PREDICTIVE MODEL FOR SUCCESS IN ALGEBRA: A CASE STUDY

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Dissertation submitted in partial fulfillment of the requirements for the degree of Master of Science in Business Statistics

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Declaration of the Candidate and the Supervisor

I declare that this is my own work and this dissertation does not incorporate without acknowledgement any material, previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief that it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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Abstract

The objectives of this study were to identify noncognitive variables that would help to predict success (pass or fail) in Algebra and use these variables to develop and validate a statistical model to predict the outcome (pass or fail) of Algebra. First year students enrolled in Algebra (n=164) at a private higher education institute were surveyed on their past achievement, educational goals, parents' educational qualifications. A modified version of a validated noncognitive questionnaire was administered in this study. Significant categorical and continuous noncognitive variables were identified using chi square test of association and test for independent samples respectively. The significant categorical and continuous variables were used as explanatory variables in binary logistic regression with grade in Algebra (pass or fail) as the dichotomous response variable. The best-fitted model was identified using Backward Wald method. The model developed was significant, explained 56.2% the variance of the response variable based on Nagelkerke R^2 and correctly classified 81.0% of cases. The errors were random. The significant noncognitive variables were gender, mother possessing a degree or a higher qualification, Realistic Self-Appraisal and the Availability of a Strong Support Person. The variables in the model did not correlate significantly as indicated by tolerance statistics and Variance Inflation Factors. Based on the model, a unit increase in Realistic Self-Appraisal and Availability of a Strong Support Person would increase the odds of passing the Algebra exam by 1.893 and 1.542 respectively. Being a female would increase the odds of passing the exam by .260 times, while the mother possessing a degree or a higher qualification would increase the odds of passing the exam by 8.511 times. Researchers, academics, academic administrators and student support services stand to benefit from this study as noncognitive variables could be used in statistical models to predict success of students from private universities and higher education institutes in Sri Lanka.

Keywords: Binary Logistic Regression, Noncognitive Questionnaire, Noncognitive Variables, Private Universities

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While I toiled the past couple of years with coursework, dissertation and my own work, my wife Mumthaz did a fantastic job of maintaining peace at home and supporting Tahira and Imad in their studies. For the painful sacrifices she makes *every* single day of *her* life so that my kids and I can continue to do well in our lives, it is only befitting that I, an ageing man on a cardiac stent, in this moment of ambivalence, dedicate this work for her.

Azad Ibrahim

Dedication

Mumthaz – *omnia amoris et multo amplius*

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List of Abbreviations

AL	Advanced Level
ASSP	Availability of a strong support person
DCS	Demonstrated community service
HEI	Higher education institute
KAF	Knowledge acquired in field
LR	Likelihood ratio
MLE	Maximum likelihood estimation
NCQ	Noncognitive questionnaire
NCV	Noncognitive variable
OL	Ordinary Level
PRLG	Preference for long-term goals
PSC	Positive self-concept
RSA	Realistic self-appraisal
SAT	Scholastic Aptitude Test
SLP	Strong leadership position
UDR	Understanding and dealing with racism

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CHAPTER 1
INTRODUCTION

This chapter describes the background, the rationale, the significance and the objectives of this research.

1.1 Background

A topic of interest to educational researchers, academics and academic administrators in higher education is the academic success of students. Despite many years of research, there is still a large body of unexplained knowledge on factors which influence course completion and student success in higher education institutions (Braton, 2005). Although progress in research has resulted in a greater understanding student dropout in certain fields of higher education (Austin, 1978a, 1979b; Pascerella, 1988; Tintus, 1985), until recently, research efforts have largely ignored students of private universities and private higher education institutes (HEIs) Sri Lanka.

Lack of research on private university students means that researchers and educationists in Sri Lanka 'borrow' frameworks and models developed by the West to make policy decisions without any theoretical understanding of the Sri Lankan higher education context. In Sri Lanka, most research efforts have largely ignored the students of private higher education institutes (HEIs) and for-profit universities. Although there is considerable debate on post-secondary remediation in education offered by private universities and private HEIs in Sri Lanka, private universities do fulfill a critical societal and economic need in the higher education sector by offering a wide variety of courses to a diverse population of students.

In Sri Lanka, students of private universities are more diverse compared to their colleagues in public (state) universities and often exhibit wider variation in terms of academic ability, long-term educational goals, drive and focus to achieve academic success, family support and obligations and family socioeconomic status than

students of public universities in Sri Lanka. Despite on-going criticism, private universities in Sri Lanka have certainly provided educational opportunities to segments of the population who would have otherwise not pursued any postsecondary education.

Therefore, Sri Lankan scholars should increase their research efforts to better understand the differences between private and public university students. Increasing student retention and successful course completion is one of the key goals of any academic institution, whether private or public. The consequences of drop-out of universities are significant for students, parents, academic and administrative staff. The importance of completing at least a first degree is clear: in the long-term, school leavers without a first degree are likely to earn less than graduates. The students who are vulnerable for dropping out from universities and institutions of higher education are usually the first year students. Hence, the timely and early identification of 'at-risk' students – those who are likely to drop their courses and leave university is an essential component of any strategy on student retention. Once identified, such 'at-risk' students could be supported academically to increase their chance of completing the degree. Only a thorough understanding of success of private university students in Sri Lanka would facilitate policy recommendations at the national level. This is likely to lead to increased student success and retention in many private universities and tertiary-level private HEIs in Sri Lanka.

1.2 Mathematics and Student Success

Mathematics is a field of study in which first year undergraduates are likely to need 'help' in the form of tutoring (Adlemen, 2008). The need for mathematical thinking and reasoning continues to exponentially increase as the society becomes more numerically-literate (McCanter, 2010). Generally, numerical literacy is a common indicator to gauge the level of education of employees (Oudhaven, 2012). Although Sri Lankan students perform at a similar level to their peers in other countries in the primary grades, their achievement lags behind by the seventh grade and is worse at the end of their tenth year of schooling (TIMSS, 2011). As a whole, Sri Lankan

Advanced Level students performed among the lowest of the thirty countries in pure mathematics. Performance of Sri Lankan students in combined mathematics was the lowest among the twenty countries which administered assessments in advanced mathematics (TIMSS, 2011).

In 2014, a study commissioned in Sri Lanka found that 61 percent of (local) Ordinary Level students performed at a basic level while only 23 percent were deemed proficient in mathematics (NEREC, 2014). Further, in many countries, it is claimed that higher levels of mathematical / numerical ability are necessary to keep up with increased competition for jobs (Prasad & Likewis, 2008). The International Labor Organization (ILO) estimates that growth rates for 12 of the 20 vocations and professions in the world will require a master's degree (ILO, 2009). Research suggests that demand for university-educated employees will increase in the foreseeable future. Adlemen (2010) iterates that the best predictors of academic success of undergraduates are usually the number of secondary school-level mathematics and science courses, grades of mathematics either at Ordinary Level or Advanced Level, grades of undergraduate-level mathematics courses, highest level of courses in the physical science domain taken and mathematics aptitude tests.

It has also been shown that students who correct their 'weaknesses' in mathematics and subjects in the physical science domain stand a better chance of complete their degrees as opposed to those who do not address their problems on time (Adlemen, 1998; Bihar, 2010). Only after continuous research into the predictors of student success, can academics, academic administrators and student support officers of private universities in Sri Lanka, report on the success of models that predict student success.

1.2.1 Algebra

Algebra is branch of mathematics, in which, students usually need remedial classes and tutoring support. Increasing the success of students enrolled in Algebra is important for two reasons. First, students who experience success in Algebra at early

stages of their academic lives at universities are likely to continue their studies and complete their degree. Second, Algebra is a pre-requisite for most of the first degrees offered by private HEIs and universities in Sri Lanka. Thus, students who correct their 'weaknesses' in Algebra and experience success early in their academic life are much more likely to feel empowered as learners and therefore be more successful in their course of study.

1.3 Significance of the Study

Research shows that cognitive measures such as the results of formal examinations, grade point average (GPA), Z score in the AL examination and scores of standardized tests such as the Scholastic Aptitude Test (SAT) contribute to models that predict student success in a university, there are shortcomings in predictive models that focus largely on cognitive measures (Pascerella & Tanzini, 2008). In many studies on retention and course completion, researchers decided to include noncognitive measures in addition to or instead of cognitive and other measures. A large proportion of these studies indicate that incorporating noncognitive variables increase the predictive power of statistical models as compared to 'traditional' models that use only cognitive factors. Pascerella and Tanzini (2001) conclude that student grades in examinations are significantly influenced by factors such as parental involvement, personal organization, study habits and learning styles. Many of the statistical models that aim to predict success fail to include important noncognitive factors and attributes (Mow & Kanan, 2003). However, research in educational psychology indicates that noncognitive variable-based models are being developed to quantify / model the relationship between student success and noncognitive factors.

The ability to accurately predict student success in higher education is essential. Predicting the success of students early in their academic lives, specifically for freshmen, is perhaps even more important for private universities and HEIs than other types of higher education institutions because of the diverse student body. Private universities in Sri Lanka enroll academically at-risk students. However, they

do not appear to be 'ready' to identify them. Without validated statistical models to identify and implement remedial measures to resolve the issues of freshmen, the chances of students successfully completing their studies are greatly diminished.

In Sri Lanka, private universities and private tertiary-level HEIs enroll large numbers of students who either prefer to study in private-sector funded institutions either because it is their choice or as a result of missing out on admission to state universities. The existing body of research on undergraduate student success was not developed for use with the highly diverse private university student populations. It is now the responsibility of researchers to develop and validate models which would assist private university academics and administrators to provide these diverse students with institutional policies and instructional strategies to ensure student success.

This study proposes and validates a noncognitive variable-based statistical model that could predict student success in for-profit educational contexts. Specifically, this study determines the type and the extent to which noncognitive variables increase student success at a private HEI, particularly the first year students who enroll in Algebra.

1.4 Objectives

In view of the above, the objectives of this study are to:

(1) identify the type of noncognitive variables which would help to predict the success (pass or fail) of students in Algebra

(2) develop a predictive model using such noncognitive variables

(3) validate the model

1.5 Structure of the Dissertation

This dissertation is organized into five chapters.

Chapter 2 summarizes the research conclusions of a select body of research on the role and importance of noncognitive variables in higher education. Chapter 3 presents the methodology and procedures for analyses. Chapter 4 presents the findings with reference to the research objectives presented in this chapter. Chapter 5 summarizes the findings of this study and proposes recommendations.

CHAPTER 2
REVIEW OF LITERATURE

This chapter summarizes the findings of a select body of research that has identified the impact of cognitive and noncognitive variables on the success of students in higher education.

2.1 Cognitive and Noncognitive Variables

There are two broad areas of predictors of academic performance of university students. They are cognitive and noncognitive predictors.

2.1.1 Cognitive Variables (CVs)

Cognitive predictors are those attributes / characteristics that objectively measure and quantify the academic capability of students and are reported as numerical scores. Such cognitive variables are generally used to as predictors of academic success of undergraduates (Teason, 2008). Examples of noncognitive attributes include measures such as Z scores, grade point average (GPA) and grades of standardized exams such as the Scholastic Aptitude Test (SAT).

2.1.2 Noncognitive Variables (NCVs)

Noncognitive predictors are those attributes that are typically not measured by standardized tests and other forms of examinations. They relate to a students' level of adjustment to new situations, motivation and perceptions (Seldacek, 2008). Specifically, noncognitive variables are subjective, psychosocial constructs. They help to describe the feelings, perceptions and / or attitudes of a student and could be sometimes reported as a numerical score, but usually as a rank (Johanson, 1998). Research into noncognitive variables commenced as a result of the growing concern to effectively predict academic success of undergraduates (Washirtec, 1999). For example, Seldacek (1979) found evidence for a positive correlation between parental education and examination marks of first year undergraduates in the US. Kanter,

Western, and Latara (2009) have shown that noncognitive variables have the ability to provide institutions with an alternative method to "predict student performance in colleges and in universities."

The inclusion of noncognitive variables in cognitive variable-dominated models has shown to increase the overall prediction rate of student success (Picktell, Chaliot, & McArthur, 2002). Trace and Seldacek (1987) introduced noncognitive variables as those attributes that affect a student's personality and capability. Studies of selected noncognitive variables provide ample evidence to prove "that nontraditional dimensions account for as much or more of the variance in retention rates" (Hoodworth, 1994). Many noncognitive variables have been identified as statistically significant in predicting academic success. Some of the measures are: self-development (Brow, 1998), responsible behavior (McMaster, 1999), self-esteem (Johanson, 1998), academic focus (Geraldi, 1990; Johanson, 1998), self-motivation (Libenwell, 1998), center of authority (Kanter et al., 2009), expectations and self-worth (Hayden & Johanson, 1988; Trippti & Stemworth, 1999) and self-sufficiency (Schilk, 1999). These studies indicate that noncognitive variables to be statistically significant predictors of academic success of undergraduate and graduate students.

Seldacek and Brooking (1976) and Trace and Seldacek (1987) proposed eight noncognitive variables as being useful in predicting academic success for undergraduates. These noncognitive variables are:

1. Positive Self-Concept (PSC) refers to the confidence level of a student in that he / she is confident of his / her ability to complete the degree irrespective of the barriers that may arise during the academic life. The student hopes to perform well in academic and nonacademic lives and would make optimistic statements about his or her ability to handle challenges in life. A higher score for PSC corresponds to a higher degree of self-worth.

2. Realistic Self-Appraisal (RSA) is a student's ability to recognize his or her academic strengths and weaknesses. It is also the ability to recognize and accept academic weaknesses while working towards self-development. The student understands that criticism or rewards are logical consequences of his / her academic performance, even though such criticism may be unfairly aimed at the student.

3. Understands and Deals with Racism (UDR) is a measure of a student's realistic view of racism based on prior experience. A higher UDR score means that the student understands the role of the 'system' or institution and how the system impacts him / her. The student would have also developed a way of sensing and reacting to cultural, social or racial demands. Further, he or she does not criticize others for his or her own misfortunes struggles and reacts to injustice based on past experience.

4. Preference for Long-Range Goals to Short-Term or Immediate Needs (PRLG) is the ability of a student to set goals and progress towards achieving them in a timely manner without being constantly reminded by others about such long-term goals. The student waits patiently till his or her goals are fully realized. The student is able to sacrifice short term needs and has attained a level of maturity that allows him or her to look beyond the immediate problems or temptations to achieve benefits in the future.

5. Availability of a Strong Support Person (ASSP) is the ability of a student to request for help and his or her willingness to accept when help is offered by a third party. The student is capable of identifying at least one person who is able to provide support and encouragement to the students on a regular basis and at times of crises. The student knows the inherent difficulty in being isolated from the society or for being a person without social skills and does not rely on his or her own resources to overcome academic and personal problems.

6. Successful Leadership Positions (SLP) measures the quantum of leadership experience possessed by a student who is experienced in inspiring and helping others to overcome challenges in academic and nonacademic settings. The student could easily act as a mentor to his / her colleagues and would readily act as an arbiter when necessary. Moreover, he / she has would be available when his / her expertise and experience is called for by his / her peers and colleagues.

7. Demonstrated Community Service (DCS) is when a student can identify himself / herself with community-based organization and has a definitive and long-term relationship within the local community. The student has a strong desire to be an integral part of his / her local community and would often volunteer for civic society organizations that work local communities and community-based organizations.

8. Knowledge Acquired in a Field (KAF) is the ability of a student to acquire field-based work experience and knowledge or the ability to acquire knowledge about topics that he / she may not have formally studied in secondary school or college. Also, the student possesses new and innovative ways to acquire work-based information about a particular field / vocation.

2.2 Cognitive versus Noncognitive Variables

The success for undergraduates is associated more with key noncognitive attributes than to academic ability and study skills alone (Seldacek, 1987). Washirtec (1999) concluded that noncognitive variables to be as effective and at times equal to standardized examination results, especially the Advanced College Readiness Test (ACT) of the US, as predictors of academic success. Trace and Seldacek (1985, 1997) have shown in many research that NCVs to be better predictors of academic performance than SAT and ACT scores. Specifically, Trace and Seldacek (1985) found that, among freshmen, strong leadership positions was statistically significant in predicting first and third semester grades in the first year, that positive self-concept was found to be effective in predicting second trimester grades of first year students.

Their research further shows that five noncognitive variables have received greater attention in the literature and have proven to be significantly related to students' overall grade point averages (GPAs).

Cortel and Schendey (1989) concluded after researching on noncognitive variables of students at the University of Michigan in Dearborn that noncognitive variables were better than cognitive variables as predictors of success at university exams. Similarly, William and Leombardi (1998) found that traditional cognitive measures of grade point averages (GPAs) and ACT scores to be less important predictors than the noncognitive variables of social identity, self-esteem, job interests and university environment. In many studies involving cognitive and noncognitive variables, Arbony and Novartis (1998) found that for Caucasian, Indian-American and Hispanic students, noncognitive variables, as measured by a noncognitive questionnaire, were predictors of university grades. However, several authors have argued that intertwining cognitive predictors with noncognitive predictors is the most useful strategy to predict examination performance in universities (Picktell et al., 2002; Tin & Robi, 1999; Tin & Seldacek, 2005).

Over the past few decades, researchers have identified a wide range of cognitive and noncognitive variables that may predict success and course-completion rates among university students. Shafter (1991) found high academic achievement in secondary school and family background correlated to academic success by male undergraduates, while previous internship / vocational experience, stronger relationships with the parents and academic achievement in secondary school were predictive of academic success for female undergraduates. In a study of Spanish-American freshmen at six of New York's state universities, Whitley (1993) found among other variables, that the size of the secondary school attended by Spanish-American freshmen and SAT scores were statistically significant in identifying those students who completed the course beyond the freshman year. Bower (1998) has shown that Caucasian students who completed their degrees in universities were more oriented on their subjects during their third trimester and spiritual and family connections during their second semester.

2.3 Statistical Analyses Used

Trace and Seldacek (1987) questioned if noncognitive variables (NCVs) could effectively predict academic success in Caucasian, African and Indian-American students. They made use of three separate samples of incoming freshmen at the University of Chicago, Menlo Park (1987, n = 1864; 1990, n = 678; 1995, n = 472). In the final model, χ^2 (312.25) was statistically significant at the 0.05 level. The researchers established the construct validity of the NCVs as predictors of academic success which they defined as both final examination average (R^2 ranged from 39% to 58%) and continued enrollment in courses (R^2 ranged from 28% to 59%). Moreover, using structural equation modelling, it has been shown that four noncognitive variables: Leadership, Recognizing Racism, Preference for Long-term Goals and Realistic Self-Appraisal are significant factors. Similar research has been conducted by several other authors (Arbony & Novartis, 1998; Boys & Seldacek, 1999; Tin & Seldacek, 2005; Wood & Seldacek, 1998).

Wood and Seldacek (1998) reported Cronbach alpha ranging from .64 to .83 for scales on the noncognitive questionnaire (NCQ) and that seven out of the eight NCQ scales as having construct and external validity and reliability. The two constructs that needed further research were (a) Availability of a Strong Support Person and (b) Positive Self-concept. Tin and Seldacek (2005) found external construct validity for all but two NCQ scales, Strong Leadership Positions and Demonstrated Community Service. Trace and Seldacek (1997) and Arbony and Novartis (1998) used principal axis factoring to examine the underlying factor loadings of the NCQ and found similar factor structure of the NCQ for both Caucasian and Indian-American ethnic groups. Arbony and Novartis (1998) suggested that six of the NCQ factors (study skills, leadership, support for academic plans, long-term academic plans, community involvement and self-worth) were similar across three ethnic samples: Indian-American, African-American and Spanish-American students. Multiple studies have researched to determine the factor loadings and rotational matrices of the NCQ for female students (Ancy & Seldacek, 2005); community college students (Boys & Seldacek, 1999); athletes (Seldacek & Adams-Burton, 1995); Spanish students (Furte

& Sedlacek, 1998); Indian-Americans (Furte, Seldacek, & Loui, 2004; Tin, 2010); community-college students (Seldacek, 2001); and race, specifically Spanish and White students (Trace & Seldacek, 1985).

Trace and Seldacek (1987) reported reliability coefficients ranging from .65 to .84 for each item of the NCQ, with a median value of .72. Furthermore, interrater agreement on the Likert-scale questions of the NCQ ranged from .73 to .90 (Washirtec, 1999). The itemized questions and open-ended questions were evaluated by four independent experts and the range was reported with focus on academic goals (r = .73), degree of difficulty of the past accomplishments (r = .78), long-term objectives (r = .79), organizational skills (r = .79), social service to community (r = .84), academic skills and learning styles (r = .88) and overall number of extracurricular activities (r = .90) (Trace & Seldacek, 1985).

2.4 Summary

In Sri Lanka, there is a debate regarding the appropriate mix of cognitive and noncognitive variables that are required to predict academic success and course completion among university freshmen. Overall, the literature reviewed for this study identifies predictors of academic success and course completion of undergraduates and graduate students at overseas higher education institutes suggests that both cognitive and noncognitive variables are effective in predicting academic success with each variable offering varying degrees of predictability across many institutions. However, little research is available to determine success of students of private universities and HEIs in Sri Lanka.

CHAPTER 3
MATERIALS AND METHODS

This chapter includes an explanation of the study design, sample and statistical analyses used in this research.

3.1 Study Setting

This research was conducted on a group of first year students at a Colombo-based private HEI, referred to as UX. This institute offers three programs: (1) a US university transfer program (2) an Australian university transfer program and (3) a Business degree completion program. Students in the business degree completion program, if they wish to, have the opportunity to complete a 4-year Bachelor's Degree in Sri Lanka. The degree is awarded by a mid-sized, private university in North America. In the US or Australian university transfer programs (referred to transfer programs), students complete a set of pre-agreed number of first year (100-level) courses at UX and transfer the completed credits to an overseas university either in the US or Australia.

Based on internal calculations that cannot be published due to reasons of confidentiality, about 20 percent of the students who enroll at UX (in the transfer and in the degree completion programs) dropout of UX within the first year of studies. As of now, no formal research has been undertaken at UX to identify the factors that influence a student's decision to persist or dropout from UX. UX assumes that it is the series of higher mathematics courses, often perceived as difficult by the students, that causes a larger number of students to dropout within their first year.

A student at UX, irrespective of the program (transfer or degree completion) must successfully complete Algebra, the first credit-earning mathematics course before completing two more courses in mathematics, which are pre-calculus and calculus I. Every semester, a significant proportion of students are enrolled at UX and who are not competent enough to study university-level mathematics courses. Hence, only a

select group of ‘ideal’ students complete all three mathematics courses, while others dropout without completing the program. In the absence of any research findings, UX assumes that if a student successfully completes Algebra, then the student is likely to continue studies at UX.

3.2 Planning and Organizing the Survey

The target population of this research was the 164 first year students (transfer program: 73 students and degree completion: 91 students) who enrolled for Algebra in the second semester of 2015 at UX. The researcher contacted the Academic Dean and the Lecturer for Algebra to explain the objectives of the research and to request permission to use one class session during the first week of the semester to administer the questionnaire. The researcher received access to all batches of the course and administered the survey to a total of 164 students.

3.2.1 Sampling Method

Due to the exploratory nature of this study, the researcher decided to administer the questionnaire to all the first year students who registered for Algebra in the second semester of 2015 at UX.

3.2.2 Conducting the Survey

In order to minimize errors in data collection, this study used several methods advocated by survey statisticians (Dilmin, 2010). Administering the survey during class time stressed the importance of this research to the students and they completed the survey during class time. In order to minimize systematic errors in the survey, the researcher personally administered the survey.

3.2.3 Response Rate

The survey questionnaire was administered to 164 students and a total of 158 useable questionnaires were returned. This translates to a response rate of 94 percent. Of the valid questionnaires, 44.3 percent were returned from students in the transfer program and 55.7 percent from students in the degree completion program.

3.3 Survey Instrument: Noncognitive Questionnaire (NCQ)

A noncognitive questionnaire (NCQ) based on Trace and Seldacek's (1987) NCQ was used in the study. The questionnaire used in the study is given in Appendix I. Their questionnaire consists of 23 questions:

(a) Three open-ended questions on: (i) past accomplishments and leadership experiences (Q1) (ii) present goals (Q2) and (iii) group membership (Q3)

(b) Two closed-ended questions on: (i) educational expectations (Q4) and (ii) about the extent of education that a respondent hopes to acquire during his / her lifetime (Q10)

(c) Eighteen Likert-type questions addressing self-assessment and expectations in the university (Q12 to Q29)

However, additional questions were included to reflect the needs of this study and the conditions of students at UX. The modified questionnaire is a self-completed instrument that consists of the following additional questions:

- Q5: gender
- Q6: program type
- Q7: father's educational qualifications
- Q8: mother's educational qualifications
- Q9: weekly allocation of time for studies

The study used the NCQ scoring guide as described by Seldacek (2004). A copy of the scoring guide is given in Appendix II. Table 3.1 explains the questions that are used to determine the scores for the specific noncognitive variables.

Table 3.1: Questions in the NCQ used to score each noncognitive variable

Noncognitive variable	Questions (in the questionnaire) that are used to calculate the score for the noncognitive variable
Positive self-concept (PSC)	Q1, Q4, Q10, Q21, Q24 and Q29
Realistic self-appraisal (RSA)	Q4, Q13 and Q22
Understand and deals with racism (UDR)	Q12, Q19, Q23, Q27 and Q28
Preference for long-range goals (PRLG)	Q2*, Q14 and Q20
Availability of a strong support person (ASSP)	Q16, Q25 and Q26
Successful leadership positions (SLP)	Q3**, Q15 and Q18
Demonstrated community service (DCS)	Q3** and Q17
Knowledge acquired in a field (KAF)	Q2* and Q3**

* Responses to question 2 were used to calculate the final scores for (1) preference for long range goals (PRLG) and (2) knowledge acquired in field (KAF).

** Responses to question 3 were used to calculate the final scores for (1) successful leadership positions (SLP) (2) demonstrated community service (DCS) and (3) knowledge acquired in field (KAF).

During the scoring process, a numerical value based on the scoring guide was assigned to each open-ended response. A mean score was calculated for NCQ items with more than one response and the mean was then rounded to the nearest whole number. The scoring key uses complex calculation techniques. The range of scores

for each noncognitive variable is provided in table 3.2. A high score indicates a higher strength for the particular noncognitive variable.

Table 3.2: Highest and lowest possible scores for each noncognitive variable

Noncognitive variable	Lowest possible score	Highest possible score
Positive self-concept (PSC)	7	27
Realistic self-appraisal (RSA)	4	14
Understand and deals with racism (UDR)	5	25
Preference for long-range goals (PRLG)	3	13
Availability of a strong support person (ASSP)	3	15
Successful leadership positions (SLP)	3	13
Demonstrated community service (DCS)	2	8
Knowledge acquired in a field (KAF)	2	6

Each participant's score was calculated individually and the scores were recorded in a password-protected document. Every NCQ score was reviewed four times for accuracy. The spreadsheet contained equations that automatically calculated the scores for each noncognitive variable. The equations are based on the scoring guide from Seldacek's Revised Scoring Key found in Appendix II of this report.

3.4 Variables

The items in the modified NCQ administered in this study come from two sources: Trace and Seldacek's (1987) NCQ and UX. The items in the modified NCQ were the explanatory variables, while the dependent variable was the final grade of a student in the Algebra summative exam held at the end of the second trimester of 2015.

The response variable was a dichotomous variable with "1" denoting a pass (73% or more) and "0" denoting a fail in the final exam. Table 3.3 presents the coding structure of the explanatory variables.

Table 3.3: Coding structure of the independent variables

Variable and [question]	Type of variable and codes
Type of program (Q6)	Categorical (transfer = 0, completion = 1)
Gender (Q5)	Categorical (female = 0, male = 1)
Fathers' highest qualification (highest EqF) [Q7]	Categorical (less than a first degree = 0, first degree or higher qualification = 1)
Mothers' highest qualification (highest EqM) [Q7]	Categorical (less than a first degree = 0, first degree or higher qualification = 1)
Weekly allocation of time for studies (Q9)	Categorical (10 hours or less = 0, 11 to 20 hours = 1, more than 20 hours = 2)
Positive self-concept (Q1, Q4, Q10, Q21, Q24 and Q29)	Quantitative (min = 7, max = 27)
Realistic self-appraisal (Q4, Q13 and Q22)	Quantitative (min = 4, max = 14)
Understand and deals with racism (Q12, Q19, Q23, Q27 and Q28)	Quantitative (min = 5, max = 25)
Preference for long-range goals (Q2*, Q14 and Q20)	Quantitative (min = 3, max = 13)
Availability of a strong support person (Q16, Q25 and Q26)	Quantitative (min = 3, max = 15)
Successful leadership positions (Q3**, Q15 and Q18)	Quantitative (min = 3, max = 13)
Demonstrated community service (Q3** and Q17)	Quantitative (min = 2, max = 8)
Knowledge acquired in a field (Q2* and Q3**)	Quantitative (min = 2, max = 6)

* Responses to question 2 were used to calculate the final scores for (1) preference for long range goals (PRLG) and (2) knowledge acquired in field (KAF).

** Responses to question 3 were used to calculate the final scores for (1) successful leadership positions (SLP) (2) demonstrated community service (DCS) and (3) knowledge acquired in field (KAF).

3.5 Statistical Technique

The principal statistical technique selected for this study, binary logistic regression, is consistent with previous research that has examined the predictive ability of multiple explanatory variables on a dichotomous response variable. All statistical analyses were completed on SPSS® (IBM®, 2013; version 22.0) software.

3.5.1 Binary Logistic Regression

The central mathematical concept that underlies binary logistic regression is the logit – the natural logarithm of an odds ratio. Generally, logistic regression is well-suited for describing and testing hypotheses about relationships between a categorical outcome variable and one or more categorical or continuous predictor variables. In the simplest case of binary linear regression for one continuous predictor X (a student's grade on a test) and one dichotomous outcome variable Y (the student being recommended for remedial classes), the plot of such data results in two parallel lines, each corresponding to a value of the dichotomous outcome (figure 3.1). Because the two parallel lines are difficult to be described with an ordinary least squares regression equation due to the dichotomy of outcomes, categories are created for the predictor and the mean of the outcome variable is computed for the respective categories. The resultant plot of categories' means will appear linear in the middle, but curved at the ends (figure 3.1, the S-shaped curve).

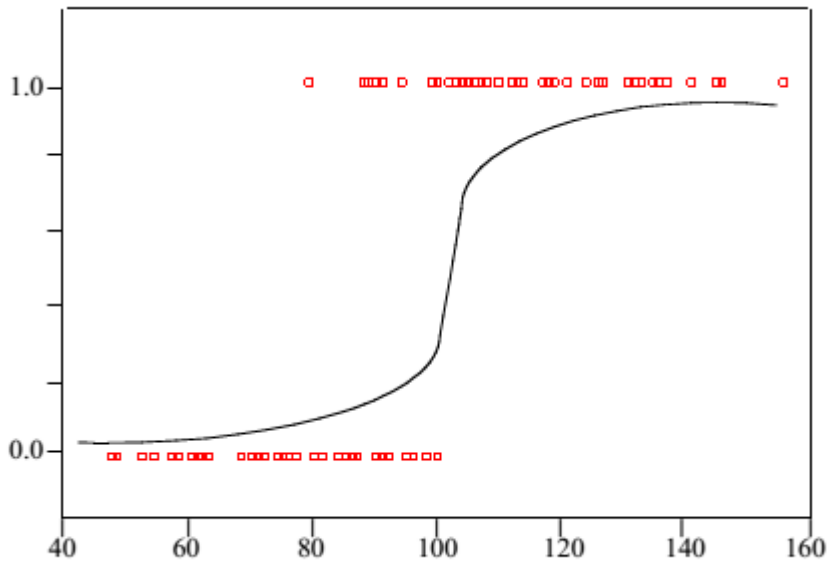

Figure 3.1: Relationship of a dichotomous response variable with a continuous predictor

Such a shape, often referred to as sigmoidal or S-shaped curve, is difficult to describe with a linear equation for two reasons. First, the extremes do not follow a linear trend. Second, the errors are neither normally distributed nor constant across the entire range of data (Peng, Manz, & Keck, 2001). Binary logistic regression solves these problems by applying the logit transformation to the outcome variable. In essence, the logistic model predicts the logit of Y from X. As stated earlier, the logit is the natural logarithm (ln) of odds of Y. Odds are ratios of probabilities (π) of Y happening (i.e., a student is recommended for remedial classes) to probabilities (1 – π) of Y not happening (i.e., a student is not recommended for remedial classes).

The simplest logistic model has the form: logit (Y) = natural log (odds) = ln $\left(\frac{\pi}{1-\pi}\right) = \alpha + \beta X$. Taking antilog of the equation on both sides, an equation can be derived to predict the probability of occurrence of the outcome variable as follows:

π = probability (Y = outcome of interest | X = *x*, a specific value of X) = $\frac{e^{\alpha+\beta X}}{1+e^{\alpha+\beta X}}$

where π is the probability of the outcome of interest or "event," such as a student being referred for remedial classes. α is the Y intercept, β is the regression

coefficient, and e = 2.71828 is the base of the system of natural logarithms. X can be categorical or continuous, but Y is always categorical. The value of the coefficient β determines the direction of the relationship between X and the logit of Y. When β is greater than zero, larger (or smaller) X values are associated with larger (or smaller) logits of Y. Conversely, if β is less than zero, larger (or smaller) X values are associated with smaller (or larger) logits of Y.

Extending the logic of the simple binary logistic regression to multiple predictors a complex binary logistic regression model for Y could be constructed as follows: logit (Y) = $\ln\left(\frac{\pi}{1-\pi}\right)$ = $\alpha + \beta_1 X_1 + \beta_2 X_2$. Therefore, π = probability (Y = outcome of interest | $X_1 = x_1$, $X_2 = x_2$) = $\frac{e^{\alpha+\beta_1 X_1+\beta_2 X_2}}{1+e^{\alpha+\beta_1 X_1+\beta_2 X_2}}$ where π the probability of the event, α is the Y intercept, βs are regression coefficients, and Xs are a set of predictors. Data are entered into the analysis as 0 or 1 coding for the dichotomous outcome, continuous values for continuous predictors and dummy codings (0 or 1) for categorical predictors.

Binary logistic regression does not have as many assumptions as linear regression. However the following assumptions are important:

- Cases and errors should be independent
- A linear relationship holds between the continuous independent variables and the logit transformation of the dependent (outcome) variable
- No multicollinearity
- No significant outliers or influential points
- Categories are mutually exclusive and exhaustive

CHAPTER 4
RESULTS AND DISCUSSION

4.1 Introduction

In this chapter, the collected data / responses are analyzed according to the flowchart in figure 4.1. Relevant details are given in each section.

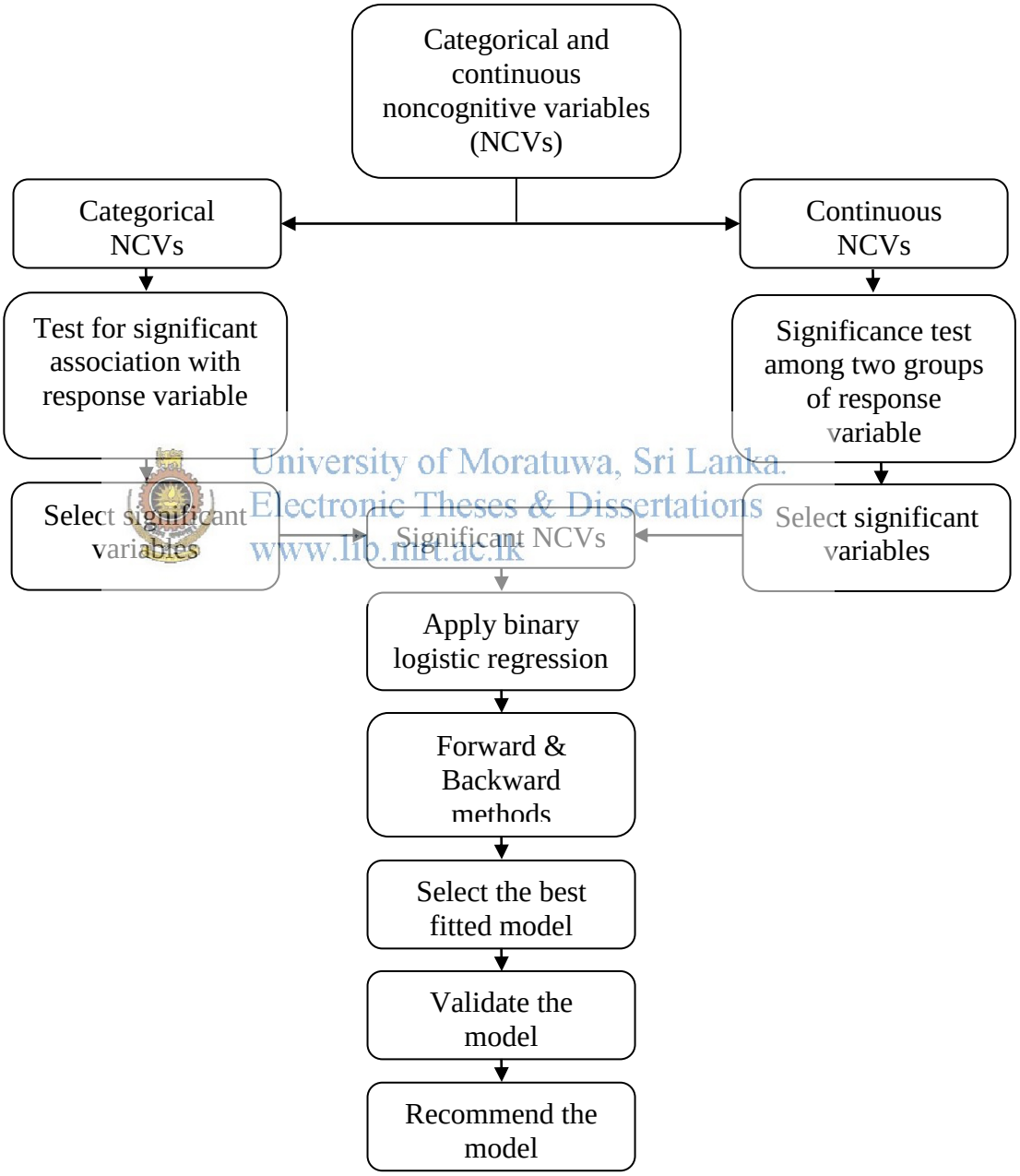

Figure 4.1: Flowchart of statistical analyses

4.2 Association between the Response Variable and Categorical Noncognitive Variables

This section reports the results of the significance tests to identify which, if any, of the five categorical noncognitive variables (program type, gender, weekly study time, highest educational qualification of the father and the highest educational qualification of the mother) is significant. This was done using chi-square test of association between each categorical noncognitive variable with the dichotomous response variable (grade of the final exam).

4.2.1 Association between Program Type and Grade

The analysis of the grades shows that 96 students (61%) passed the examination. Table 4.1 presents the two-way frequency table between the grade and the program type.

Table 4.1: Two-way frequency table for program type versus grade

			Grade for Algebra		Total
			Fail	Pass	
Program type	Transfer	Count	27	43	70
		% within program	38.6%	61.4%	100.0%
	Degree Completion	Count	35	53	88
		% within program	39.8%	60.2%	100.0%

Likelihood chi square statistic $\chi^2(1) = .024$, $p = .878$.

Results in table 4.1 indicate that there is no statistically significant association between the program type and the grades of the final examination for Algebra as the *p*-value of the chi square statistic is greater than 5% ($p = .878$). It can be concluded that the grades of the students do not depend on the type of program. It is confirmed as the percentage of students who fail the Algebra examination given that the students are from the transfer program or from the completion program are 38.6% and 39.8% respectively.

4.2.2 Association between Gender and Grade

Ninety-five of the respondents (60%) were males. Table 4.2 presents the two-way frequency table between gender and grades.

Table 4.2: Two-way frequency table for gender versus grade

			Grade for Algebra		Total
			Fail	Pass	
Gender	Female	Count	17	46	63
		% within gender	27.0%	73.0%	100.0%
	Male	Count	45	50	95
		% within gender	47.4%	52.6%	100.0%

Likelihood chi square statistic $\chi^2(1) = 6.602$, $p = .01$.

Results in table 4.2 indicate that there is a statistically significant association between the gender and the grades of the final examination for Algebra as the *p*-value of the chi square statistic is less than 5% ($p = .01$). It can be concluded that the grades of the students depend on the gender of the students. The percentage of students who fail the Algebra examination among males (47.4%) is significantly higher than that of females (27.0%).

4.2.3 Association between Weekly Study Time and Grade

About 75 percent of the respondents stated that they study for less than 10 hours a week, while four percent of the respondents stated that they allocate more than 20 hours per week for studies. Table 4.3 presents the two-way frequency table for weekly study time and the grades of the students.

Table 4.3: Two-way frequency table for weekly study versus grade

			Grade for Algebra		Total
			Fail	Pass	
Weekly study time	Less than 10 hours	Count	48	71	119
		% within study time	40.3%	59.7%	100.0%
	More than 10 hours	Count	14	25	39
		% within study time	35.9%	64.1%	100.0%

Likelihood chi square statistic $\chi^2(2) = 4.075$, $p = .130$.

Results in table 4.3 indicate that there is no statistically significant association between the weekly study time and the grades of the final examination for Algebra as the *p*-value of the chi square statistic is greater than 5% ($p = .130$). It can be concluded that the grades of the students do not depend on the weekly study time.

4.2.4 Association between the Father's Level of Education (EqF) and Grade

The survey instrument contained two questions about the level of education of the parents (one question on the education of the father and the other on the mother). Of the 158 respondents, 110 stated (70%) that the highest educational qualification of the father was less than a first degree. One hundred and ten students (out of 158) stated that that the highest educational qualification of the father was less than a degree. Table 4.4 presents the two-way frequency table for the grades of the respondents based on the father's highest educational level.

Table 4.4: Two-way frequency table for father's level of education versus grade

			Grade for Algebra		Total
			Fail	Pass	
Highest EqF	Less than a degree	Count	49	61	110
		% within highest EqF	44.5%	55.5%	100.0%
	Degree or above	Count	13	35	48
		% within highest EqF	27.1%	72.9%	100.0%

Likelihood chi square statistic $\chi^2(1) = 4.274$, $p = .039$.

Results in table 4.4 indicate that there is a statistically significant association between the highest educational qualification of the father and the grades of the final examination for Algebra as the *p*-value of the chi square statistic is less than 5% (p = .039). In other words, it confirms that the success rate of students in Algebra is significantly influenced by the father's educational level. The failure rate of students whose fathers possessing a degree or a higher qualification (27.1%) is significantly lower than that of students whose fathers possess a degree or a higher qualification (72.9%).

4.2.5 Association between Mother's Level of Education (EqM) and Grade

Table 4.5 presents the two-way frequency table for the grades of the respondents based on the mother's highest educational level.

Table 4.5: Two-way frequency table for mother's level of education versus grade

			Grade		Total
			Fail	Pass	
Highest EqM	Less than a degree	Count	53	56	109
		% within highest EqM	48.6%	51.4%	100.0%
	Degree or above	Count	9	40	49
		% within highest EqM	18.4%	81.6%	100.0%

Likelihood chi square statistic $\chi^2(1) = 12.979$, $p = .000$.

Results in table 4.5 indicate that there is a statistically significant association between the highest educational qualification of the mother and the grades of the final examination for Algebra as the *p*-value of the chi square statistic is less than 5% (p = .000). The failure rate of students whose mothers possessing a degree or a higher qualification (18.4%) is significantly lower than the rate of passing students whose mothers possess a degree or a higher qualification (81.6%).

4.3 Tests of Continuous Noncognitive Explanatory Variables

The significant continuous noncognitive variable selection was done by applying t-tests to test if the mean scores for each noncognitive variable in the 'pass' group (students who passed the final exam for Algebra) is significantly different from the mean score for the 'fail' group (students who failed the final exam for Algebra). The test was carried out for each continuous noncognitive variable: positive self-concept (PSC), realistic self-appraisal (RSA), understand and deals with racism (UDR), preference for long-range goals (PRLG), availability of a strong support person (ASSP), successful leadership positions (SLP), demonstrated community service (DCS) and knowledge acquired in a field (KAF).

4.3.1 Significance test for Positive Self-Concept (PSC)

The sample mean scores (standard deviation) of positive self-concept (PSC) were found to be 11.69 (2.17) and 13.65 (2.40) respectively for the group who failed and passed the Algebra exam. Levene's test confirmed that the variances between the two groups are not significant at the 5 percent level of significance (p = .553). As shown in table 4.6, the difference in means between the two groups of respondents is statistically significant at the 5 percent level of significance (t = -5.185, p = .000).

Table 4.6: Comparison of PSC between the two groups

		Levene's test of equality of variances		t-test for equality of means		
		F	Sig.	t	df	Sig. (2 tailed)
PSC	Equal variances assumed	.353	.553	-5.185	156	.000
	Equal variances not assumed			-5.298	139.445	.000

4.3.2 Significance test for Realistic Self-Appraisal (RSA)

The sample mean scores (standard deviation) of realistic self-appraisal (RSA) were found to be 7.19 (1.44) and 8.83 (1.78) respectively for the group who failed and passed the Algebra exam. Levene's test confirmed that the variances between the two groups are significant at the 5 percent level of significance (p = .023). As shown in table 4.7, the difference in means between the two groups of respondents is statistically significant at the 5 percent level of significance (t = -6.380, p = .000).

Table 4.7: Comparison of RSA between the two groups

		Levene's test of equality of variances		t-test for equality of means		
		F	Sig.	t	df	Sig. (2 tailed)
RSA	Equal variances assumed	5.244	.023	-6.098	156	.000
	Equal variances not assumed			-6.380	148.184	.000

4.3.3 Significance test for Understand and Deals with Racism (UDR)

The sample mean scores (standard deviation) of understand and deals with racism (UDR) were found to be 17.32 (2.87) and 17.40 (2.72) respectively for the group who failed and passed the Algebra exam. Levene's test confirmed that the variances between the two groups are not significant at the 5 percent level of significance (p = .665). As shown in table 4.8, the difference in means between the two groups of respondents is not statistically significant at the 5 percent level of significance (t = -.162, p = .872).

Table 4.8: Comparison of UDR between the two groups

		Levene's test of equality of variances		t-test for equality of means		
		F	Sig.	t	df	Sig. (2 tailed)
UDR	Equal variances assumed	.188	.665	-.162	156	.872
	Equal variances not assumed			-.160	125.465	.873

4.3.4 Significance test for Preference for Long-Range Goals (PRLG)

The sample mean scores (standard deviation) of preference for long-range goals (PRLG) were found to be 6.27 (1.68) and 6.15 (1.68) respectively for the group who failed and passed the Algebra exam. Levene's test confirmed that the variances between the two groups are not significant at the 5 percent level of significance (p = .914). As shown in table 4.9, the difference in means between the two groups of respondents is not statistically significant at the 5 percent level of significance (t = .469, p = .640).

Table 4.9: Comparison of PRLG between the two groups

		Levene's test of equality of variances		t-test for equality of means		
		F	Sig.	t	df	Sig. (2 tailed)
PRLG	Equal variances assumed	.012	.914	.469	156	.640
	Equal variances not assumed			.469	130.252	.640

4.3.5 Significance test for Availability of a Strong Support Person (ASSP)

The sample mean scores (standard deviation) of availability of a strong support person (ASSP) were found to be 10.27 (1.94) and 12.46 (1.65) respectively for the group who failed and passed the Algebra exam. Levene's test confirmed that the variances between the two groups are not significant at the 5 percent level of

significance (p = .188). As shown in table 4.10, the difference in means between the two groups of respondents is statistically significant at the 5 percent level of significance (t = -7.563, p = .000).

Table 4.10: Comparison of ASSP between the two groups

		Levene's test of equality of variances		t-test for equality of means		
		F	Sig.	t	df	Sig. (2 tailed)
ASSP	Equal variances assumed	1.747	.188	-7.563	156	.000
	Equal variances not assumed			-7.305	115.229	.000

4.3.6 Significance test for Strong Leadership Positions (SLP)

The sample mean scores (standard deviation) of strong leadership positions (SLP) were found to be 6.21 (1.70) and 6.70 (1.24) respectively for the group who failed and passed the Algebra exam. Levene's test confirmed that the variances between the two groups are significant at the 5 percent level of significance (p = .005). As shown in table 4.11, the difference in means between the two groups of respondents is statistically significant at the 5 percent level of significance (t = -1.951, p = .035).

Table 4.11: Comparison of SLP between the two groups

		Levene's test of equality of variances		t-test for equality of means		
		F	Sig.	t	df	Sig. (2 tailed)
SLP	Equal variances assumed	7.983	.005	-2.084	156	.039
	Equal variances not assumed			-1.951	102.409	.035

4.3.7 Significance test for Demonstrated Community Service (DCS)

The sample mean scores (standard deviation) of demonstrated community service (DCS) were found to be 3.47 (1.07) and 3.42 (1.02) respectively for the group who failed and passed the Algebra exam. Levene's test confirmed that the variances between the two groups are not significant at the 5 percent level of significance (p = .700). As shown in table 4.12, the difference in means between the two groups of respondents is not statistically significant at the 5 percent level of significance (t = .301, p = .764).

Table 4.12: Comparison of DCS between the two groups

		Levene's test of equality of variances		t-test for equality of means		
		F	Sig.	t	df	Sig. (2 tailed)
DCS	Equal variances assumed	.149	.700	.301	156	.764
	Equal variances not assumed			.299	126.303	.766

4.3.8 Significance test for Knowledge Acquired in a Field (KAF)

The sample mean scores (standard deviation) of knowledge acquired in a field (KAF) were found to be 3.02 (.90) and 3.07 (.86) respectively for the group who failed and passed the Algebra exam. Levene's test confirmed that the variances between the two groups are not significant at the 5 percent level of significance (p = .963). As shown in table 4.13, the difference in means between the two groups of respondents is not statistically significant at the 5 percent level of significance (t = -.398, p = .691).

Table 4.13: Comparison of KAF between the two groups

		Levene's test of equality of variances		t-test for equality of means		
		F	Sig.	t	df	Sig. (2 tailed)
KAF	Equal variances assumed	.002	.963	-.398	156	.691
	Equal variances not assumed			-.395	126.583	.694

4.4 Modelling Noncognitive Variables through Logistic Regression

The significant variables identified in sections 4.2 and 4.3 were input to develop a binary logistic model to predict the outcome of Algebra. Two stepwise selection methods, Forward Wald and Backward Wald were used to develop the model. Hosmer and Lemeshow (2000) advocated that the minimum number of cases per independent variable should be ten. Since this research has seven independent variables, 158 cases are considered adequate to fit a logistic regression model, according to Hosmer and Lemeshow.

4.4.1 Results of Forward Wald Selection Method

A. Hosmer-Lemeshow (H-L) Statistic

The Hosmer and Lemeshow (H-L) test in table 4.14 is not statistically significant (p = .408) indicating that the predictors have a significant effect over the constant.

Table 4.14: H-L test (Forward Wald)

Step	Chi-square	df	Sig.
1	2.434	6	.876
2	33.272	8	.000
3	10.777	8	.215
4	7.205	7	.408

B. Model Summary

Table 4.15 indicates how much variation in the response variable can be explained by the model (the equivalent of R^2 in multiple regression). The table reports the Cox & Snell R^2 and Nagelkerke R^2 values, which calculate the explained variation. Therefore, the explained variation in the response variable for the model with all the predictors ranges from 40.3% to 54.6%.

Table 4.15: Model summary (Forward Wald)

Step	-2 Log Likelihood (-2LL)	Cox & Snell R^2	Nagelkerke R^2
1	164.180[a]	.260	.352
2	148.910[a]	.328	.444
3	138.439[b]	.371	.503
4	130.159[b]	.403	.546

a. Estimation terminated at iteration number 5 because parameter estimates changed by less than .001.

b. Estimation terminated at iteration number 6 because parameter estimates changed by less than .001.

C. Category Prediction

Logistic regression estimates the probability of an event occurring – in this case, passing the exam for Algebra. If the estimated probability of the event occurring is greater than or equal to .5 (better than even chance), the event is classified as occurring (passing the exam). It is common to use logistic regression to predict whether cases can be correctly classified (predicted) from the independent variables. Therefore, it becomes necessary to have a method to assess the effectiveness of the predicted classification against the actual classification. All such methods revolve around the observed and predicted classifications, which are presented in the classification table 4.16 (only the last step is presented):

Table 4.16: Classification summary (Forward Wald)

			Predicted		
			Fail	Pass	Percentage correct
Step 4	Observed	Fail	39	23	62.9
		Pass	19	77	80.2
	Overall percentage				73.4

The cut value is .500

The subscript in the table states that the 'cut value is .500'. This means that if the probability of a case being classified into the 'pass' category is greater than .5, then that case is classified into the 'pass'. Otherwise, the case is classified to belong to the 'fail' category. The classification table, which did not include any of the independent variables indicated that 60.8% of cases overall could be correctly classified by simply assuming that all the students would pass the exam. However, with the independent variables added, the model correctly classifies 73.4% of cases overall. That is, the addition of the explanatory variables improves the overall prediction of cases into their observed categories of the response variable. Hence, the percentage accuracy in classification (PAC) of the model is 73.4%.

Sensitivity is the percentage of cases that had the observed characteristic (a 'pass' in the exam) which were correctly predicted by the model (true positives). In this case, 80.2% of participants who passed the exam were also predicted by the model to have passed the final exam for Algebra.

Specificity is the percentage of cases that did not have the observed characteristic (a 'fail' in the exam) and were also correctly predicted as not having the observed characteristic (true negatives). In this case, 62.9% of participants who failed the exam were correctly predicted by the model to have failed the exam for Algebra.

The positive predictive value is the percentage of correctly predicted cases with the observed characteristic compared to the total number of cases predicted as having the characteristic (a 'pass' in the exam). In this case, this is 77.0% [77 ÷ (77+23)]. That is, of all the cases predicted as passing the exam, 77.0% were correctly predicted as passing the exam by the model.

The negative predictive value is the percentage of correctly predicted cases without the observed characteristic compared to the total number of cases predicted as not having the characteristic (a 'fail' in the exam). In this case, this is 67.2% [39 ÷ (39+19)]. That is, of the all cases predicted as failing the exam, 67.2% were correctly predicted as failing the exam by the model.

D. Variables in the Equation

Table 4.17 shows the explanatory variables and their statistical significance to the model.

Table 4.17: Variables in the equation (Forward Wald)

		B	S.E.	Wald	df	Sig.	Exp(B)	95% CI for Exp(B)	
								Lower	Upper
Step 1[a]	ASSP	.665	.117	32.501	1	.000	1.944	1.547	2.443
	Constant	-7.161	1.335	28.748	1	.000	.001		
Step 2[b]	RSA	.472	.130	13.226	1	.000	1.603	1.243	2.068
	ASSP	.591	.124	22.545	1	.000	1.805	1.414	2.303
	Constant	-10.071	1.722	34.208	1	.000	.000		
Step 3[c]	RSA	.582	.145	16.115	1	.000	1.790	1.347	2.379
	ASSP	.533	.129	17.057	1	.000	1.704	1.323	2.194
	Highest EqM(1)	1.613	.532	9.199	1	.000	5.016	1.769	14.221
	Constant	-10.705	1.853	33.366	1	.000	.000		
Step 4[d]	RSA	.665	.157	17.927	1	.000	1.945	1.429	2.647
	ASSP	.525	.135	15.023	1	.000	1.690	1.296	2.205
	Gender(1)	-1.304	.472	7.648	1	.000	.271	.108	.684
	Highest EqM(1)	1.921	.552	12.102	1	.000	6.825	2.313	20.139
	Constant	-10.557	1.983	28.349	1	.000	.000		

a. Variables entered on step 1: ASSP
b. Variables entered on step 2: RSA
c. Variables entered on step 3: Highest EqM
d. Variables entered on step 4: Gender

Note: gender(1) is for males and is compared to females (coded 0). Highest educational qualification(1) is for degree or higher qualification and is compared to qualifications below a degree (coded 0)

Based on step 4 of the above table, all the variables are statistically significant at the 5 percent level of significance.

The table also includes the odds ratios of each explanatory variable in the Exp (B) column along with their confidence intervals [95% C.I. for Exp (B) column]. The interpretation of the odds ratio is as follows:

- Holding the other variables constant, a unit increase in each of the continuous noncognitive variables, realistic self-appraisal (RSA) and availability of a strong support person (ASSP) increases the odds of passing the Algebra examination by 1.945 times and 1.690 times respectively.

- Holding the other variables constant, being a female, increases the odds of passing the Algebra examination by .271 times than a male, while being a child of a mother who possesses a degree or a higher qualification increases the odds of the child passing the exam by 6.825 times than being a child of a mother who does not possess a qualification lower than a first degree.

- The confidence interval for the odds ratio for RSA, ASSP, the highest educational qualification of the mother and gender ranges from 1.429 to 2.647, 1.296 to 2.205, 2.313 to 20.139 and .108 to .684 respectively. Based on the confidence intervals, it can be concluded that all the variables are significantly different from zero.

Based on table 4.17, the logistic regression model is as follows:

$$Log\left(\frac{p}{1-p}\right) = -10.557 + .665*RSA + .525*ASSP - 1.304*Gender + 1.921*Highest$$

EqM, where p is the probability of passing the final exam for Algebra.

4.4.2 Results of Backward Wald Selection Method

A. Hosmer-Lemeshow (H-L) Statistic

The Hosmer and Lemeshow (H-L) test in table 4.18 is not statistically significant (p = .274) indicating that the predictors have a significant effect over the constant.

Table 4.18: H-L test (Backward Wald)

Step	Chi-square	df	Sig.
1	15.626	8	.048
2	13.963	8	.083
3	8.714	7	.274

B. Model Summary

Table 4.19 indicates how much variation in the response variable can be explained by the model (the equivalent of R^2 in multiple regression). The table reports the Cox & Snell R^2 and Nagelkerke R^2 values, which calculate the explained variation. Therefore, the explained variation in the response variable for the model with all the predictors ranges from 41.5% to 56.2%.

Table 4.19: Model summary (Backward Wald)

Step	-2 Log Likelihood (-2LL)	Cox & Snell R^2	Nagelkerke R^2
1	125.989[a]	.419	.567
2	126.268[a]	.418	.566
3	126.998[a]	.415	.562

a. Estimation terminated at iteration number 6 because parameter estimates changed by less than .001.

C. Category Prediction

The observed and predicted classifications are presented in the classification table 4.20 (only the last step is presented):

Table 4.20: Classification summary (Backward Wald)

			Predicted		
			Fail	Pass	Percentage correct
Step 3	Observed	Fail	49	13	79.0
		Pass	17	79	82.3
	Overall percentage				81.0

The cut value is .500

With the explanatory variables added, the model now correctly classifies 81.0% of cases overall. That is, the addition of the explanatory variables improves the overall prediction of cases into their observed categories of the response variable. Hence, the percentage accuracy in classification (PAC) of the model is 81.0%.

Sensitivity is the percentage of cases that had the observed characteristic (a 'pass' in the exam) which were correctly predicted by the model (true positives). In this case, 82.3% of participants who passed the exam were also predicted by the model to have passed the final exam for Algebra.

Specificity is the percentage of cases that did not have the observed characteristic (a 'fail' in the exam) and were also correctly predicted as not having the observed characteristic (true negatives). In this case, 79.0% of participants who failed the exam were correctly predicted by the model to have failed the exam for Algebra.

The positive predictive value is the percentage of correctly predicted cases with the observed characteristic compared to the total number of cases predicted as having the characteristic (a 'pass' in the exam). In this case, this is 85.6% [79 ÷ (79+13)]. That is, of all the cases predicted as passing the exam, 85.6% were correctly predicted as passing the exam by the model.

The negative predictive value is the percentage of correctly predicted cases without the observed characteristic compared to the total number of cases predicted as not having the characteristic (a 'fail' in the exam). In this case, this is 74.2% [49 ÷ (49+17)]. That is, of the all cases predicted as failing the exam, 74.2% were correctly predicted as failing the exam by the model.

D. Variables in the Equation

Table 4.21 shows the explanatory variables and their statistical significance to the model.

Table 4.21: Variables in the equation (Backward Wald)

		B	S.E.	Wald	df	Sig.	Exp(B)	95% CI for Exp(B)	
								Lower	Upper
Step 1[a]	PSC	.180	.104	3.000	1	.083	1.197	.977	1.466
	RSA	.683	.171	16.045	1	.000	1.981	1.418	2.767
	ASSP	.428	.149	8.274	1	.004	1.534	1.146	2.054
	SLP	-.189	.204	.860	1	.354	.828	.555	1.235
	Gender(1)	-1.331	.485	7.521	1	.006	.264	.102	.684
	Highest EqF(1)	.306	.578	.280	1	.597	1.358	.437	4.216
	Highest EqM(1)	1.845	.676	7.446	1	.006	6.327	1.682	23.806

		B	S.E.	Wald	df	Sig.	Exp(B)	95% CI for Exp(B)	
								Lower	Upper
	Constant	-10.688	2.304	21.519	1	.000	.000		
Step 2[a]	PSC	.172	.102	2.851	1	.091	1.187	.973	1.449
	RSA	.677	.170	15.808	1	.000	1.968	1.409	2.747
	ASSP	.445	.146	9.225	1	.002	1.560	1.171	2.079
	SLP	-.172	.201	.730	1	.393	.842	.568	1.249
	Gender(1)	-1.342	.485	7.656	1	.006	.261	.101	.676
	Highest EqM(1)	2.027	.591	11.741	1	.001	7.588	2.381	24.183
	Constant	-10.771	2.315	21.656	1	.000	.000		
Step 3[a]	PSC	.181	.103	3.085	1	.079	1.198	.979	1.466
	RSA	.638	.163	15.401	1	.000	1.893	1.376	2.603
	ASSP	.433	.145	8.966	1	.003	1.542	1.161	2.048
	Gender(1)	-1.346	.488	7.608	1	.006	.260	.100	.677
	Highest EqM(1)	2.141	.585	13.421	1	.000	8.511	2.707	26.764
	Constant	-11.632	2.188	28.262	1	.000	.000		

a. Variable(s) entered on step 1: PSC, RSA, ASSP, SLP, Gender, Highest EqF, Highest EqM

Note: gender(1) is for males and is compared to females (coded 0). Highest educational qualification(1) is for degree or higher qualification and is compared to qualifications below a degree (coded 0)

Based on step 3 of the above table, all the variables except positive self-concept (PSC) are statistically significant at the 5 percent level of significance.

The table also includes the odds ratios of each explanatory variable in the Exp (B) column along with their confidence intervals [95% C.I. for Exp (B) column]. The interpretation of the odds ratio is as follows:

- Holding the other variables constant, a unit increase in each of the continuous noncognitive variables, realistic self-appraisal (RSA) and availability of a strong support person (ASSP) increases the odds of passing the Algebra examination by 1.893 times and 1.542 times respectively.

- Holding the other variables constant, being a female, increases the odds of passing the Algebra examination by .260 times than a male, while being a child of a mother who possesses a degree or a higher qualification increases the odds of the child passing the exam by 8.511 times than being a child of a mother who does not possess a qualification lower than a first degree.

- The confidence interval for the odds ratio for RSA, ASSP, the highest educational qualification of the mother and gender ranges from 1.376 to 2.603, 1.161 to 2.048, 2.707 to 26.764 and .100 to .677 respectively. Based on the confidence intervals, it can be concluded that all the variables are significantly different from zero.

Based on table 4.21, the logistic regression model is as follows:

$$Log\left(\frac{p}{1-p}\right) = -11.632 + .181*PSC + .638*RSA + .433*ASSP - 1.346*Gender + 2.141*HighestEqM$$, where p is the probability of passing the final exam for Algebra.

4.5 Model Selection

The preceding sections 4.4.1 and 4.4.2 presented the results of building a logistic regression model to predict the outcome (grade) for Algebra using two stepwise variable selection methods, Forward Wald and Backward Wald. In both methods, three categorical noncognitive variables (gender, father's highest educational qualification and the mother's highest educational qualification) and four continuous noncognitive variables [positive self-concept (PSC), realistic self-appraisal (RSA), availability of a strong support person (ASSP) and strong leadership position (SLP)] were input as explanatory variables. The dichotomous response variable was the grade at final exam for Algebra. While both methods have identified the same set of noncognitive variables as significant, important differences are presented in table 4.22.

Table 4.22: Comparison of results: Forward Wald and Backward Wald

Measure	Forward (Wald)	Backward (Wald)
Significant explanatory variables	RSA, ASSP, Gender, Highest EqM	
Cox & Snell R^2	40.3%	41.5%
Nagelkerke R^2	54.6%	56.2%
Percentage accuracy in classification (PAC)	73.4%	81.0%
Sensitivity	80.2%	82.3%
Specificity	62.9%	79.0%
Positive predictive value	77.0%	85.6%
Negative predictive value	67.2%	74.2%

Since all the measures in the above table are higher for the Backward Wald method, the model generated by Backward Wald is better than that of Forward Wald.

4.5.1 Receiver Operating Curve (ROC)

Another feature that helped in the selection of the best-fitted model is the Area Under the Curve (AUC), also referred to as index of accuracy in the RO Curve. The prediction power of the model increases with the increase of the AUC.

The RO Curve is obtained by plotting sensitivity [true positives (TP)] on y axis against 1 – specificity [false positives (FP)] on the x axis. The area under the curve ranges from .5 to 1.0 with larger values indicating a better fit. The RO Curve is a measure of goodness-of-fit that is often used to evaluate the fit of a logistic regression model and is based on measuring sensitivity and 1 – specificity for all possible cutoff points. The ROC of random guessing lies on the diagonal line. The

ROC of a perfect diagnostic technique is a point at the upper left corner of the graph, where sensitivity proportion is 1.0 and the 1 – specificity proportion is 0.

Table 4.23: Area under the ROC Curve

Feature in the RO Curve	Forward (Wald)	Backward (Wald)
Area Under the Curve	.881	.896
Standard error[a]	.026	.024
Asymptotic Sig[b].	.000	.000
Asymptotic 95% confidence interval	.830 to .931	.848 to .943

a. Under nonparametric assumption
b. Null hypothesis: true area = .5

A review of the above table (4.23) indicates that although AUCs generated by Forward Wald and Backward Wald are both significant at the 5% level of significance with $p = .000$, based on a slightly higher AUC and a slightly lower standard error, the binary logistic regression model developed using Backward Wald is the best-fitted model for the data.

Hence, the final equation is:

$$Log\left(\frac{p}{1-p}\right) = -11.632 + .181*PSC + .638*RSA + .433*ASSP - 1.346*Gender + 2.141*Highest\ EqM$$

where p is the probability of passing the final exam for Algebra.

4.6 Model Validation

4.6.1 Examining Residuals

The main objectives of examining residuals in any regression are to: (1) isolate points for which the model fits poorly and (2) isolate points that exert an undue influence on the model. To assess the former standardized residual and deviance

statistics were examined. To assess the latter, influence statistics such as Cook's distance, DFBeta and leverage were examined. For the logistic regression model developed by Backward Wald, residuals were examined using the guidelines given in table 4.24. The significant noncognitive variables identified in sections 4.2.1 and 4.3.1 were input in logistic regression to generate the residuals.

Table 4.24: Guidelines for examining residuals

Statistic / label	Name	Comment
COO_1	Cook's distance	Should be less than 1
LEV_1	Leverage	Lies between 0 (no influence) and 1 (complete influence). The expected leverage is (k+1)/N, where k is the number of predictors and N is the sample size. Using k = 7 and N = 158, leverage = .0506
ZRE_1	Standardized residual	Only 5% should lie outside ±1.96 and about 1% should lie outside ±2.58. Cases above or below 3 warrant inspection
DFB0_1	DF Beta for the constant	Should be less than 1
DFB1_1	DF Beta for the first predictor	Should be less than 1 (this applies for DFBeta's of other predictor variables

An examination of the residuals (Appendix III) indicated that the above criteria were met by the model. However, casewise listing of standardized residuals (table 4.25) indicated that cases 12 and 43 should be further investigated or removed from the analysis / model-building process. Due to the exploratory nature of this study, the researcher decided to retain the two cases.

Table 4.25: Casewise listing of standardized residuals

Case	Selected status[a]	Observed grade	Predicted	Predicted group	Temporary variable	
					Resid	ZResid
12	S	P**	.034	F	.966	5.331
43	S	P**	.142	F	.858	2.455

a. S = Selected, U = Unselected cases and *** = Misclassified cases
b. Cases with studentized residuals greater than 2.000 are listed

4.6.2 Testing for Multicollinearity

Multicollinearity can affect the parameters of regression models. Multicollinearity occurs when there is a strong linear relationship between several explanatory variables (Keith, 2006; Lomax, 2001). Logistic regression is also prone to the biasing effect of collinearity. Hence, the existence of multicollinearity was tested using the same explanatory variables (PSC, RSA, SLP, ASSP, gender, highest educational qualification of the father and the highest educational qualification of the mother) and the dichotomous response variable, grade.

Since the binary logistic regression option in SPSS does not have an option for producing collinearity diagnostics, Tolerance and VIF values in table 4.26 were produced by running a linear regression with the seven exploratory variables. The explanatory variables in the current study had no tolerances below .1 and no VIF value above 10. As such, the assumption of no multicollinearity holds true for logistic regression model developed using Backward Wald method.

Table 4.26: Tolerance and VIF values for the model

	Collinearity statistics	
	Tolerance	VIF
PSC	.683	1.465
RSA	.680	1.471
ASSP	.609	1.643

	Collinearity statistics	
	Tolerance	VIF
SLP	.758	1.319
Gender	.897	1.114
Highest EqF	.704	1.420
Highest EqM	.676	1.479

CHAPTER 5
CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

According to the model developed by Backward Wald, it was found that the significant noncognitive variables are gender, mother possessing a degree or a higher qualification, realistic self-appraisal (RSA) and the availability of a strong support person (ASSP). According to the model, a unit increase in realistic self-appraisal and availability of a strong support person would increase the odds of passing the Algebra exam by 1.893 and 1.542 respectively. Being a female would increase the odds passing the exam by .260 times, while the mother possessing a degree or a higher qualification would increase the odds of passing the exam by 8.511 times. The developed model is:

$$p = \frac{e^{(.181*PSC+.638*RSA+.433ASSP-1.346*gender-11.632)}}{1+e^{(.181*PSC+.638*RSA+.433*ASSP-1.346*gender-11.632)}}$$ where p is the probability of passing the Algebra exam.

5.2 Recommendations

The findings of this study would help institutions such as UX to be aware of early warning signals to help to identify students who would benefit from different types of academic support. UX should carefully examine these variables which hold the potential to identify at-risk students in Algebra, a key first year subject at UX. As availability of a strong support person (ASSP) is significant noncognitive variable in terms of achieving success in Algebra, UX should consider formulating policies which would make academic counselling mandatory for students enrolling in Algebra. The findings indicate that students who use advising / mentoring services are more likely to pass Algebra and continue their course of study.

Another recommendation to UX is that it should collect data on students' past achievement, including exit exam grades such as those from the OL and / or AL examination. Efforts should also focus on collecting data on parental education as the mother's educational qualifications are found to be significant. Data collection should also be extended to measure the noncognitive constructs introduced in this study.

5.3 Implications for Future Research

It was hoped that this study would be an initial step in the development of a statistical model (based on noncognitive variables) to predict student success in Algebra. Hence, this study needs to be replicated at other for-profit universities and private higher education institutes in Sri Lanka. Only then it would be possible to determine the extent to which noncognitive variables accurately predict / model different samples of students in different subjects / academic disciplines. Replicating the study is important as only then academics and academic administrators would understand the full predictive power of noncognitive variables as predictors of student success and course completion at private higher education institutes. Many private universities in Sri Lanka enroll a higher proportion of part-time students. Hence, this study should also be extended to different types of students, to determine if the results are similar to those found with this sample of students at UX. Future research should also be more longitudinal in nature. Also, further research must be done to observe how measures of early student success in subjects such as Algebra would translate to success in other years at the university. Research should also look at different combinations of cognitive and noncognitive variables that can be used as explanatory variables to predict / model longer term student success.

Hopefully, this exploratory study would serve as an entry for additional research with this large yet understudied population of students – students of for-profit universities in Sri Lanka. Further research with different samples of for-profit university students and alternative measures of noncognitive variables are necessary to ensure a validated questionnaire that could be used to accurately predict the likelihood of student success at for-profit universities and private HEIs in Sri Lanka.

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Appendix I

Noncognitive Questionnaire Used in the Study

Q1: Please list three things that you are proud of having done in your life

_____

_____

_____

Q2: Please list three goals that you have for yourself right now

_____

_____

_____

Q3: Please list groups belonged to (formal or informal) and offices held (if any) in your school or community

_____

_____

_____

Q4: At UX, about 15%-20% of students typically leave before finishing a program. If this should happen to you, what will be the most likely cause? **(select ONE answer only)**

Option 1: ☐ absolutely certain that I will complete the program / complete the credits required to transfer to US or Australia
Option 2: ☐ accept a job
Option 3: ☐ to enter another college / university in Sri Lanka
Option 4: ☐ expensive / cost more than my family could afford
Option 5: ☐ marriage
Option 6: ☐ lack of interest in studies
Option 7: ☐ lack of academic ability to pursue a degree
Option 8: ☐ insufficient reading or study skills
Option 9: ☐ no response

Appendix I (continued)

Q5: Please indicate your gender

☐ male
☐ female

Q6: Please indicate the type of program you are studying

☐ US or Australian transfer program
☐ degree completion program

Q7: Please indicate your father's **HIGHEST** educational qualification by checking the relevant cage.

Highest qualification	Father or guardian
Less than a first degree (bachelor's degree)	
First degree **or** a professional qualification (such as CIMA, CIM, ACCA, etc) **or** a qualification higher than a first degree (such as a master's degree or a doctorate)	

Q8: Please indicate your mother's **HIGHEST** educational qualification by checking the relevant cage.

Highest qualification	Mother or guardian
Less than a first degree (bachelor's degree)	
First degree **or** a professional qualification (such as CIMA, CIM, ACCA, etc) **or** a qualification higher than a first degree (such as a master's degree or a doctorate)	

Q9: How much time do you expect to spend during a typical week studying or doing homework?

☐ 10 hours or less per week
☐ 11 to 20 hours or less per week
☐ more than 20 hours per week

Q10: How much education do you expect to get during your lifetime?

☐ certificate-level qualification
☐ diploma-level qualification
☐ bachelor's degree or equivalent
☐ master's degree
☐ doctoral degree such as PhD

Appendix I (continued)

Q11: Respond to the following statements below with your feelings at present or with your expectations of how things will be.

SD: Strongly Disagree
D: Disagree
N: Neutral
A: Agree
SA: Strongly Agree

	SD (5)	D (4)	N (3)	A (2)	SA (1)
Q12: UX should use its influence to improve the social conditions of our community					
Q13: It should not be very hard to obtain A or B grades in this course					
Q14: I get easily distracted when I try to do something and it doesn't work					
Q15: I am sometimes looked up to by others					
Q16: If I run into problems in my studies, I have someone who would listen to me and help me					
Q17: There is no use in doing things for people, you only find that they will not do anything good for you.					
Q18: In groups where I am comfortable, I am often looked to as leader					
Q19: I expect to have a harder time than most students at UX					
Q20: Once I start something, I finish it					
Q21: When I believe strongly in something, I act on it.					
Q22: I am as skilled academically as the average students at UX					
Q23: I expect I will encounter racism at UX					
Q24: People can easily change me even though I thought my mind was fixed on the subject					
Q25: My friends and relatives don't feel I should go to a university					
Q26: My family always wanted me to go to a university					
Q27: If tutoring is made available on campus at no cost, I would attend regularly					
Q28: I want a chance to prove myself academically					
Q29: My school grades (in the past) don't really reflect what I can do					

Appendix II

Scoring Guide for the Questionnaire Used in the Study

- Question 1

Question	The noncognitive variable(s) used to score by this question…	Score assigned to the question by reading the respondent's answer
Q1: Please list three things that you are proud of having done	Positive self-concept (PSC)	Score of "1" if: at least 75% of the students at UX could have accomplished this goal (examples: "completed secondary school," "held a part-time job") Score of "2" if: at least 50% of the students at UX could have accomplished this goal (examples: "played in a sports team," "was a member of a school club") Score of "3" if: only if the top 25% of the students at UX could have accomplished this goal (examples: "won an academic award," "was captain of the football team") Score of "0" if: The respondent did not respond to this question
After each response is coded, the final score for this question 1 is determined by calculating the mean of scores for each response and rounding to the nearest integer		

Appendix II (continued)

- Question 2

Responses to question 2 are used to calculate the final scores for (1) preference for long range goals (PRLG) and (2) knowledge acquired in the field (KAF).

Question	The noncognitive variable(s) used to score by this question…	Score assigned to the question by reading the respondent's answer
Q2[A]: Please list three goals that you have for yourself right now	Preference for long range goals (PRLG)	<u>Score of "1" if:</u> a vague and/or immediate, short-term goal (examples: "to meet people," "to get a good timetable," "to gain self-confidence") <u>Score of "2" if:</u> a specific goal with a stated future orientation that could be accomplished during undergraduate study (examples: "to join a club so I can meet more people," "to get a good schedule so I can get good grades in the semester," "to run for a seat in the students' council") <u>Score of "3" if:</u> a specific goal with a stated future orientation that would occur after undergraduate study (examples, "to get a good schedule so I can get the classes I need for postgraduate study," "to become a CEO of a listed company") <u>Score of "0" if:</u> The respondent did not respond to this question
After each response is coded, the final score for this question 2[A] is determined by calculating the mean of scores for each response and rounding to the nearest integer		

Appendix II (continued)

Question	The noncognitive variable(s) used to score by this question…	Score assigned to the question by reading the respondent's answer
Q2[B]: Please list three goals that you have for yourself right now	Knowledge acquired in a field (KAF)	Score of "1" if: not at all academic or school-related; vague or unclear (examples: "to get married," "to do better," "to become a better person") Score of "2" if: school related, but not necessarily or primarily education-oriented (examples: "to join a club," "to become the student council president") Score of "3" if: directly related to education (examples: "to get a 3.5 GPA," "to get to know my teachers") Score of "0" if: The respondent did not respond to this question
After each response is coded, the final score for this question 2[B] is determined by calculating the mean of scores for each response and rounding to the nearest integer		

- Question 3

Responses to question 3 are used to calculate the final scores for (1) successful leadership positions (SLP) (2) demonstrated community service (DCS) and (3) knowledge acquired in field (KAF).

Appendix II (continued)

Question	The noncognitive variable(s) used to score by this question…	Score assigned to the question by reading the respondent's answer
Q3[A]: Please list groups belonged to (formal or informal) and offices held (if any) in your school or community	Successful leadership positions (SLP)	Score of "1" if: ambiguous group or no clear reference to activity performed (example: "helped in school") Score of "2" if: membership but no formal or implied leadership role; it has to be clear that it's a functioning group and, unless the criteria are met for a score of 3 as described below, all groups should be coded as 2 even if you, as the rater, are not familiar with the group (for example, "was part of a group that worked on community service projects through my church"). Score of "3" if: leadership was required to fulfill role in group (for example, officer or implied initiator, organizer, or founder) or entrance into the group was dependent upon prior leadership (for example, "organized a tutoring group for underprivileged children in my community," "student council") Score of "0" if: The respondent did not respond to this question
After each response is coded, the final score for this question 3[A] is determined by calculating the mean of scores for each response and rounding to the nearest integer		

Appendix II (continued)

Question	The noncognitive variable(s) used to score by this question…	Score assigned to the question by reading the respondent's answer
Q3[B]: Please list groups belonged to (formal or informal) and offices held (if any) in your school or community	Demonstrated community service (DCS)	Score of "1" if: no community service performed by group, or vague or unclear in relation to community service (for example, "basketball team") Score of "2" if: some community service involved, but it is not the primary purpose of the group (for example, "Scouts") Score of "3" if: group's main purpose is community service (for example, "Big Brothers/Big Sisters") Score of "0" if: The respondent did not respond to this question
After each response is coded, the final score for this question 3[B] is determined by calculating the mean of scores for each response and rounding to the nearest integer		

Appendix II (continued)

Question	The noncognitive variable(s) used to score by this question…	Score assigned to the question by reading the respondent's answer
Q3[C]: Please list groups belonged to (formal or informal) and offices held (if any) in your school or community	Knowledge acquired in a field (KAF)	Score of "1" if: not at all academic or school-related; vague or unclear Score of "2" if: school related, but not necessarily or primarily education-oriented Score of "3" if: directly related to education Score of "0" if: The respondent did not respond to this question
After each response is coded, the final score for this question 3[C] is determined by calculating the mean of scores for each response and rounding to the nearest integer		

- Question 4:

Question	The noncognitive variable(s) used to score by this question…	Score assigned to the question by reading the respondent's answer
Q4: At UX, about 15%-20% of students typically leave before finishing a program. If this should happen to you, what will be the most likely cause?	Positive self-concept (PSC) **and** Realistic self-appraisal (RSA)	Score of "4" if: a respondent selected option 1 Score of "2" if: a respondent selected any **one** of the options from 2 to 8 Score of "0" if: a respondent selected option 9
After each response is coded, the final score for this question 1 is determined by calculating the mean of scores for each response and rounding to the nearest integer		

- Questions 12 to 29

For questions 12 to 29, positive (+) questions scored "as is". Negative (-) questions were reverse coded. A shortcut for calculating scores for reverse coded questions is to subtract the response for the question from 6.

Question	Direction	The noncognitive variable scored by the question…
Q12	-	Understand and deals with racism (UDR)
Q13	-	Realistic self-appraisal (RSA)
Q14	+	Preference for Long Range Goals (PLRG)
Q15	-	Successful leadership positions (SLP)
Q16	-	Availability of a strong support person (ASSP)
Q17	+	Demonstrated community service (DCS)
Q18	-	Successful leadership positions (SLP)
Q19	+	Understand and deals with racism (UDR)
Q20	-	Preference for Long Range Goals (PLRG)
Q21	-	Positive self-concept (PSC)
Q22	-	Realistic self-appraisal (RSA)
Q23	-	Understand and deals with racism (UDR)
Q24	+	Positive self-concept (PSC)
Q25	+	Availability of a strong support person (ASSP)
Q26	-	Availability of a strong support person (ASSP)
Q27	-	Understand and deals with racism (UDR)
Q28	-	Understand and deals with racism (UDR)
Q29	-	Positive self-concept (PSC)

The following equations were used to compute the scores for each noncognitive variable:

- Final score for Positive Self-Concept (PSC) is given by =
  Q1 score + Q4 score + Q10 score + (6 – Q21 score) + Q24 score + (6 – Q29 score)

- Final score for Realistic Self-Appraisal (RSA) is given by =
  Q4 score + (6 – Q13 score) + (6 – Q22 score)

- Final score for Understands and Deals with Racism (UDR) is given by =
  (6 – Q12 score) + Q19 score + (6 – Q23 score) + (6 – Q27 score) + (6 – Q28 score)

- Final score for Preference for Long-Range Goals (PRLG) is given by =
  Q2[A] score + Q14 score + (6 – Q20 score)

Appendix II (continued)

- Final score for Availability of a Strong Support Person (ASSP) is given by = (6 – Q16 score) + Q25 score + (6 – Q26 score)

- Final score for Successful Leadership Experience (SLP) is given by = Q3[A] score + (6 – Q15 score) + (6 – Q18 score)

- Final score for Demonstrated Community Service (DCS) is given by = Q17 score + Q3[B] score

- Final score for Knowledge Acquired in a Field (KAF) is given by = Q2[B] score + Q3[C] score

Appendix III

Residual Statistics

Case ID	COO_1	LEV_1	ZRE_1
1	0.0238	0.0451	-0.7094
2	0.0051	0.0285	0.4175
3	0.0002	0.0091	0.1261
4	0.0010	0.0183	0.2359
5	0.1024	0.0407	-1.5533
6	0.0010	0.0197	0.2232
7	0.0002	0.0099	0.1333
8	0.0006	0.0166	0.1797
9	0.0037	0.0287	0.3553
10	0.0580	0.0385	1.2040
11	0.0016	0.0221	0.2676
12	0.5336	0.0184	5.3307
13	0.0001	0.0088	-0.0901
14	0.0210	0.0669	-0.5408
15	0.1286	0.0147	-0.8639
16	0.0443	0.0598	0.8350
17	0.0017	0.0293	0.2377
18	0.0387	0.0503	0.8551
19	0.0010	0.0208	0.2207
20	0.0035	0.0254	0.3638
21	0.0040	0.0289	0.3682
22	0.0868	0.0676	-1.0941
23	0.0615	0.0330	-1.3426
24	0.0012	0.0208	0.2416
25	0.0101	0.0407	0.4887
26	0.0132	0.0322	0.6287
27	0.0321	0.0944	0.5547
28	0.0276	0.0385	-0.8305
29	0.0003	0.0127	0.1414
30	0.0008	0.0205	0.1944
31	0.0808	0.0108	0.8053
32	0.0126	0.0388	-0.5581
33	0.0145	0.0471	-0.5408
34	0.0836	0.0610	1.1351
35	0.0003	0.0124	-0.1634

Case ID	COO_1	LEV_1	ZRE_1
36	0.0001	0.0091	-0.1202
37	0.0000	0.0061	-0.0833
38	0.0063	0.0404	-0.3868
39	0.0000	0.0052	0.0799
40	0.0749	0.0697	-0.9994
41	0.0000	0.0012	0.0274
42	0.0015	0.0308	0.2181
43	0.4152	0.0645	2.4547
44	0.0014	0.0227	-0.2490
45	0.0006	0.0154	0.1877
46	0.0001	0.0078	0.1112
47	0.0002	0.0113	0.1349
48	0.0324	0.0633	-0.6927
49	0.0290	0.0520	0.7273
50	0.0084	0.0442	0.4257
51	0.0449	0.0559	-0.8710
52	0.1728	0.0387	-2.0706
53	0.0541	0.0502	-1.0114
54	0.0042	0.0257	0.3983
55	0.0003	0.0119	0.1567
56	0.0081	0.0260	-0.5515
57	0.1391	0.0410	-1.8036
58	0.0030	0.0331	-0.2984
59	0.0001	0.0086	0.1112
60	0.0008	0.0163	0.2130
61	0.0010	0.0208	0.2207
62	0.1351	0.1004	1.0999
63	0.0746	0.0673	1.0168
64	0.0942	0.0389	1.5249
65	0.0414	0.0488	-0.8984
66	0.1193	0.0588	1.3823
67	0.0476	0.0486	-0.9649
68	0.0681	0.0824	-0.8710
69	0.0275	0.0530	-0.7014
70	0.0297	0.0497	0.7537
71	0.0238	0.0451	-0.7094
72	0.0051	0.0285	0.4175
73	0.0002	0.0091	0.1261
74	0.0010	0.0183	0.2359

Case ID	COO_1	LEV_1	ZRE_1
75	0.1024	0.0407	-1.5533
76	0.0010	0.0197	0.2232
77	0.0002	0.0099	0.1333
78	0.0006	0.0166	0.1797
79	0.0037	0.0287	0.3553
80	0.0580	0.0385	1.2040
81	0.0016	0.0221	0.2676
82	0.5336	0.0184	0.3307
83	0.0001	0.0088	-0.0901
84	0.0210	0.0669	-0.5408
85	0.1286	0.0147	-0.8639
86	0.0443	0.0598	0.8350
87	0.0017	0.0293	0.2377
88	0.0387	0.0503	0.8551
89	0.0010	0.0208	0.2207
90	0.0035	0.0254	0.3638
91	0.0040	0.0289	0.3682
92	0.0868	0.0676	-1.0941
93	0.0615	0.0330	-1.3426
94	0.0012	0.0208	0.2416
95	0.0101	0.0407	0.4887
96	0.0132	0.0322	0.6287
97	0.0321	0.0944	0.5547
98	0.0276	0.0385	-0.8305
99	0.0003	0.0127	0.1414
100	0.0008	0.0205	0.1944
101	0.0808	0.1108	0.8053
102	0.0126	0.0388	-0.5581
103	0.0145	0.0471	-0.5408
104	0.0836	0.0610	1.1351
105	0.0003	0.0124	-0.1634
106	0.0001	0.0091	-0.1202
107	0.0000	0.0061	-0.0833
108	0.0063	0.0404	-0.3868
109	0.0000	0.0052	0.0799
110	0.0749	0.0697	-0.9994
111	0.0000	0.0012	0.0274
112	0.0015	0.0308	0.2181
113	0.4152	0.0645	0.4547

Case ID	COO_1	LEV_1	ZRE_1
114	0.0014	0.0227	-0.2490
115	0.0006	0.0154	0.1877
116	0.0001	0.0078	0.1112
117	0.0002	0.0113	0.1349
118	0.0324	0.0633	-0.6927
119	0.0290	0.0520	0.7273
120	0.0084	0.0442	0.4257
121	0.0449	0.0559	-0.8710
122	0.1728	0.0387	-2.0706
123	0.0541	0.0502	-1.0114
124	0.0042	0.0257	0.3983
125	0.0003	0.0119	0.1567
126	0.0081	0.0260	-0.5515
127	0.1391	0.0410	-1.8036
128	0.0030	0.0331	-0.2984
129	0.0001	0.0086	0.1112
130	0.0008	0.0163	0.2130
131	0.0010	0.0208	0.2207
132	0.1351	0.1004	1.0999
133	0.0746	0.0673	1.0168
134	0.0942	0.0389	1.5249
135	0.0414	0.0488	-0.8984
136	0.1193	0.0588	1.3823
137	0.0476	0.0486	-0.9649
138	0.0681	0.0824	-0.8710
139	0.0275	0.0530	-0.7014
140	0.0297	0.0497	0.7537
141	0.0003	0.0119	0.1567
142	0.0081	0.0260	-0.5515
143	0.1391	0.0410	-1.8036
144	0.0030	0.0331	-0.2984
145	0.0001	0.0086	0.1112
146	0.0008	0.0163	0.2130
147	0.0010	0.0208	0.2207
148	0.0132	0.0322	0.6287
149	0.0321	0.0944	0.5547
150	0.0276	0.0385	-0.8305
151	0.0003	0.0127	0.1414
152	0.0008	0.0205	0.1944

Case ID	COO_1	LEV_1	ZRE_1
153	0.0808	0.0111	0.8053
154	0.0126	0.0388	-0.5581
155	0.0145	0.0471	-0.5408
156	0.0836	0.0610	1.1351
157	0.0003	0.0124	-0.1634
158	0.0001	0.0091	-0.1202

Case ID	DFB0_1	DFB1_1	DFB2_1	DFB2_1	DFB3_1	DFB4_1	DFB5_1
1	-0.1611	-0.0017	0.0144	0.0023	0.0306	0.0324	0.0324
2	-0.1128	0.0015	0.0064	0.0043	0.0055	-0.0008	-0.0008
3	-0.0206	0.0002	0.0013	0.0008	-0.0006	0.0050	0.0050
4	-0.0446	0.0003	0.0028	0.0017	-0.0004	0.0144	0.0144
5	0.2699	-0.0138	-0.0286	0.0101	-0.0317	-0.0033	-0.0033
6	-0.0587	0.0007	0.0033	0.0022	0.0001	0.0020	0.0020
7	-0.0172	0.0001	0.0009	0.0010	-0.0040	0.0054	0.0054
8	-0.0445	0.0003	0.0022	0.0021	0.0000	0.0012	0.0012
9	-0.0626	-0.0006	0.0030	0.0039	0.0025	0.0251	0.0251
10	0.0661	0.0082	0.0071	-0.0194	0.0469	-0.0259	-0.0259
11	-0.0494	0.0014	0.0034	0.0004	-0.0006	0.0198	0.0198
12	0.2447	-0.0543	-0.0380	-0.0230	0.1609	-0.2159	-0.2159
13	-0.0148	-0.0001	0.0006	0.0011	-0.0015	0.0013	0.0013
14	-0.1816	0.0079	0.0069	0.0032	-0.0247	-0.0237	-0.0237
15	-0.4148	0.0150	-0.0101	0.0228	0.0744	-0.1026	-0.1026
16	0.0259	0.0003	-0.0122	0.0045	0.0327	0.0660	0.0660
17	-0.0259	-0.0018	0.0029	0.0028	-0.0111	0.0136	0.0136
18	0.0413	0.0113	-0.0071	-0.0064	-0.0541	-0.0111	-0.0111
19	-0.0415	0.0019	0.0030	0.0001	-0.0099	0.0052	0.0052
20	-0.0611	0.0024	0.0046	0.0011	-0.0209	0.0050	0.0050
21	-0.0697	0.0032	0.0016	0.0030	-0.0195	0.0021	0.0021
22	-0.1679	-0.0009	-0.0209	0.0231	0.0867	-0.0051	-0.0051
23	-0.0290	-0.0024	-0.0078	0.0025	0.0906	0.0140	0.0140
24	-0.0449	0.0017	0.0036	0.0004	-0.0115	0.0052	0.0052
25	-0.0673	-0.0009	0.0000	0.0066	0.0094	0.0365	0.0365
26	-0.1321	-0.0001	0.0047	0.0092	0.0191	-0.0166	-0.0166
27	0.0132	0.0110	-0.0086	-0.0058	-0.0390	0.0637	0.0637
28	-0.0456	-0.0057	-0.0049	0.0134	-0.0324	0.0179	0.0179
29	-0.0226	0.0004	0.0020	0.0002	-0.0012	0.0072	0.0072
30	-0.0469	-0.0003	0.0036	0.0021	-0.0005	0.0017	0.0017
31	-0.0435	-0.0201	0.0304	0.0067	0.0213	-0.0243	-0.0243

Case ID	DFB0_1	DFB1_1	DFB2_1	DFB2_1	DFB3_1	DFB4_1	DFB5_1
32	-0.1117	0.0008	-0.0028	0.0107	-0.0222	0.0170	0.0170
33	-0.1656	0.0064	0.0094	-0.0017	0.0172	0.0332	0.0332
34	0.1948	-0.0033	-0.0173	-0.0037	0.0500	0.0840	0.0840
35	-0.0346	0.0009	0.0017	0.0009	-0.0047	0.0059	0.0059
36	-0.0227	0.0006	0.0010	0.0007	-0.0027	0.0034	0.0034
37	-0.0122	0.0000	0.0008	0.0005	-0.0015	0.0018	0.0018
38	-0.0855	-0.0040	0.0059	0.0081	-0.0168	0.0126	0.0126
39	-0.0082	0.0001	0.0007	0.0002	-0.0018	0.0025	0.0025
40	-0.0894	0.0080	0.0202	-0.0214	0.0482	0.0634	0.0634
41	-0.0016	0.0000	0.0001	0.0001	-0.0003	0.0003	0.0003
42	-0.0359	0.0013	0.0047	-0.0016	-0.0024	0.0174	0.0174
43	0.9884	-0.0424	0.0100	-0.0359	-0.0876	-0.0929	-0.0929
44	-0.0648	0.0018	0.0009	0.0031	-0.0079	0.0088	0.0088
45	-0.0349	0.0000	0.0024	0.0020	-0.0070	0.0018	0.0018
46	-0.0140	0.0003	0.0006	0.0006	-0.0029	0.0042	0.0042
47	-0.0186	0.0002	0.0005	0.0013	-0.0038	0.0051	0.0051
48	-0.1886	-0.0083	0.0063	0.0179	0.0378	0.0107	0.0107
49	-0.0152	-0.0057	-0.0041	0.0151	-0.0417	-0.0301	-0.0301
50	-0.0700	-0.0033	0.0027	0.0102	-0.0229	-0.0083	-0.0083
51	-0.0627	0.0087	-0.0182	0.0075	-0.0364	0.0247	0.0247
52	0.2340	0.0095	-0.0215	-0.0149	0.0258	-0.1742	-0.1742
53	-0.1192	0.0105	0.0064	-0.0132	0.0562	0.0497	0.0497
54	-0.0604	0.0013	0.0055	0.0020	-0.0238	0.0036	0.0036
55	-0.0283	0.0005	0.0016	0.0012	-0.0051	0.0020	0.0020
56	-0.0945	-0.0008	0.0034	0.0068	-0.0253	0.0224	0.0224
57	0.1819	-0.0085	0.0017	-0.0057	-0.0361	-0.1616	-0.1616
58	-0.0614	0.0012	0.0076	-0.0012	-0.0150	0.0191	0.0191
59	-0.0174	-0.0001	0.0010	0.0009	-0.0005	0.0036	0.0036
60	-0.0398	0.0006	0.0029	0.0014	-0.0089	0.0032	0.0032
61	-0.0415	0.0019	0.0030	0.0001	-0.0099	0.0052	0.0052
62	-0.1048	0.0110	-0.0384	0.0236	0.0761	-0.0835	-0.0835
63	-0.0593	0.0224	-0.0083	-0.0140	0.0448	-0.0192	-0.0192
64	0.4340	-0.0090	-0.0109	-0.0124	-0.0714	-0.0607	-0.0607
65	0.0139	-0.0144	0.0068	0.0099	-0.0409	0.0240	0.0240
66	0.1093	0.0245	-0.0112	-0.0294	0.0634	-0.0321	-0.0321
67	0.0429	0.0106	0.0047	-0.0198	-0.0504	0.0630	0.0630
68	0.0296	0.0117	0.0161	-0.0275	-0.0566	0.0775	0.0775
69	-0.0429	0.0071	0.0125	-0.0131	-0.0432	0.0557	0.0557
70	0.0143	0.0017	-0.0011	-0.0035	0.0206	0.0731	0.0731

Case ID	DFB0_1	DFB1_1	DFB2_1	DFB2_1	DFB3_1	DFB4_1	DFB5_1
71	-0.1611	-0.0017	0.0144	0.0023	0.0306	0.0324	0.0324
72	-0.1128	0.0015	0.0064	0.0043	0.0055	-0.0008	-0.0008
73	-0.0206	0.0002	0.0013	0.0008	-0.0006	0.0050	0.0050
74	-0.0446	0.0003	0.0028	0.0017	-0.0004	0.0144	0.0144
75	0.2699	-0.0138	-0.0286	0.0101	-0.0317	-0.0033	-0.0033
76	-0.0587	0.0007	0.0033	0.0022	0.0001	0.0020	0.0020
77	-0.0172	0.0001	0.0009	0.0010	-0.0040	0.0054	0.0054
78	-0.0445	0.0003	0.0022	0.0021	0.0000	0.0012	0.0012
79	-0.0626	-0.0006	0.0030	0.0039	0.0025	0.0251	0.0251
80	0.0661	0.0082	0.0071	-0.0194	0.0469	-0.0259	-0.0259
81	-0.0494	0.0014	0.0034	0.0004	-0.0006	0.0198	0.0198
82	1.2447	-0.0543	-0.0380	-0.0230	0.1609	-0.2159	-0.2159
83	-0.0148	-0.0001	0.0006	0.0011	-0.0015	0.0013	0.0013
84	-0.1816	0.0079	0.0069	0.0032	-0.0247	-0.0237	-0.0237
85	-0.4148	0.0150	-0.0101	0.0228	0.0744	-0.1026	-0.1026
86	0.0259	0.0003	-0.0122	0.0045	0.0327	0.0660	0.0660
87	-0.0259	-0.0018	0.0029	0.0028	-0.0111	0.0136	0.0136
88	0.0413	0.0113	-0.0071	-0.0064	-0.0541	-0.0111	-0.0111
89	-0.0415	0.0019	0.0030	0.0001	-0.0099	0.0052	0.0052
90	-0.0611	0.0024	0.0046	0.0011	-0.0269	0.0050	0.0050
91	-0.0697	0.0032	0.0016	0.0030	-0.0195	0.0021	0.0021
92	-0.1679	-0.0009	-0.0209	0.0231	0.0867	-0.0051	-0.0051
93	-0.0290	-0.0024	-0.0078	0.0025	0.0906	0.0140	0.0140
94	-0.0449	0.0017	0.0036	0.0004	-0.0115	0.0052	0.0052
95	-0.0673	-0.0009	0.0000	0.0066	0.0094	0.0365	0.0365
96	-0.1321	-0.0001	0.0047	0.0092	0.0191	-0.0166	-0.0166
97	0.0132	0.0110	-0.0086	-0.0058	-0.0390	0.0637	0.0637
98	-0.0456	-0.0057	-0.0049	0.0134	-0.0324	0.0179	0.0179
99	-0.0226	0.0004	0.0020	0.0002	-0.0012	0.0072	0.0072
100	-0.0469	-0.0003	0.0036	0.0021	-0.0005	0.0017	0.0017
101	-0.0435	-0.0201	0.0304	0.0067	0.0213	-0.0243	-0.0243
102	-0.1117	0.0008	-0.0028	0.0107	-0.0222	0.0170	0.0170
103	-0.1656	0.0064	0.0094	-0.0017	0.0172	0.0332	0.0332
104	0.1948	-0.0033	-0.0173	-0.0037	0.0500	0.0840	0.0840
105	-0.0346	0.0009	0.0017	0.0009	-0.0047	0.0059	0.0059
106	-0.0227	0.0006	0.0010	0.0007	-0.0027	0.0034	0.0034
107	-0.0122	0.0000	0.0008	0.0005	-0.0015	0.0018	0.0018
108	-0.0855	-0.0040	0.0059	0.0081	-0.0168	0.0126	0.0126
109	-0.0082	0.0001	0.0007	0.0002	-0.0018	0.0025	0.0025

Case ID	DFB0_1	DFB1_1	DFB2_1	DFB2_1	DFB3_1	DFB4_1	DFB5_1
110	-0.0894	0.0080	0.0202	-0.0214	0.0482	0.0634	0.0634
111	-0.0016	0.0000	0.0001	0.0001	-0.0003	0.0003	0.0003
112	-0.0359	0.0013	0.0047	-0.0016	-0.0024	0.0174	0.0174
113	0.9884	-0.0424	0.0100	-0.0359	-0.0876	-0.0929	-0.0929
114	-0.0648	0.0018	0.0009	0.0031	-0.0079	0.0088	0.0088
115	-0.0349	0.0000	0.0024	0.0020	-0.0070	0.0018	0.0018
116	-0.0140	0.0003	0.0006	0.0006	-0.0029	0.0042	0.0042
117	-0.0186	0.0002	0.0005	0.0013	-0.0038	0.0051	0.0051
118	-0.1886	-0.0083	0.0063	0.0179	0.0378	0.0107	0.0107
119	-0.0152	-0.0057	-0.0041	0.0151	-0.0417	-0.0301	-0.0301
120	-0.0700	-0.0033	0.0027	0.0102	-0.0229	-0.0083	-0.0083
121	-0.0627	0.0087	-0.0182	0.0075	-0.0304	0.0247	0.0247
122	0.2340	0.0095	-0.0215	-0.0149	-0.0258	-0.1742	-0.1742
123	-0.1192	0.0115	0.0064	-0.0132	0.0562	0.0497	0.0497
124	-0.0604	0.0013	0.0055	0.0020	-0.0238	0.0036	0.0036
125	-0.0283	0.0005	0.0016	0.0012	-0.0051	0.0020	0.0020
126	-0.0945	-0.0008	0.0034	0.0068	-0.0253	0.0224	0.0224
127	0.1819	-0.0085	0.0017	-0.0057	-0.0361	-0.1616	-0.1616
128	-0.0614	0.0012	0.0076	-0.0012	-0.0150	0.0191	0.0191
129	-0.0174	-0.0001	0.0010	0.0009	-0.0005	0.0036	0.0036
130	-0.0398	0.0006	0.0029	0.0014	-0.0089	0.0032	0.0032
131	-0.0415	0.0019	0.0030	0.0001	-0.0099	0.0052	0.0052
132	-0.1048	0.0110	-0.0384	0.0236	0.0761	-0.0835	-0.0835
133	-0.0593	0.0224	-0.0083	-0.0140	0.0448	-0.0192	-0.0192
134	0.4340	-0.0090	-0.0109	-0.0124	-0.0714	-0.0607	-0.0607
135	0.0139	-0.0144	0.0068	0.0099	-0.0409	0.0240	0.0240
136	0.1093	0.0245	-0.0112	-0.0294	0.0634	-0.0321	-0.0321
137	0.0429	0.0106	0.0047	-0.0198	-0.0504	0.0630	0.0630
138	0.0296	0.0117	0.0161	-0.0275	-0.0566	0.0775	0.0775
139	-0.0429	0.0071	0.0125	-0.0131	-0.0432	0.0557	0.0557
140	0.0143	0.0017	-0.0011	-0.0035	0.0206	0.0731	0.0731
141	-0.0283	0.0005	0.0016	0.0012	-0.0051	0.0020	0.0020
142	-0.0945	-0.0008	0.0034	0.0068	-0.0253	0.0224	0.0224
143	0.1819	-0.0085	0.0017	-0.0057	-0.0361	-0.1616	-0.1616
144	-0.0614	0.0012	0.0076	-0.0012	-0.0150	0.0191	0.0191
145	-0.0174	-0.0001	0.0010	0.0009	-0.0005	0.0036	0.0036
146	-0.0398	0.0006	0.0029	0.0014	-0.0089	0.0032	0.0032
147	-0.0415	0.0019	0.0030	0.0001	-0.0099	0.0052	0.0052
148	-0.1321	-0.0001	0.0047	0.0092	0.0191	-0.0166	-0.0166

Case ID	DFB0_1	DFB1_1	DFB2_1	DFB2_1	DFB3_1	DFB4_1	DFB5_1
149	0.0132	0.0110	-0.0086	-0.0058	-0.0390	0.0637	0.0637
150	-0.0456	-0.0057	-0.0049	0.0134	-0.0324	0.0179	0.0179
151	-0.0226	0.0004	0.0020	0.0002	-0.0012	0.0072	0.0072
152	-0.0469	-0.0003	0.0036	0.0021	-0.0005	0.0017	0.0017
153	-0.0435	-0.0201	0.0304	0.0067	0.0213	-0.0243	-0.0243
154	-0.1117	0.0008	-0.0028	0.0107	-0.0222	0.0170	0.0170
155	-0.1656	0.0064	0.0094	-0.0017	0.0172	0.0332	0.0332
156	0.1948	-0.0033	-0.0173	-0.0037	0.0500	0.0840	0.0840
157	-0.0346	0.0009	0.0017	0.0009	-0.0047	0.0059	0.0059
158	-0.0227	0.0006	0.0010	0.0007	-0.0027	0.0034	0.0034