned simply to enjoy themselves, irrespective of the long-term consequences.

The structural equation models demonstrate that the beneficial effect of living in University Accommodation, previously observed both in the descriptive statistics and in the logistic regression analysis, is via the mediating variables of Social Integration and Commitment, rather than through any of the constructs associated with Academic Integration. This seems plausible, and is perhaps a further reassuring affirmation of the cogency of the models.

The exogenous variables, General Faculties Category and University Accommodation, are possibly subject to self-selection, as in the logistic regression analysis, and their role in the causal models is correspondingly ambiguous. It is not clear whether these variables represent the type of students attracted to these particular parts of the organisation, or whether the role of these variables in the models is to demonstrate the effect on students of these particular organisational entities.

Ecological variables such as age, social class and gender appear not to be the best predictors of Summer Persistence. While there may be correlations of varying degrees between these variables and attrition rates, it is possible to discard them in favour of

variables having better statistical significance in these more comprehensive, descriptive models.

The structural equation models also demonstrate that although first-year students may have legitimate financial concerns, this is not one of the prime drivers of attrition, at least at this relatively early stage in a student's career. This may change as the burden of debt accumulates with the subsequent passage of time, however.

The structural equation models may be used to elaborate upon the interpretations of the logistic regression results in Chapter 8, where the distinction was drawn between Pre-Summer Leavers and Summer Leavers. The main intention was to ensure that the logistic regression analysis techniques previously applied to all leavers would still be applicable to Summer Leavers when taken on their own. This was confirmed and, in addition, some interesting differences between the two categories of leavers were detected. The structural equation models can now be used to derive additional explanations of these differences, of which there were three.

First, it was discovered that attrition in the General Faculty Category took place relatively early in the year. (It was 'front-loaded'.) It was also subsequently observed that students in this Faculty Category also held relatively low Expectations for the Future. It is therefore of interest to speculate whether this correlation is simply coincidental, or whether the two phenomena are related in some way. If they are connected, it may be supposed that the lack of any clear goals is felt most keenly at the beginning of a student's university career, when the effects of separation, in terms of Van Gennep's theory, are at their strongest, and before the transition and incorporation phases are complete.

Secondly, it appeared from the logistic regression analysis that older students were inclined to persevere for longer than their younger counterparts. It was supposed on the basis of what had been said in the focus group meetings that this was because older students are more strongly motivated. Age does not appear as a relevant variable in the structural equation models. It may therefore be concluded that factors such as Academic Self-Concept and Academic Integration do, indeed, offer better explanations of attrition, and that age owes its significance in the logistic regression models to the fact that it is correlated with one or more of the constructs appearing in the structural equation models. This provides at least a modest affirmation of the contentions made above concerning older students.

Thirdly, it was noted that students in University Accommodation were more likely than others to stay until the end of the teaching year. It was thought that this was perhaps either (a) because they were already financially committed to pay a full session's rent, in any case, or (b) because they wished to take advantage of the social ambience of University Accommodation for as long as possible. The association in the structural equation models between Social Integration and staying in University Accommodation lends weight to the second explanation, while not excluding the first.

The structural equation models have useful policy implications, commensurate with their descriptive detail, and these are elaborated upon below.

Telephone Interviews (Chapter 12)

The qualitative research serves both to reaffirm some of the quantitative findings, and to add some supplementary information, as noted above.

For example, it will be recollected that interaction with faculty is considered to be an important part of Academic Integration in Tinto's model. However, in order to maximise response rates and improve validity, this particular subject was not explored in the questionnaires. It may be supposed from the exit interviews that, while the reasoning behind the questionnaire design might or might not have been justified, the quality and frequency of students' interaction with academic staff is probably a significant component of Academic Integration, but one which is not present in the structural equation models.

The idea that some decisions to leave may be protracted over a period of time, and that the officially recorded leaving dates, in cases where they are indeed recorded at all, may be considerably later than the effective leaving dates, is supplemental information, not obtainable by any other route in this study.

As well as extending the range of topics explored, the telephone interviews are also helpful in supplying details of the more general constructs found to be of statistical significance in the empirical models. This makes the empirical models more convincing, and makes it easier to suggest practical solutions. The step jump from school to university, described by interviewees, as well as by both students and staff alike at the focus group meetings, gives some substance to the idea of Perspicacity at Matriculation incorporated in the structural

equation models. Similarly, references to bereavement and difficulties with childcare facilities perhaps exemplify the more generic construct of Extraneous Problems.

Conclusions on Substantive Findings

The substantive conclusions described above are of significance in their own right. Different parts of the research have yielded different outcomes, and the overall effect is essentially cumulative. It is not clear that so much would have been learned, had the various stages of the study been tackled in a different order or in a less dynamic manner. For example, the focus group meetings suggested that student and staff perceptions were by no means exceptional at the University of Glasgow, and that much could be gained by utilising the literature on student attrition for the purposes of framing the questionnaires. The exploratory principal components analysis described in Chapter 9 was one of the stepping stones used to substantially clarify and develop the putative path model shown in Appendix 6.9 in such a way as eventually to generate the models of the type shown in Appendices 11.4.1 to 11.4.12. Some of the practical implications of the findings and their implications in the context of research in this area generally are considered below.

Practical Policy Implications

The purpose of this study is not to elaborate to any great extent on the policy prescriptions that follow from the research. Specific policy implications are constrained both by the methodology and scope of the research but it is, nevertheless, possible to make a few statements of practical import.

The difficulties associated with the *ex post facto* experimental design have already been described; it is not possible to list a set of interventions that have been demonstrated in practice to reduce first-year student attrition. One can only identify a series of variables that appear to be associated with retention rates, and suppose that policies that influence these variables would also have knock-on influences on retention. The lack of statistical control in the design and the possibility of self-selection, in particular, imply that the degree of certainty that may be ascribed to these secondary effects is limited.

The study has focused directly on only student-related variables; some institutional variables could conceivably be just as important, and might interact with the student-

related variables in very discernible ways. Furthermore, it has been possible only to assess the effects of attitudinal constructs on Summer Leavers, rather than all first-year leavers. These considerations also constrain the scope of the practical policy prescriptions that may be adduced, as well as reducing the confidence that may be expressed in their likely efficacy.

Some relatively minor policy prescriptions have already been mentioned above. More generally, it may be said that each explanatory variable in the logistic regression equations and each construct in the structural equation models has the potential in practice to influence retention, and policies that have a favourable impact on these variables may be anticipated to have a positive influence on retention.

Rather than work through these variables systematically, some of the more important policy implications that follow from this study for the different institutional stakeholders in the higher education sector are identified below. It will be observed that these recommendations are derived at least in part from the qualitative aspects of the research, as well as from the quantitative parts. The recommendations made do not by any means constitute a comprehensive strategy for tackling retention; they reflect only what has been learned in this study.

For Government

The provision of higher education for those who display little or no commitment to their own betterment, to their institution, or to the objectives of higher education generally is likely to be money wasted. The successful widening of participation will be achieved not just by ensuring that more school leavers have the requisite qualifications, but also that they have a true commitment to and realistic expectation of the academic environment which they are entering. The view of the Robbins Committee, “that courses of higher education should be available for all those who are qualified by ability and attainment to pursue them and who wish to do so” (Committee on Higher Education, 1963, p. 8) – with emphasis on the final phrase – seems as true today as it was over 40 years ago when it was first articulated.

For the Funding Councils

First, Smith and Naylor (2001) have pointed out that the Funding Councils' institutional performance indicators have serious flaws of a statistical nature. The publication of these statistics implies that there exists a degree of dependability in their calculation that cannot be substantiated. By focusing on student-related factors, this study has demonstrated that there are in existence many factors that influence retention over which institutions can at best exert only indirect control (Family Support and Extraneous Problems, to name only two). Whatever is being measured by these indicators is only in part "institutional". Given the importance placed on these indicators nationally, there is a great need for them to be redefined to meet these objections, and for the considerable limitations of the existing statistics to be clearly explained.

Secondly, state finance should be targeted on individuals rather than postcodes in order to maximise the impact of strategies for widening participation in higher education. Current practice is wasteful in this respect, and appears to depend unduly on an over-simplistic analysis of the issue. Policy should be determined from a more careful evaluation of the evidence, and the avoidance of ecological fallacies.

For the Higher Education Statistics Agency

The existing set of reasons for student departure that the Higher Education Statistics Agency requires institutions to use in their routine statutory returns serves little if any purpose. HESA should reassess the reasons why it collects this information. If it is required at all, it might be legitimate to focus on short-term instrumental reasons for withdrawal, or it might be considered more worthwhile to explore the phenomenon at a more conceptual level, for example. It should be appreciated, however, that understanding the causes of student attrition can be very difficult. At the very least, the existing system should be changed to allow for more than one reason to be cited for each individual's withdrawal. It should also be made possible to cite institutional reasons for departure as well as causes attributed to the students themselves.

Recruitment and Admission

The University should continue to use Entry Point Score as a criterion for entry. Perhaps relatively greater emphasis should be placed on qualifications obtained in fifth year, where this is not already the case. There is clear evidence that Commitment during the first year of study plays an important part in determining retention rates. It may therefore be supposed that Entry Point Score might not need to be so rigidly adhered to in cases where applicants can demonstrate strong commitment, in particular. Other factors demonstrated to be relevant at the time of matriculation are self-assuredness and perspicacity, and these might also be taken into account. Family support is a very important asset for younger students, in particular, so recruitment programmes should be designed to appeal to and inform the parents of intending students as well as the applicants themselves. Clear advice needs to be given to applicants concerning the cost of being at university, and of the need to devote a particular amount of time to study each week. Efforts should be made to convey to applicants a sense of the ambience of everyday student life. Of greatest importance, however, is the need for clarity concerning the academic expectations that the University has of students attending particular courses. This is mentioned again below.

Students on Course

Behind the constructs of Self-Assuredness and Perspicacity at Matriculation, in particular, lies the perception, on the part of at least some academic staff, of the apparently widening divergence in expectations between new students on the one hand and staff on the other concerning the learning environment and, more specifically, levels of academic support provided. This appears to be a product of the differences in the nature of provision between university and school, as well as the widening levels of ability nowadays apparent in the student population. The University is hugely constrained by resource limitations in its ability to address what appears to be a systemic problem. A strategic response is therefore essential; a policy of gradually and tacitly debasing academic standards will eventually prove to be self-defeating.

Such a strategy would need to start with a carefully researched statement of the problem and a recognition that academic time, in particular, is finite. The elements of such a strategy would include:

- Radically new teaching practices that allow teaching staff to be more approachable and to be more personally engaged with the progress of their students, in order to combat what has been described as the current “impersonal, self-coping culture”;
- A clear statement – often repeated – of the academic expectations which the University has of students and of the academic environment to which they will be exposed;
- More effective communication with potential applicants concerning the “true culture of the place”;
- Early feedback on new students’ academic progress;
- Early identification of students at risk; and
- A clear and well-publicised system whereby students may (or may not) opt to change courses, at least at the beginning of the academic year.

Induction

Also behind the concepts of Self-Assuredness and Perspicacity at Matriculation lies the idea of an induction programme – already well established in the University – but which might with benefit be extended to run through most if not all of the first year. The purpose here is not to write a comprehensive syllabus for such a programme, but to point out the desirability of it incorporating the following features, which follow from the findings of this study:

- Reinforcement of the messages for applicants described above;
- Mechanisms to facilitate social integration (at least in moderation), particularly for commuter students;
- Advice concerning the necessity of studying for a certain number of hours each week, and how this is to be achieved in practice;
- Deterrence from excessive socialising that erodes academic study time;
- Information concerning the various support services that are available to students; and
- Recognition of older students as a separate group, with different needs and aspirations.

Support Services

Academic Help and Feedback is clearly relevant under the heading of support services, and has been mentioned above. It seems germane also to call for a fuller acknowledgement in terms of the levels of help and counselling provided for students experiencing Extraneous

Problems, exemplified by rather nebulous ‘personal problems’ and more specific concerns of a non-academic nature, such as Financial Concerns and difficulties with accommodation. There is also quantitative evidence that the lack of a clear sense of academic and career progression (“employability”) amongst students in the General Faculty Category is damaging to retention. This, too, should be addressed.

Leavers

The main challenge for the University is to bring about systemic change in teaching and learning practices that will boost students’ Academic Integration and Commitment. But where this fails it might be possible to do more to help those who are “slipping away”. About two-thirds of leavers appear not to inform the University that they are withdrawing. In many cases, this appears not to be a precipitate decision, but rather one that evolves over a period of time. It appears that in about fifty percent of cases the process is not complete until the summer months. Increased endeavours should be made to keep channels of communication open with non-attendees, in order to be able to offer assistance and encouragement to persevere, in cases where this seems worthwhile. Those students suffering a prolonged period of illness or incapacity, including those who have experienced a serious physical assault, might be particularly amenable to this form of help.

Reflections on the Literature and Recommendations for Future Research

The earlier, quantitative results (Chapters 4 and 5) are broadly consistent with the results reported by Lenning (1982), Woodley, Thompson, and Cowan (1992), HEFCE (1999a *et seq.*), Morgan, Flanagan, and Kellaghan (2001), Smith and Naylor (2001), and the National Audit Office (2002), for example. This study does not include such a comprehensive analysis of students’ background and academic characteristics as that which Smith and Naylor, in particular, have been able to produce, using a much larger data set. However, the present purpose is not simply to detect the correlates of attrition, but also to try to demonstrate at least some of the underlying causation.

It was reported in Chapter 2 that Yorke *et al.* (1997) had identified “lack of commitment to the programme” and “chose wrong field of study” as being two of the prime reasons why students leave early. This study partially corroborates each of these contentions. Whereas

Yorke focuses on commitment specifically “to the programme”, the evidence presented in this study suggests that commitment is a broader construct, based on wider loyalties and motivations. The conceptual framework put forward in this study also allows Yorke’s second proposition to be contextualized in such a way that various policy interventions can be identified hopefully to avert the problem. It is also noteworthy that studies such as Yorke’s, which depend exclusively upon respondents’ accounts of events that have taken place previously in their lives, omit any mention of the damaging effects of excessive socialising that have been detected in this study.

This study bears out Ozga and Sukhnandan’s (1998) emphasis on the lack of preparedness as one of the antecedents of attrition, although in the somewhat different and more closely defined vocabulary of the structural equation modelling. Ozga and Sukhnandan also point to the compatibility between students and their courses and institutions as being important. This, too, is borne out by this study, albeit at the more abstract level of the concepts of Academic Integration and Social Integration.

Tinto

The structural equation modelling follows in the tradition of Spady (1971) and Pascarella and Terenzini (1980), for example, in that it offers a rationale to explain the underlying dynamics of attrition. The original inspiration for the formulation of the structural equation models came from Tinto’s Student Integration Model. However, both the structure and content of the final structural equation models are different from the causal paths adduced from Tinto’s work by Braxton, Sullivan, and Johnson (1997), for example. It will be recollected that these authors found that relatively few of the tenets incorporated within Tinto’s model had been substantiated in practice. It is nevertheless of interest to compare the causal paths established in this study with those that Braxton, Sullivan, and Johnson considered to have strong support in the literature. Table 13.1 summarises the position. In essence, the models proposed in this study eliminate the distinction between initial and subsequent commitments, as well as between institutional and goal commitment. They also use a different definition of Academic Integration. These amendments, along with the introduction of other constructs not present in Tinto’s theory, appear to produce a satisfactory outcome. The two main propositions retained from the literature are that Social Integration promotes Commitment, and that Commitment, in turn, is a direct antecedent of persistence, itself.

Braxton, Sullivan & Johnson, 1997 (Chapter 2):			Current Study: (Chapter 11):
Fifteen Testable Propositions From Tinto's Model (‘→’ represents causation)	Appendix 2.5 Supported (Single Institutions)?	Appendix 2.6 Supported (Multiple Institutions)?	Supported (Single Institution)?
1. Entry characteristics → Initial institutional commitment	✓	-)
2. Entry characteristics → Initial goal commitment	-	✓)
3. Entry characteristics → Persistence	-	-)
4. Initial goal commitment → academic integration	-	-	) Initial commitments not) measured;
5. Initial goal commitment → Social integration	-	-	) direct influence of) Entry Characteristics on
6. Initial institutional commitment → Social integration	-	-	) Summer Persistence not) established
7. Initial institutional commitment → Academic integration	-	-)
8. Academic integration → Subsequent goal commitment	-	-	✓) But goal and) institutional
9. Social integration → Subsequent institutional commitment	✓	-	✓) commitments) not distinguished
10. Initial institutional commitment → Subsequent institutional commitment;	✓	✓)
11. Initial goal commitment → Subsequent goal commitment	✓	✓	) Initial commitments not) measured
12. Subsequent goal commitment → persistence	-	✓	✓) But goal and) institutional
13. Subsequent institutional commitment → Persistence	✓	-	✓) commitments) not distinguished
14. Goal commitment ↔ Institutional commitment	-	-	- Ditto
15. Academic integration ↔ Social integration	-	-	✓

Table 13.1 Support for the Fifteen Testable Propositions Derived from Tinto's Student Integration Model

In Chapter 4 it was reported that Degree examination appearances and performance seem to be associated with retention. However, for the purposes of this study it was decided that examination performance should be treated as an outcome variable, rather than as an explanatory variable, although it is acknowledged that this treatment is exceptional by comparison to the work of other researchers in this field; most writers include GPA as an indicator of Tinto's Academic Integration construct, for example.

Model C in Chapter 11 is consistent with Tinto's contention that Academic and Social Integration are mutually supporting, at least to a modest extent. This is not one of the

strongly supported propositions that follow from his theory, according to Braxton, Sullivan, and Johnson (1997), so this result is of academic as well as practical interest.

Overall, it seems that while Tinto's model has served as a useful catalyst for the creation of a causal framework upon which to base the primary research for this study, only relatively few of the original propositions contained within it have been substantiated in practice. However, given the apparently sparse support for these propositions in the literature generally, this is perhaps not surprising.

Various attempts to elaborate upon Tinto's theory were described in Chapter 2, and various studies of the relevance of particular constructs were mentioned. The relevance of the following constructs appears to have been substantiated in this study: Expectations for the Future, Family Support, Academic Self-Concept, and Academic Effort. On the other hand, Financial Concerns seem to be of only marginal importance. This seems consistent with Lenning's contention (1982 – see Chapter 2) that blaming financial difficulties may be a convenient way of externalising one's decision to withdraw. The use of persisters as control subjects in this study makes it possible to offer a truer assessment of the relative importance of this variable.

HEFCE

It is possible now also to comment further on the reasons for student departure given by HEFCE to the House of Commons Select Committee on Education and Employment (HEFCE, 2001 – HE137), already cited in Chapter 2.

“Incompatibility between the student and their [sic] course or institution...”

In the language of the structural equation modelling, this is a combination of Academic Integration and Commitment, both of which affect retention. What the structural equation models demonstrate, though, is that these are not standalone, independent phenomena; there are antecedents in play that may result in poor Academic Integration and Commitment.

“When applying to an HEI, students do not always have sufficient information on the institution or course...”

There may be practical reasons why for some students this is a genuine problem and, for others, it appears not to be. These may be issues that need to be addressed by institutions. The structural equation models suggest, however, that, given an even playing field, some students may be more adept at or may be better placed to acquire the requisite course information, because of their greater Perspicacity at Matriculation. This, in turn, stems from higher levels of Self-Assuredness at Matriculation and Family Support.

“This can lead to difficulties if the academic or social reality does not meet with the student’s expectations.”

The models test the matching of expectations to reality in the academic sphere, but not the social sphere. They do bear out the importance of meeting academic expectations, while at the same time pointing out the relevance of other, associated variables.

“Lack of preparation for the HE experience. Some students do not have the self-management skills to live away from the parental home, or the study skills to cope with HE.”

The structural equation models neither confirm nor refute the assertions concerning preparation or general life skills. They do, however, confirm the relevance of some (but not all) of the components of study skills, such as Academic Effort and Academic Self-Concept. They also highlight the dangers of excessive Social Integration.

“Lack of commitment to the course. Parental or peer group expectations are often the main reasons a student applies to HE; obtaining a degree can often be low down on the list of reasons for applying.”

Commitment is certainly very important. Parental support is more often beneficial than detrimental. Whether Subsequent Commitment, using the terminology of Tinto’s schema, is necessarily related primarily to the reasons for applying to university, as supposed by HEFCE, is not clear. It seems more likely that there are other, intermediating variables.

“Financial hardship. Such hardship was frequently cited as an influence on withdrawal, though the researchers found that this was a supplementary rather than the sole reason.”

It appears from this study that to downplay the role of financial hardship is appropriate, at least with regard to first-year students.

“Poor academic progress”

This would manifest itself in a combination of low Academic Integration and, perhaps, low Academic Self-Concept in the structural equation models. Academic progress, as such, was not examined explicitly in this study. The period of time used for the analysis was too short for compulsory withdrawal to be a significant issue; only a very small number of students are required to withdraw by the beginning of the second year of study because of lack of academic achievement.

In short, there appears to be fairly good consistency with HEFCE’s views, although it is not perfect. The main omission from HEFCE’s analysis is the failure to recognise the importance of Social Integration and, more specifically, the pernicious effects of weak Commitment, coupled with high Social Integration.

Bourdieu

The analysis presented in Chapter 11 is couched in terms of the motivations of individuals, and seeks to identify the realities and perceptions that guide their thought processes through to the point when they either withdraw or persist. The unit of analysis is the individual student.

It is perhaps also possible to contextualize the models using a higher level of analysis than the individual. One of the ideas introduced in Chapter 2 was that students would be most likely to persist at those institutions having levels of organisational cultural capital most closely equivalent to their personal levels of cultural capital (Berger, 2002). This proposition is founded in the work of Bourdieu although, conceptually, it is similar to Spady’s construct of normative congruence. Testing this particular implication of Bourdieu’s theory of social reproduction would require research to be carried out at a number of different institutions, and is consequently outwith the scope of this study.

However, a further, level-one proposition that follows from Bourdieu’s theory is that “Students with higher levels of cultural capital are more likely to persist, across all types of institutions, than are students with less access to cultural capital” (Berger, 2002, p. 114).

This idea can be tested using data from individual institutions in order to build up evidence in support of it. Berger notes that cultural capital is not easy to measure, because it is a symbolic rather than a material resource. He suggests, though, that it should be measured “in terms of students’ knowledge about and manifestation of manners, styles, and norms that generally are believed to be found in the social interactions of the upper socioeconomic stratum” (p. 117 - 8). It may then be argued that Expectations for the Future, as defined in the causal models, are an indicator of this construct. They may also be taken as a manifestation of organisational cultural capital to the extent that they reflect students’ beliefs concerning the high value placed on degrees awarded by the University of Glasgow and the attendant high societal status attained by those having acquired these degrees.

It was noted in Chapter 2 that Bourdieu’s concepts of cultural capital and habitus are closely related. Habitus may be thought of as a set of predispositions acquired in the earliest part of socialisation, and which determine subsequent choices in life. This bounded rationality manifests itself in terms of preferences, attitudes and behaviour patterns. In the context of this study, high levels of Family Support, Self-Assuredness at Matriculation, Perspicacity at Matriculation, and Academic Self-Concept may all be taken as evidence of the attitudinal dimension of an ingrained habitus that promotes persistence at university. Having good school leaving qualifications and living in university accommodation may be said to be examples of the behavioural and preferential aspects of the same phenomenon. Berger further posits that students having higher levels of cultural capital are more likely to become integrated into the academic and social systems, and it seems that the extent of such integration might well be demonstrated in the constructs of Academic and Social Integration as they appear in the structural equation models. The structural equation models might therefore be interpreted as representing the mechanism by which social inequalities are transmitted from one generation to the next. This is an interesting possibility that has not yet been tested.

The logistic regression analyses and the structural equation models both highlight the importance of school leaving qualifications; however, the logistic regression analysis suggests and the structural equation models confirm that there are other factors involved in determining attrition rates. This is consistent with Bourdieu’s view that participation in higher education cannot be explained simply in terms of intelligence or giftedness. On the other hand, correlations between Social Group on the one hand and the levels of these

other factors on the other have not been established in this study. The rather weak partial correlations between Social Group and the various constructs in the models shown in Chapter 11 suggest that there may be some form of social reproduction in progress, but it is not one that can readily be interpreted in terms of the 1990 Standard Occupation Classifications, at least. It is conceivable, however, that by excluding entrants having non-school-leaving entry qualifications, variability in those constructs relevant to Bourdieu's theory may have been attenuated to such an extent that the models are not capable of demonstrating the relevant linkages. In short, Bourdieu's theory seems attractive as a basis for explaining attrition, but does not appear to be supported by the data as an explanation of dropout rates in the later part of the first year of study. It is conceivable, though, that a study of different types of withdrawal using a broader range of students at, preferably, more than one institution might yield different results.

The structural equation models are parsimonious, having omitted most of Lenning's (1982) list of variables found to be associated with retention rates. The decision to include expectations, following Tinto (1993) and Braxton, Vesper, and Hossler, (1995), seems to have been vindicated. It also transpires that Academic Self-Concept (Spady, 1970; Kanoy, Wester, and Latta, 1989) and Family Support (Lenning, 1982) have pivotal roles in the models. On the other hand, the results do not bear out aspects of Bean's later formulations (1982a, 1983) of his model, which exclude pre-matriculation characteristics.

It seems important that the ground gained should not subsequently be lost. Reference was made to the importance of Entry Point Scores, for example, as a determinant of retention. It would be important that this should not be overlooked in future research of a similar nature. The failure of the logistic regression analysis adequately to incorporate the attitudinal constructs but the subsequent success of the structural equation models confirms the potential usefulness of the latter in research into student retention. Methodological triangulation, used correctly, has been demonstrated to be very effective.

Conversely, some of the weaknesses of the current study would best be avoided in future. The shortcomings of the research design have been alluded to. They are by no means unique to this study, however. Secondly, there is a need, which is particularly acute in the UK, for adequately validated survey instruments designed to facilitate this sort of research. The re-interpretation and reconstitution of the constructs underlying the questionnaires used in this study might not have been necessary, had there been in existence generally recognised instruments ready for the purpose in hand.

The important, new findings, in particular, should be tested further. This comment applies particularly to the observation that Social Integration appears to be an important determinant of retention, and that there may be a significant minority of students who are simply not motivated to succeed academically at university. More generally, each of the paths in the causal models constitutes a testable proposition.

The study produces certain promising lines of general enquiry that also merit further investigation. Extensive reference has already been made to Bourdieu's theory of social reproduction. In addition, there is conceptually a clear overlap with some of the seven life-task orientations that Brower (1992) borrowed from the field of cognitive social psychology and this, too, seems to be a promising area for further work, given that the initial interpretations of the structural equation models were framed in terms akin to those used by Brower. Thirdly, this study says nothing about Astin's concept of involvement, defined in terms of students' reported behaviours. It could be beneficial explicitly to meld together behavioural and perceptual constructs in a single model. This, too, remains a matter for the future.

Finally, it appears that the cultural differences between UK and North America are not so great that ideas emanating on one side of the Atlantic cannot usefully be transported to the other. There is ample opportunity for symbiosis between the two developing schools of thought; they are really not so distinct as may be imagined.

