Exploring first year academic achievement through structural equation modelling.

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Abstract

The purpose of this research was to develop and test a multicausal model of the individual characteristics associated with academic success in first-year Australian university students. This model comprised the constructs of: previous academic performance, achievement motivation, self-regulatory learning strategies, and personality traits, with end-of-semester grades the dependent variable of interest. The study involved the distribution of a questionnaire, which assessed motivation, self-regulatory learning strategies and personality traits, to 1193 students at the start of their first year at university. Students' academic records were accessed at the end of their first year of study to ascertain their first and second semester grades. This study established that previous high academic performance, use of self-regulatory learning strategies, and being introverted and agreeable, were indicators of academic success in the first semester of university study. Achievement motivation and the personality trait of conscientiousness were indirectly related to first semester grades, through the influence they had on the students' use of self-regulatory learning strategies. First semester grades were predictive of second semester grades. This research provides valuable information for both educators and students about the factors intrinsic to the individual that are associated with successful performance in the first year at university.

The first year at university is arguably the most crucial year affecting the academic achievement of students, as it is during their first year of university that their attitudes towards the course, approaches to learning, and self-perceptions are developed. This study addressed academic performance in first-year university students, and focused on identifying the important individual characteristics of academically successful students, through the use of structural equation modelling. This study explored the 'individual characteristics' of successful students, as distinct from examining the environment, or external influences, on achievement. More specifically, the emphasis of the research was on variables intrinsic to the student, such as their personality characteristics, their motivational beliefs, and the learning strategies they employed in order to perform.

Australian universities, like most universities internationally, base a large portion of entrance-making decisions on the previous academic performance of the applicant (Andrich & Mercer, 1997), as previous academic performance is considered to be one of the best predictors of an individual's achievement at university. The majority of individuals (both school leavers and mature-age students) applying for entry into an Australian university are awarded a tertiary entrance rank (QUT, 2002). This rank is generally based on the previous academic performance of the applicant and is calculated from academic qualifications, including high school grades and grades from other tertiary institutions. This tertiary entrance rank is then used as an estimate of academic potential at university and is utilised to determine who will be offered a place in the university.

Murphy, Papanicolaou, and McDowell (1999) reported on a study, carried out over a three-year period, from 1995 to 1998, at the Royal Melbourne Institute of Technology, that examined the relationship between tertiary entrance rank (TER) and academic performance at university. They found that three different patterns emerged in the relationship between TER and grades at university. They discovered that, for students with a high TER (above 80), there was a statistically

significant relationship between TER and grades (r = 0.4). For students with an average to high TER (40 to 80), there was no statistically significant relationship between TER and grades. For students with a low TER (less than 40), there was a variable relationship between TER and grades. Murray-Harvey and Keeves (1994) established that entrance ranks have a limited utility for predicting success at university, because once university grades are available (i.e., after the first semester or first year of study), these become the most important predictors of future performance at university.

Murphy, Papanicolaou and McDowell (1999, p.2) suggested that these results provided "strong encouragement to students, academics, schools and the wider community that students with a range of achievement in their final year of secondary school (Year 12) can and do succeed in demanding courses in higher education". Mouw and Khanna (1993) believed that academic achievement depends not only on whether one 'can' do it, but whether one 'will' do it. They suggested that willingness to perform was just as important, if not more important, when considering students' academic achievement at university. DeRaad and Schouwenburg (1996, p. 313) concluded, "achievement through ability alone is the exception rather than the rule. Most tasks demand more than brilliance".

Over the last decade, there has been an increasing emphasis on independent learning, and students have been encouraged to take personal responsibility for their studies. Moses and Ramsden (1992) highlight one of the values of modern Australian universities as encouraging students to be independent learners and to develop a desire for life-long learning. With the increasing recognition of the importance of students taking personal responsibility for their learning, came a growing interest in the concept of self-regulated learning. Self-regulation is now seen as a vital ingredient to performance in educational settings (Wolters & Rosenthal, 2000; Zimmerman, 1990a, 1990b, 2000).

Zimmerman (1990b, p. 4)) has argued that self-regulated learners are metacognitively, motivationally, and behaviourally active participants in their own learning". When examining self-regulation, Zimmerman (1990b) distinguished between self-regulatory processes and self-regulatory strategies. Self-regulatory processes refer to motivational characteristics such as self-efficacy and values, whereas self-regulatory strategies refer to specific behaviours utilised to effectively achieve the task. Zimmerman (1990a) believed that while 'most students' would exercise self-regulatory processes, it is the utilisation of self-regulatory strategies that differentiates 'most students' from self-regulated learners. It is vital that students view the outcome of the task as favourable/beneficial if they are to apply self-regulatory strategies to achieve the task. Zimmerman (1994) stated that the two most important determinants of self-regulation are self-motivation and effective use of learning strategies. Self-motivation consists of factors such as self-efficacy, goals, values, and attributional processes, while learning strategies include such behaviours as time management and planning.

Recently, self-regulation theory has been criticised for failing to take into account more stable aspects of the individual such as personality. Matthews et al. (2000) viewed traits as important aspects of self-knowledge, and they suggested that these influenced self-regulation. Motivational beliefs were viewed as stemming from the more stable enduring personality traits of the individual. Demetriou (2000) supported this view, pinpointing the need for 'self' theories to be encapsulated in a theory of self-regulation. Demetriou suggested that personality traits influenced an individual's development of preferences for activities and characteristic approaches to tasks. He conceptualised the link between personality, motivation and behaviours as existing at three levels: personality is viewed as a high level concept influencing the intermediate level of motivation, which in turn influences the lower behavioural/action level.

Previous research utilising modelling approaches to examine academic achievement have found a complex interrelationship exists between individual characteristics, learning strategies and academic achievement. Murray-Harvey (1993) developed a causal path model of academic achievement using the predictor variables of: approach to learning motives and strategies, learning style, age, sex, locus of control, metacognitive capability, and students self rated performance. It was found that metacognitive capability was the most important variable identifying successful students. Drew and Watkins (1998), using structural equation modelling, examined the relationship between affective variables, learning approaches and academic achievement. They showed that academic achievement was influenced both by causal attributions and self-concept. Internal locus of control was negatively related to a surface approach which was in turn negatively related to academic achievement, meaning that if one were to have an internal locus of control they would be less likely to use the surface learning strategies that lead to poorer grades. High self concept of ability was related to a deeper approach to learning which was in turn related to higher academic achievement, meaning that students with high self concepts were more likely to use deep strategies that lead to higher grades. It was explained that deeper learning approaches were related to higher internal locus of control and higher self-concept of ability as students hold a sense of control over the learning situation.

This research examines the relationship between previous academic performance, personality traits, motivational beliefs, learning strategies and academic achievement in first-year university students, using a structural equation modelling approach. While previous academic performance is the most important factor in entrance decisions for most universities, it is the contention of the authors that factors intrinsic to the individual student are also vital ingredients of academic achievement.

Method

Participants

The participants in this study were 1193 first-year university students across 8 faculties at the Queensland University of Technology (QUT) (this sample size represented approximately a 76% response rate from the approached sample of 1560). Five hundred and seventy five males, 603 females, and 15 people who did not indicate their gender participated in the study. Ages ranged from 16 to 58 (M =21.44, SD=7.09).

Materials

The initial student questionnaire assessed personality, achievement motivation, self-reported learning strategies and obtained demographic details about participants. Academic data was obtained by accessing the student records held by the university (students provided informed consent for their records to be accessed when they completed the initial questionnaire).

Academic Records

Academic records showed each student's entrance rank and these were used as an index of previous academic performance. For school leavers, an Overall Position (OP) score was available. This OP ranks students in relation to others on a scale from 1 to 25, with 1 being the highest and 25 being the lowest. For mature-age students, a Queensland Tertiary Admission Centre (QTAC) rank was available. This rank places students on a scale from 1 to 99 with 99 being the highest and 1 being the lowest. As it was important to place all students on a comparable scale, a conversion table from QTAC (QUT, 2002) was used to convert QTAC ranks to their equivalent OP score.

For a measure of academic achievement, grade point averages (GPA's) were accessed from student records. GPA's are a measure of a student's average performance across all subjects in which they are enrolled. They range from 1 to 7, with a grade of 7 being the highest and classified as a high

distinction, a grade of 6 being a distinction, a grade of 5 being a credit, a grade of 4 being a pass, a grade of 3 being a low pass, a grade of 2 being a fail, and a grade of 1 being a low fail.

It is important to note that while an OP of 1 is the highest entrance rank, a grade of 1 at QUT is the lowest grade, therefore a negative relationship is expected between these two variables. However, for ease of interpretation in the structural equation modelling section, negative signs are removed and entrance rank is referred to as previous performance, with better previous performance predicted to positively relate to higher achievement at university.

Achievement Motivation

Five scales from the Motivated Strategies for Learning Questionnaire (MSLQ), developed by Garcia and Pintrich (1995) were used to assess academic self-efficacy (8 items), control of learning beliefs (4 items), intrinsic goal orientation (or learning goals) (4 items), extrinsic goal orientation (or performance goals) (4 items), and task value (6 items). The academic self-efficacy scale measures the extent to which one believes that one has the ability to succeed in a given academic task. The control of learning beliefs scale measures the degree to which students attribute outcomes to factors within their own control, rather than to external agents. The intrinsic goal orientation scale measures a desire for learning and mastery, while the extrinsic goal orientation scale measures a desire for high grades. Task value beliefs refer to the students' interest in the subject and their views about the use and importance of the subject. Participants respond to a series of statements on a seven point likert scale, ranging from 1 (not at all true of me) to 7 (very true of me).

Self-Regulated Learning Strategies

Five sub-scales from the Learning Strategies scale from the MSLQ were also used. The full learning strategies scale consists of the three sub-scales: cognitive learning strategies, self-regulatory strategies and resource management. The five sub-scales that were used were the

elaboration and organisation sub-scale from the cognitive learning scale, the metacognitive self-regulation scale, and the time management and effort regulation sub-scale from the resource management scale. The meaning of each of the learning strategy scales is as follows. The elaboration scale refers to paraphrasing and summarising. The organisation scale involves outlining the major points and using tables to illustrate points. The metacognitive self-regulation scale measures goal setting, observing one's understanding of the task, and task-dependent regulation. The time management scale involves appropriate use of one's time. Effort regulation refers to delaying gratification and persisting in tasks, regardless of difficulty. These sub-scales were chosen because the authors concluded that they best encapsulated Zimmerman's (1990b) definition of self-regulation, and that they were all reflective of deep learning approaches.

Personality Traits

The Neuroticism Extraversion Openness Five Factor Inventory (NEO-FFI) which is a short version of the NEO Personality Inventory-Revised (NEO-PI-R), developed by Costa and McCrae (1992), was used to assess the big five personality traits of neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness. The NEO-FFI consists of 60 items with 12 items per personality-trait scale. Participants rate their level of agreement with a series of statements on a five point Likert scale (1 = strongly disagree to 5 = strongly agree).

High scores on neuroticism indicate a tendency to experience disruptive emotions and irrational thoughts, whereas low scores on neuroticism indicate a level of emotional stability. High scores on openness to experience indicate an active imagination, intellectual curiosity and independence in judgements, whereas low scores indicate conventional behaviours and narrow outlooks. High scores on agreeableness indicate a degree of altruism and sympathy for others, while low scores on agreeableness indicate a level of antagonism and scepticism. High scores on conscientiousness indicate self-control, purposeful and reliable behaviour and strong will, while low scores on

conscientiousness indicate apathetic behaviour and a level of hedonism. Finally, high scores on extraversion indicate a tendency for sociability and a general liking of people and groups, while low scores on extraversion indicate a level of introversion or a more reserved, independent individual. It is important to note, that while 'introversion' is hypothesised to be positively related to achievement outcomes, the NEO-FFI scale measures 'extraversion'. As the NEO-FFI conceptualises introversion and extraversion to be two ends of the one continuum (Costa & McCrae, 1992), for ease of interpretation in the structural equation modelling section, the extraversion scale is referred to as introversion, and negative signs are removed.

Procedure

Participants were recruited to participate in the study in one of three ways: (1) in lecture time (n = 841), (2) as part of a credit for research program in a first year psychology subject (n = 185), and (3) via a mail-out survey (n = 167). For procedure (1) and (2), the questionnaire was distributed to students and students were given adequate time to complete the questionnaire and return it to the researcher in class time. For procedure (3), an email was sent to all students enrolled at the university, and students who indicated their interest in participating were mailed a copy of the questionnaire to complete and return.

Results

Statistical Approach

A two-step approach to structural equation modelling (SEM) was used in this research, as recommended by Anderson and Gerbing (1988). The measurement models were specified and tested prior to the testing of the full structural model. The aim in developing the measurement models prior to the full structural model was to assess the validity and reliability of the constructs before their use in the full model (Anderson & Gerbing, 1988).

Measurement Models Constructs

In the development of the measurement models, one-factor congeneric measurement models were calculated for each of the achievement motivation constructs (academic self-efficacy, locus of control, learning goals, performance goals, and task value) and for each of the self-regulatory strategy constructs (elaboration, organisation, self-regulation, time management, and effort regulation). Lisrel 8.3 (Jöreskog and Sörbom, 1996) was used to perform these analyses and the following procedure was used in calculating each of these one-factor congeneric models. The one-factor model was initially calculated using all items from the relevant sub-scale from the MSLQ, using maximum likelihood estimation. Standardised lambda coefficients and standardised error terms were inspected to identify those items considered most important in the one-factor model and those variables considered least important as a measure of the latent construct (i.e., with small lambda coefficients and large error variance according to the specifications provided by Holmes-Smith, 2001). If items were identified as poor measures of the latent construct, they were removed from subsequent model development for the sake of parsimony. Table 1 shows the results of each of these one factor model analyses.

Insert Table 1

Factor scores from these one-factor models were used to create a composite variable. After this stage, the achievement motivation constructs and the self-regulatory strategy constructs were treated slightly differently. For the achievement motivation constructs, the maximised reliability were calculated in SPSS using the fitted covariance matrix, error matrix and factor scores. With the standard deviation and variance of the composite variable, and the maximised reliability value, lambda x parameter coefficients and error coefficients for the composite variable were calculated. These values were then used in all subsequent structural model analyses. This procedure followed

Holmes-Smith's (2001) recommendations. However, as the elaboration, organisation, self-regulation, time management, and effort regulation constructs were to be used as indicators of a latent construct of self-regulatory strategies, there was no need to set the lambda y coefficients and error coefficients, because these variables would load on a second order latent construct.

As the NEO-FFI is a standardised psychometric measure, all the personality composite variables (i.e., neuroticism, extraversion, conscientiousness, openness to experience, and agreeableness) were constructed using the recommended approach detailed by Costa and McCrae (1992), rather than constructing one-factor models. However, the lambda x parameter coefficients and error coefficients were calculated in a similar manner to that described previously for the one-factor congeneric measurement models. As one-factors models were not calculated for the personality factors, alpha coefficients were used as a measure of reliability. Measurement of these constructs was then fixed for all subsequent structural model analyses. (Note: While the NEO-FFI scale measures Extraversion, Extraversion has a negative relationship with achievement. For the sake of clarity, all negative signs have been removed from the models that follow, and the current study refers to the 'Extraversion' scale as the 'Introversion' scale.)

Finally, the error coefficients were fixed for the three academic achievement measures, previous performance, GPA Semester One, and GPA Semester Two. The estimation of these constructs with less than three indicators is problematic, as it may result in negative values/matrices that are not positive definite, and this will result in the construct not being identified. These are known as 'Heywood cases' and the solution that is recommended in dealing with these cases is to fix the error coefficient for these variables to a small positive value (0.05), to enable the model to be identified (Bollen, 1989).

Table 2 reports the observed variable path and error coefficients for those values that were fixed from calculations of the measurement models. These values remain fixed for all subsequent structural model analyses, and therefore will only be reported in this section. Figure 1 illustrates the initial model of academic achievement. Both directly observed variables and latent constructs are highlighted in this model. All subsequent models will only illustrate structural paths and standardised coefficients for these paths. As can be seen in Figure 1, only one indicator for each of the independent constructs is used in the full model, and these are based on results from the first step of the analysis - the measurement model analysis. From this analysis, it can be seen that there are eleven indicators of 11 independent latent constructs, five indicators of a latent construct of self-reported self regulatory strategies, and two indicators of 2 dependent latent constructs.

Insert Table 2 and Figure 1 Here

Descriptive Results

The means and standard deviations for all variables in the study for the total sample of students who obtained grades of a pass or above, males/females, and school leavers/mature-age students are shown in Table 3. Table 4 depicts the correlation matrix for all variables of interest, with statistically significant correlations being indicated by an asterisk.

Insert Table 3 and 4 Here

Structural Equation Model of Academic Achievement

Prelis 2.3 (Jöreskog and Sörbom, 1996) was used to prepare the data for use in structural equation modelling (using Lisrel 8.30). On initial screening of the data for the structural equation model, the following information was found. The number of participants with complete data for all variables for this analysis was 682. One hundred and thirty two cases had one missing value, while 10 cases

had two missing values. For 104 participants, an entrance rank was not available, and for 48 students a GPA for second semester was not available.

The full structural model as depicted in Figure 1 was tested in the first instance. Maximum likelihood estimation was used with a Santorra Bentler adjustment (Holmes-Smith 2001), to take into account non-normal data. Table 5 reports the goodness-of-fit measures and squared multiple correlations for the endogenous variables.

Insert Table 5 Here

While the chi square value and NNFI were less than satisfactory, all other fit indices showed either a satisfactory fit (RMSEA, CFI, and GFI) or a good fit (RMR) according to the specification provided by Holmes-Smith (2001). Modification indices specified no statistically significant improvements to the model by addition of any parameters. Based on the goodness-of-fit indices and lack of statistically significant modification indices, this model was accepted as showing satisfactory fit. Thus, the adjustment made to the next stage of the model was to remove all non-significant paths from the model estimation.

Three paths were non-significant in this model. The structural path between *academic self-efficacy* and *self-reported learning strategies* was not statistically significant (*academic self-efficacy* accounted for only 3% of the variance in *learning strategies*), indicating that *academic self-efficacy* was not a statistically significant predictor of *self-reported learning strategies*. The structural paths between the two personality traits of *openness to experience* and *neuroticism* to achievement in Semester One were also not statistically significant (*openness to experience* and *neuroticism* accounted for only 4% and 6% of the variance in *learning strategies* respectively), indicating that *openness to experience* and level of *neuroticism* were not related to achievement in Semester One.

Table 5 reports the statistics and Figure 2 illustrates the results for the final model. The model was not negatively affected by removing the non-significant paths from the model and, while the model was not significantly improved by removing these paths, the final model is a more parsimonious model. This adjusted model was accepted as the final model of achievement for first-year university students. The final model accounts for a total of 64% of the variance in self-reported learning strategies, 26% of the variance in Semester One achievement, and 33% of the variance in Semester Two achievement. *Previous performance* was the most important predictor of achievement in Semester One, accounting for 16.8% of the variance in Semester One grades. *Self-reported self-regulatory learning strategies* were the second most important predictor of achievement in Semester One, accounting for 4.8% of the variance. *Introversion*, followed by *agreeableness*, were the next most important predictors of achievement in Semester One, accounting for 3.2% and 0.81% of the variance, respectively. *Self-reported self-regulatory learning strategies* were best predicted by conscientiousness, which accounted for 15.2% of the variance. *Task value* accounted for 7.8% of the variance in self-reported learning strategies and *locus of control* accounted for 3.6% of the variance in *self-reported learning strategies*. *Performance goals* were the next most important predictors, followed by *learning goals*, which accounted for 3.2% and 1.7% of the variance in *self-reported learning strategies* respectively. Achievement in Semester One was found to account for 33% of the variance in second semester achievement.

Insert Table 5 and Figure 2 Here

Discussion

The model of academic achievement proposed in this research was found to be an acceptable representation of the relationships between constructs in the research. The majority of predicted paths were found to be statistically significant. The most important construct affecting achievement in Semester One in this model was previous academic performance, accounting for 16.8% of the

variance in Semester One grades overall. Students who had previously attained high grades (resulting in high university entrance ranks) were more likely to attain high grades at university than students with poorer previous performance. This construct was more important than the student's self-reported use of learning strategies and more important than their personality traits.

Knowledge of a student's self-reported use of learning strategies enhanced the prediction of that student's grades in first semester, accounting for 4.8% of the variance in Semester One grades. Students who reported a greater use of effective learning strategies were more likely to achieve higher grades than students who reported a low use of effective learning strategies. This finding provided support for previous research, which identified the positive effect that self-regulatory strategies had on academic performance (Garcia & Pintrich, 1996; Pintrich & DeGroot, 1990). It is not surprising that students who manage their time effectively, who regulate the amount of effort they expend on tasks, who self-monitor their comprehension, who draw connections between readings and lecture material, and who effectively organise course material attain higher grades than students who do not practise such behaviours.

Conscientiousness was the most important predictor of learning strategy use, accounting for 15.2% of the variance. Students who displayed high levels of conscientiousness were more likely to report that they utilised learning strategies than students with a more lackadaisical nature. Valuing the task was the second most important predictor of self-reported self-regulatory learning strategies, accounting for 7.8% of the variance. It would be expected that students who believed the task they were performing was an inherently useful and beneficial learning exercise would utilise behaviours that maximise their chances of understanding the material. An internal locus of control was the third most important predictor of self-reported learning strategies, accounting for 3.6% of the variance, with students who had an internal locus of control, rather than believing that their outcomes were dependent on extrinsic factors, being more likely to espouse their use of learning

strategies. Intrinsic learning goals accounted for 1.7% and extrinsic performance goals accounted for 3.2% of the variance in self-reported learning strategies. However, a negative relationship was hypothesised between extrinsic performance goals and self-reported learning strategies which was not supported. In fact, endorsement of goals that focused on one's performance were more important predictors of learning strategy use than the endorsement of goals oriented toward learning. Firstly, it is likely that the performance goals measured in this study reflected performance-approach goals, and recent research has suggested that performance-approach goals are conducive to positive outcomes (Eccles & Wigfield, 2002). Secondly, the nature of assessment in the university environment may also influence the relationship between goals and strategies. If students have heavy workloads and restricted time to complete tasks, a focus on the practicalities of learning only what is needed to achieve high grades, rather than learning for the purpose of a deep understanding of the material, may be more conducive to performance. Students may become strategic in their approach to learning, and while they may report that they use a variety of learning strategies, the aim of employing these strategies is focused on the achievement of high grades, rather than a deep appreciation of the material.

In terms of personality, introverted and agreeable students were more likely to attain higher grades than students who were more extraverted and antagonistic in their personalities. Introversion accounted for 3.2% of the variance in Semester One achievement, and was the third most important predictor of achievement in the model. Introversion has been identified as an important trait in academia, with introverts presumed to be less socially preoccupied, showing better concentration and being more organised in previous research (Entwistle, 1983; Goff & Ackerman, 1992). A student's level of agreeableness was related to achievement, with more agreeable students attaining higher first semester grades than students who were more antagonistic in their personality. This construct accounted for approximately 1% of the variance in first semester grades. It is plausible that students who exhibit higher levels of agreeableness, adjust quickly to the new academic

environment, accept, and hence complete the requirements of their courses, and are less likely to antagonise their lecturers, all of which may contribute to their higher achievement at university.

The relationship between academic self-efficacy and self-reported learning strategies was not statistically significant, suggesting that the level of academic self-efficacy was not related to self-reported utilisation of learning strategies. There are several reasons why academic self-efficacy may not have been predictive of self-reported learning strategies or achievement in the model of achievement. Firstly, as academic self-efficacy was measured at the beginning of the first year of university, students may not have yet formed an accurate perception of their own ability to perform in the university environment. Secondly, the measure of academic self-efficacy may have been too general to detect any relationship between self-efficacy and self-reported learning strategies or grades in the model of achievement. Pajares (1996) cautioned that one of the inherent problems with self-efficacy research lies in the specificity of the self-efficacy construct being measured. Thridly, level of academic self-efficacy may not be as important a predictor of self-reported learning strategies and achievement as previous research suggests. Pajares (1996) reported that the majority of students are overconfident about their abilities, and he believes that this is conducive to higher performances as this increases the students' persistence on tasks. Schunk (1994) proposed that low academic self-efficacy is not necessarily detrimental to the utilisation of self-regulatory strategies. He suggested that low academic self-efficacy might result in the student exerting more effort and adopting effective learning strategies to compensate for their perceived lack of ability.

The path between neuroticism and achievement was not important, signifying that a students' level of neuroticism or emotional instability does not directly affect the grades attained in the first semester. It is possible that neuroticism has a differential effect across groups of students. For some students, a certain level of neuroticism might be conducive to performance if it motivates

them to channel effort into their studies, while for other students neuroticism may have a detrimental effect on performance.

A student's openness to experience was not related to achievement, with students who were more open to their experiences attaining similar grades to students who were narrower in their outlook. While limited previous research has supported the relationship between openness to experience and academic achievement (Rothstein, Paunonen, Rush and King, 1994), the findings from the current research suggest further work is needed in this area.

Summary and Conclusion

The purpose of this research was to develop and test a prospective multi-causal model of academic achievement in first-year university students. The model of academic achievement was developed based largely on self-regulation theory, and from empirical findings in relation to previous academic performance and personality traits. This model was tested using structural equation modelling, and was accepted with some minor modifications as a satisfactory representation of the data. This research has demonstrated that, for students to achieve high levels of academic success during the difficult transition period that is evident in the first year at university, having both the skill to perform and the will to succeed are important. The first year of university signals a new learning environment for the majority of students, and while previous demonstrated ability may have been important in the university selection process, students also need to be motivated to employ the strategies necessary to complete the learning tasks, to excel in their studies.

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Table 1

Results of One-Factor Congeneric Measurement Model Analyses (N = 1193)

Statistic	Chi Square	RMSEA[1]	NNFI[2]	CFI[3]	RMR[4]	GFI[5]
Self-efficacy	127.51 (*p*= .00)	0.13	0.95	0.97	0.03	0.95
Locus of control	45.44 (*p*= .00)	0.16	0.84	0.95	0.05	0.97
Learning goals	10.47 (*p*= .00)	0.07	0.95	0.98	0.03	0.99
Performance goals	14.84 (*p*= .00)	0.09	0.93	0.98	0.03	0.99
Task value	70.24 (*p*= .00)	0.20	0.88	0.96	0.03	0.96
Elaboration	79.21 (*p*= .00)	0.09	0.93	0.96	0.04	0.97
Organisation	9.75 (*p*= .00)	0.07	0.97	0.99	0.02	0.99
Self-regulation	187.12 (*p*= .00)	0.08	0.90	0.93	0.04	0.95
Time management	101.57 (*p*= .00)	0.11	0.90	0.94	0.04	0.96
Effort regulation	1.92 (*p*= .16)	0.03	0.99	1.00	0.00	1.00

Note: [1]Root Mean Square Error of Approximation, [2]Non-Normed Fit Index, [3]Comparative Fit Index, [4]Root Mean Square Residual, [5]Goodness-of-Fit Index

Table 2

Value of Fixed Path and Error Coefficients for Use in Structural Model

Statistic	Path Coefficient	Error Coefficient
Previous performance	Free	0.05
Self-efficacy	1.04	0.07
Locus of control	0.76	0.16
Learning goals	0.85	0.25
Performance goals	0.98	0.36
Task value	0.98	0.12
Conscientiousness	0.93	0.15
Introversion	0.88	0.11
Agreeableness	0.85	0.27
Openness to experience	0.85	0.27
Neuroticism	0.92	0.13
GPA Semester One	Free	0.05
GPA Semester Two	Free	0.05

Table 3

Descriptive Results Across the Total Sample, Gender and Age

Variables in Study	Males	Females	Mean School Leavers	Mature-age Students	Total Sample
	n = 575	*n* = 603	*n* = 587	*n* = 600	*N* = 1193
Entrance Rank[a]	5.74 (2.61)	6.36 (2.96)	6.19 (2.98)	5.87 (2.53)	6.07 (2.82)
1st Semester GPA	5.18 (0.79)	5.13 (0.71)	5.10 (0.73)	5.20 (0.76)	5.15 (0.75)
2ndSemester GPA	4.70 (1.42)	4.77 (1.36)	4.70 (1.38)	4.79 (1.40)	4.74 (1.39)
Motivation					
Self-efficacy	5.08 (0.97)	4.73 (1.08)	4.81 (1.01)	5.00 (1.08)	4.90 (1.05)
Locus of Control	5.47 (0.88)	5.52 (0.75)	5.45 (0.84)	5.57 (0.91)	5.50 (0.87)
Task Value	5.13 (1.09)	5.43 (1.07)	5.19 (1.13)	5.43 (1.02)	5.30 (1.09)
Learning Goals	4.77 (0.99)	4.68 (1.11)	4.60 (1.03)	4.87 (1.07)	4.72 (1.06)
Performance Goals	4.67 (1.18)	4.67 (1.18)	4.74 (1.17)	4.60 (1.19)	4.68 (1.18)
Learning Strategies					
Elaboration	4.71 (0.85)	4.93 (0.93)	4.74 (0.86)	4.95 (0.87)	4.83 (0.90)
Organisation	4.70 (1.02)	5.09 (1.04)	4.82 (1.04)	5.04 (1.05)	4.92 (1.05)
Metacognitive SR[b]	4.32 (0.84)	4.41 (0.93)	4.33 (0.87)	4.43 (0.92)	4.37 (0.89)
Time Management	4.89 (0.93)	5.20 (1.01)	5.01 (0.96)	5.14 (1.02)	5.07 (0.99)
Effort Regulation	4.84 (1.04)	5.12 (1.01)	4.93 (1.06)	5.10 (0.99)	5.00 (1.04)
Personality					
Neuroticism	20.26 (7.96)	23.62 (7.98)	22.31 (7.91)	21.86 (8.41)	22.11 (8.14)
Extraversion	28.69 (6.29)	30.50 (5.78)	30.03 (5.95)	29.20 (6.20)	29.66 (6.08)
Openness	27.79 (6.57)	29.97 (5.75)	27.99 (6.15)	30.23 (6.11)	28.98 (6.23)
Agreeableness	29.96 (5.52)	32.10 (5.45)	31.19 (5.55)	31.13 (5.67)	31.17 (5.60)
Conscientiousness	30.29 (6.74)	31.75 (6.68)	30.53 (6.65)	31.84 (6.73)	31.11 (6.71)

[a]Higher entrance ranks academically are signified by lower numeric values

[b]SR = Self-Regulation

Table 4

Correlation Matrix of All Variables in Study (N = 1193)

	Entrance Rank	GPA Sem 1	GPA Sem 2	Self-efficacy	Locus of Control	Task Value	Learning Goals	Performance Goals	Elaboration	Organisation	Self-Regulation	Time Management	Effort Regulation	Neuroticism	Extraversion	Openness	Agreeableness	Conscientiousness
Entrance Rank	1.00																	
GPA Sem 1	-.42*	1.00																
GPA Sem 2	-.23*	.52*	1.00															
Self-efficacy	-.19*	.19*	.02	1.00														
Locus of Control	-.07*	.13*	.04	.59*	1.00													
Task Value	-.02	.14*	.05	.47*	.45*	1.00												
Learning Goals	-.14*	.10*	.00	.55*	.40*	.48*	1.00											
Performance	.12*	-.04	-.02	.24*	.25*	.19*	.08*	1.00										
Elaboration	-.09	.17*	.11*	.47*	.46*	.49*	.45*	.19*	1.00									
Organisation	-.03	.13*	.09*	.38*	.35*	.43*	.29*	.29*	.69*	1.00								
Self Regulation[a]	-.05	.12*	.07*	.41*	.34*	.40*	.40*	.30*	.70*	.65*	1.00							
Time	-.04	.19*	.15*	.42*	.39*	.43*	.31*	.24*	.63*	.66*	.60*	1.00						
Effort Regulation	-.02	.15*	.13*	.38*	.33*	.38*	.26*	.28*	.53*	.51*	.53*	.64*	1.00					
Neuroticism	.06	-.00	-.03	-.35*	-.18*	-.08*	-.26*	.03	-.16*	-.11*	-.16*	-.15*	-.20*	1.00				
Extraversion	.02	-.10*	.01	.16*	.16*	.10*	.18*	.09*	.19*	.16*	.16*	.12*	.16*	-.35*	1.00			
Openness	-.07	.10*	.06	.22*	.19*	.27*	.36*	-.12*	.28*	.12*	.14*	.10*	.09*	-.03	.12*	1.00		
Agreeableness	-.06	.07*	.08*	.02	.07	.09*	.04	-.08*	.14*	.14*	.11*	.17*	.19*	-.20*	.29*	.13*	1.00	
Conscientiousnes	-.11*	.14*	.18*	.27*	.16*	.23*	.18*	.12*	.34*	.41*	.38*	.52*	.53*	-.27*	.25*	-.01	.24*	1.00

*$p<.01$

Table 5

Goodness-of-Fit and Squared Multiple Correlations for Initial and Final Model (n = 682)

	Initial Model	Final Model
Goodness-of-fit Measures	Value	Value
Chi Square Value	431.33	433.66
Chi Square *p*	<0.05	<0.05
RMSEA	0.080	0.079
CFI	0.92	0.92
NNFI	0.84	0.85
RMR	0.038	0.038
GFI	0.93	0.92
Squared Multiple Correlations		
Learning Strategies	0.65	0.64
GPA Semester One	0.26	0.26
GPA Semester Two	0.33	0.33

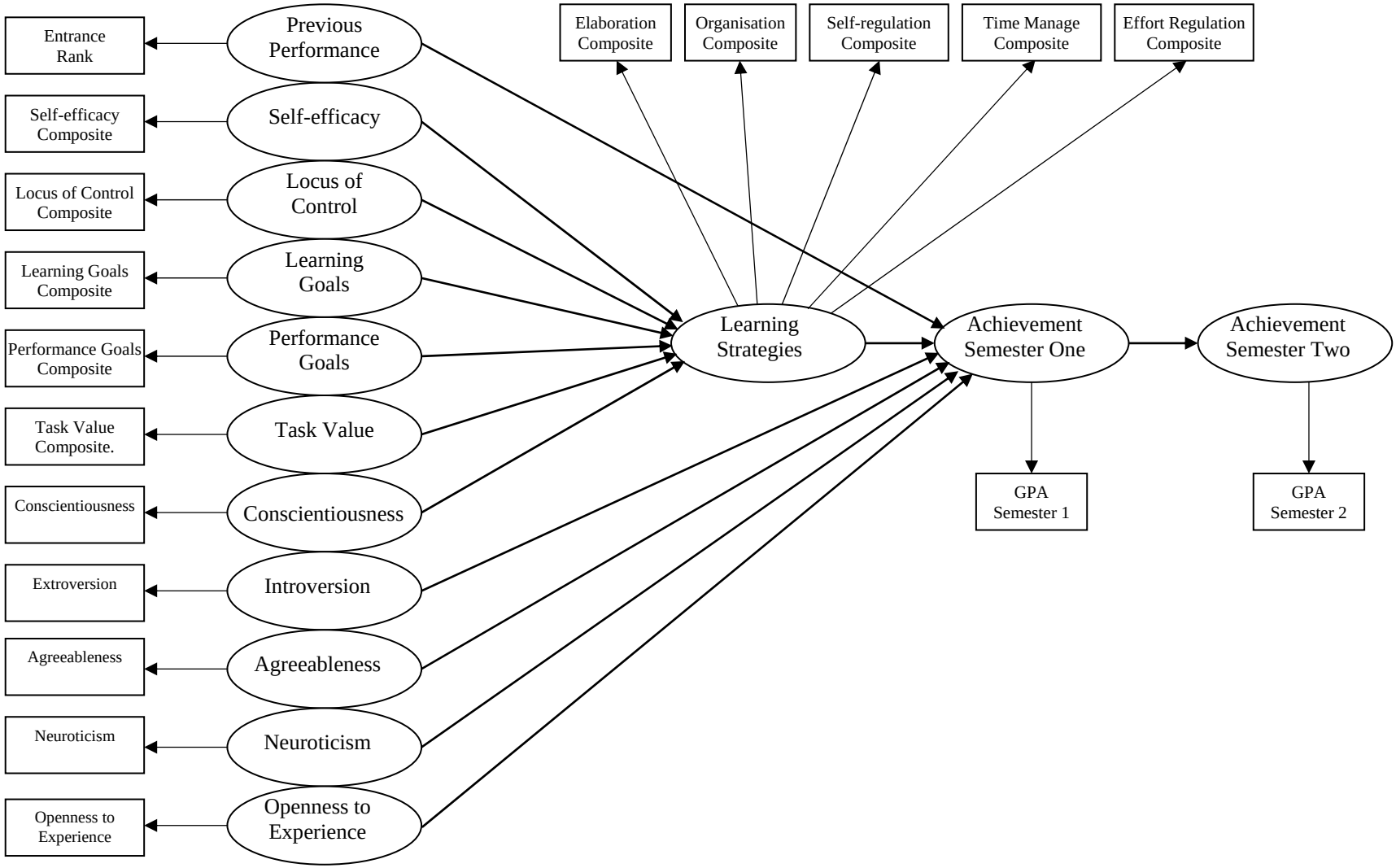

Figure 1: Proposed Model of Academic Achievement in First-year university Students.

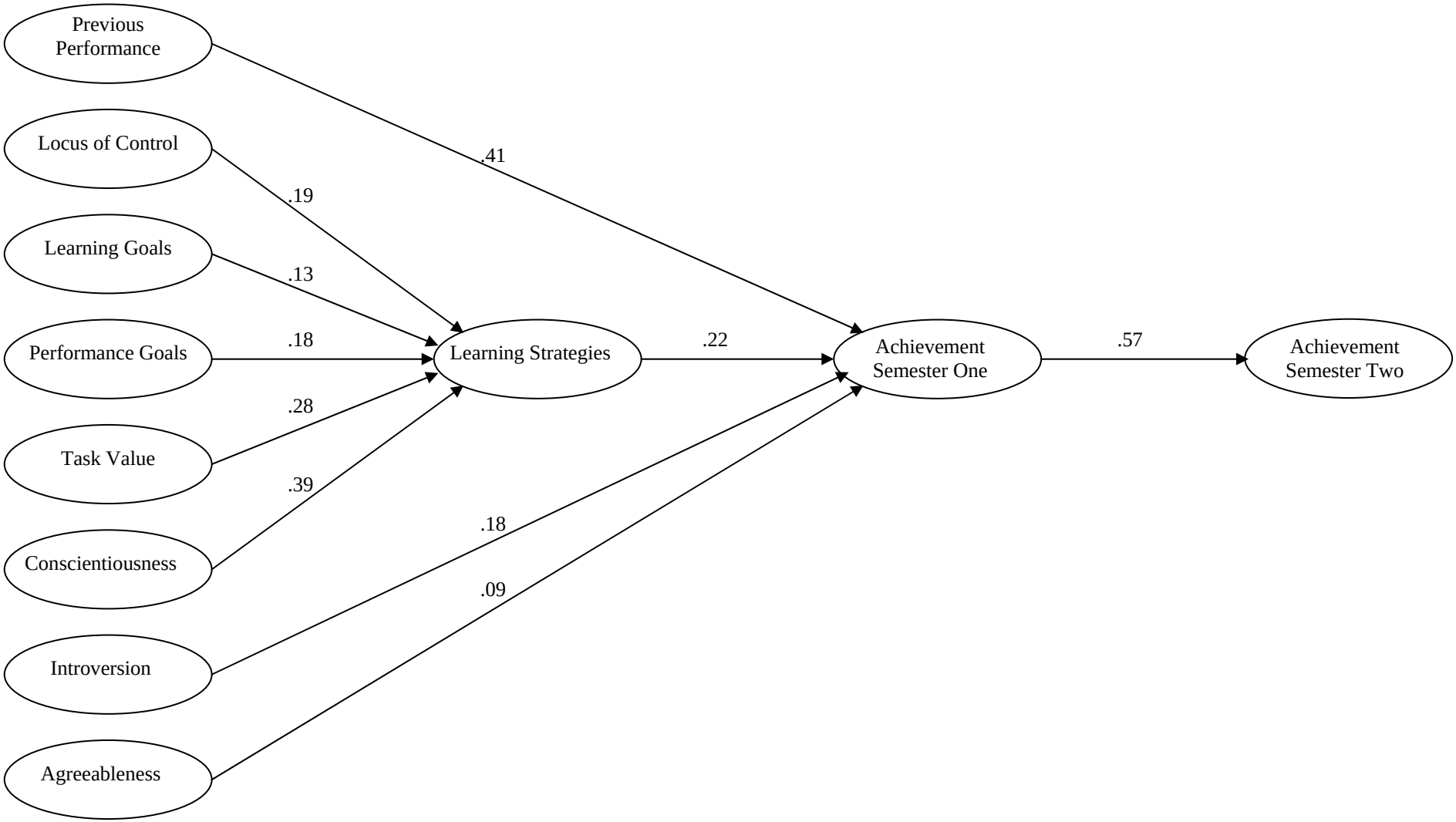

Figure 2: Final Model of Academic Achievement in First-year university Students *(n* = 682).