

**Motivation, Personality and Academic Achievement: Does Academic Motivation explain
Variation in Academic Achievement beyond Personality and Intellect?**



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Table of Contents

Abstract..... vi

Declaration..... vii

1 Introduction.....1

1.1 Definition of Academic Motivation2

1.1.1 Important Factors in Measuring Academic Motivation3

1.1.2 Measuring Academic Motivation with the Academic Motivation Scale5

1.2 Variables with relationships to academic motivation6

1.2.1 Intellectual Ability and Academic Achievement7

1.2.2 Personality Factors and Academic Achievement.....8

1.2.3 The Interaction of Academic Motivation and Personality and its Influence on Academic Achievement 11

1.2.4 Limitations in Previous Research 12

1.3 Study Aims14

2 Method 15

2.1 Participants15

2.2 Materials.....15

2.2.1 Academic Motivation.....15

2.2.2 Intellectual Ability16

2.2.3 Personality Traits17

2.2.4 Academic Achievement17

2.2.1 Self-Deceptive Enhancement.....17

2.3 Procedure18

3 Results 20

3.1 Data Validation, Quality Control and Testing Assumptions20

3.2 A Priori Power Analysis.....20

3.3 Correlations between Intelligence, Conscientiousness, Openness and Motivation traits ..21

3.4 Predicting Academic Achievement based on Intelligence, Conscientiousness, Openness and Motivation Traits22

3.5 Correlations between Intelligence, Conscientiousness, Openness and Motivation Facets 24

3.6 Predicting Academic Achievement based on Intelligence, Conscientiousness, Openness and Motivation Facets.....27

3.7	Post Hoc Power Analysis	30
4	Discussion	31
4.1	The contribution of Conscientiousness and Openness Traits to Explaining Academic Achievement.....	31
4.2	The contribution of Intelligence and Motivation Traits to Explaining Academic Achievement.....	33
4.3	The Contribution of Conscientiousness and Openness Facets to Explaining Academic Achievement.....	34
4.4	The contribution of Intelligence and Motivation Facets to Explaining Academic Achievement.....	36
4.5	Implications of the Study	37
4.6	Strengths and weaknesses of the Study	38
4.7	Future Research Directions.....	39
4.8	Conclusion.....	40
	References.....	41
	Appendix A - <i>Shapiro-Wilk Test of Normality</i>	50
	Appendix B – <i>Descriptive Statistics of the Dataset</i>	51
	Appendix C - <i>Mean Values and t-tests of Personality, Motivation and Academic Success measures by Gender</i>	52
	Appendix D – <i>Diagnostic Plot of Facet Regression Model</i>	53
	Appendix E – <i>Stepwise Elimination of Regressors for Facet Model with Openness</i>	54
	Appendix F – <i>Stepwise Elimination of Regressors for Facet Model with Openness</i>	55

List of Figures

Figure 1. Conceptualization of motivational constructs according to Self Determination Theory 5

List of Tables

Table 1. *Correlation Analysis of Intelligence, Personality and Motivation Traits and Academic Achievement*21

Table 2. *Comparison of Baseline and Trait Linear Models Predicting Academic Achievement*.....23

Table 3. *Correlation Analysis of Intelligence, Facet Level Conscientiousness, Openness and Motivation, and Academic Achievement*25

Table 4. *Comparison of Baseline, Trait and Facet Linear Models Predicting Academic Achievement*.....28

Table 5. *Comparison of Baseline, Trait and Facet Linear Models Predicting Academic Achievement Without Openness Traits or Facets*.....29

Abstract

Obtaining a good education particularly a tertiary education has links with many important lifestyle and health outcomes but requires students' to be significantly self-motivated. This study aimed to explore the relationship between motivation and academic achievement to determine whether motivation constructs have incremental validity over conventional predictors of academic achievement. Participants were surveyed using measures of intelligence, trait and facet measures of personality and academic motivation. Correlational analysis and linear regression were used to explore the data to identify what type of relationships existed between variables. Facet measures of Conscientiousness and intrinsic motivation showed higher correlations with academic achievement than trait measures. Motivation measures did not show incremental validity over intelligence and Conscientiousness though amotivation accounted for an amount of variance found significant in other studies indicating the present study suffered from low statistical power. The main significant influences on academic achievement were intelligence and Conscientiousness facet *achievement striving* with low motivation having more influence on achievement than high motivation. While results should be generalized cautiously they indicate first year students' with low intelligence, Conscientiousness and high amotivation are at risk of lower academic achievement with interventions targeting Conscientiousness and amotivation the most likely improve academic achievement.

Declaration

This thesis contains no material which has been accepted for the award of any other degree or diploma in any University, and, to the best of my knowledge, this thesis contains no materials previously published except where due reference is made. I give consent to this copy of my thesis, when deposited in the University Library, being available for loan and photocopying.

signature

3rd October, 2017

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1 Introduction

Having a good education is considered to be an important component of a rewarding lifestyle as a person's level of education predicts a number of important life and health outcomes (Hoffnug et al., 2013). However, individuals need to possess a certain level of motivation in order to obtain a good level of education. Motivation theories try to explain what things, goals and tasks might motivate a person to engage in particular activities, such as education, (Pintrich, 2003) because if we know what motivates a person to act we may be able to utilize this motivation to improve their performance in educational settings (Ryan & Deci, 2000). One of the difficulties in measuring a student's motivation is that personality measures, particularly the trait of Conscientiousness, can significantly overlap with motivational constructs such that the identification and distinction between traits of Conscientiousness and motivation are not always clear (Roberts, Lejuez, Krueger, Richards, & Hill, 2014). In addition, while much literature can be found on correlations between academic motivation and academic achievement there is little research on distinguishing the effect academic motivation has on academic achievement from the role of personality (Sorić, Penezić, & Burić, 2017). In one of the studies to examine this interaction Komarraju, Karau, and Schmeck (2009) found a modest effect of intrinsic motivation on academic achievement though this effect was moderated somewhat by Conscientiousness and did not account for the impact of intelligence. The aim of this study is to provide more clarity on the impact motivational traits have on academic achievement beyond the impact attributable to conventional measures such as intelligence and Conscientiousness. The present study will use an exploratory method, similar to that used by Komarraju et al. (2009) while incorporating improvements to the methodology as recommended by Komarraju et al. (2009) and O'Connor and Paunonen (2007).

The following sections will define academic motivation and its measurement constructs, the domains over which academic motivation may vary, the role of intelligence and personality in predicting academic achievement and how motivation and personality interact when predicting academic achievement.

1.1 Definition of Academic Motivation

Motivation in academic settings is a multifaceted concept which is reflected in the multitude of tools used to measure motivation (Martin, 2001). Academic motivation can be defined as a student's effort and drive to engage, learn effectively and achieve their potential (Martin, 2012). Of the five major theories which dominate motivation and learning research (Svinicki & Vogler, 2012) self-determination theory was chosen to provide the framework for measuring motivation in this study. Self-determination theory is the basis for the Academic Motivation Scale a widely used measure of academic motivation for both school and university level students' with good reliability and validity, producing results comparable to other commonly used motivation measures (Alivernini, 2012).

According to self-determination theory motivation is strongly linked to the concept of autonomy, the freedom to engage with new ideas, experiences and behaviours without coercion or force. Self-determination theory maintains that autonomous behaviours tend to support individual satisfaction while more controlled behaviours reduce satisfaction. Therefore level of autonomy is a better predictor of engagement and performance than the strength of motivation. (Deci & Ryan, 2012). Self-determination theory defines several motivational constructs that lie on a continuum ranging from high to low autonomy (Svinicki & Vogler, 2012; Vallerand et al., 1992). As the level of autonomy decreases so does the level of motivation

1.1.1 Important Factors in Measuring Academic Motivation

The main components of motivation, according to self-determination theory, are shown in Figure 1. The first and strongest motivational trait, intrinsic motivation, is defined by a natural tendency to seek novel experiences and challenges because of a personal enjoyment of exploration and learning (Deci & Ryan, 2012). The trait of intrinsic motivation can be separated into three facets.

Intrinsic motivation facet *know* is related to exploration, curiosity, learning goals, intrinsic intellectuality and learning. Intrinsic motivation facet *accomplish* is the pleasure or satisfaction to create or accomplish a task. Intrinsic motivation facet *experience* is engaging in activity to experience stimulating sensations in educational settings like engaging in stimulating discussions or a passion for reading books (Vallerand et al., 1992). Intrinsic motivation is associated with academic achievement and positive academic outcomes though it also correlates moderately with both Conscientiousness and Openness (Cokley, Bernand, Cunningham, & Motoike, 2001; Hazrati-Viari, Rad, & Torabi, 2013; Komarraju et al., 2009; Lim & Chapman, 2015).

The second motivational trait, called extrinsic motivation, defines motivations for where an undertaken activity has consequences separate from the activity itself. People are less likely to do the activity if the consequences are not present (Deci & Ryan, 2012). Extrinsic motivation is composed of three facets. Extrinsic motivation facet *identification* is where individuals engage in activities because they have taken responsibility undertake it (Vallerand et al., 1992). Extrinsic motivation facet *introjected* is to engage in activities because individuals pressure themselves to do them where as extrinsic motivation facet *external* refers to activities individuals are externally pressured to do them (Vallerand & Bissonnette, 1992) Extrinsic motivation facet *identification* is

similar to intrinsic motivation (Cetin, 2015a) and typically expected to positively correlate with academic achievement while extrinsic motivation facets *introjected* and *external* expected to negatively correlated with academic achievement. No significant correlations of extrinsic motivation with academic achievement were reported in the literature examined for this review though extrinsic motivation is correlated with Conscientiousness (Hazrati-Viari et al., 2013; Komarraju et al., 2009; Lim & Chapman, 2015). The construct of extrinsic motivation has been criticised for low construct validity due to overlap with intrinsic motivation (Cokley et al., 2001).

The third form of motivation is amotivation when individuals do not perceive the contingencies between outcomes and their actions and instead believe that things happen to them that are out of their control.(Vallerand et al., 1992). Individuals who are high in amotivation are characterized by a perceived lack of control over their own life events and a perception of incompetence (Cetin, 2015b) ineptitude, lack of purpose (Stover, Iglesia, Boubeta, & Liporace, 2012) and have an external locus of control (Reynolds, Sneva, & Beehler, 2010). No significant correlations of amotivation with academic achievement were reported in literature reviewed for this study, though amotivation has a negative correlation with Conscientiousness (Komarraju et al., 2009) and negatively correlated with positive educational outcomes (Cokley et al., 2001; Vallerand & Bissonnette, 1992)

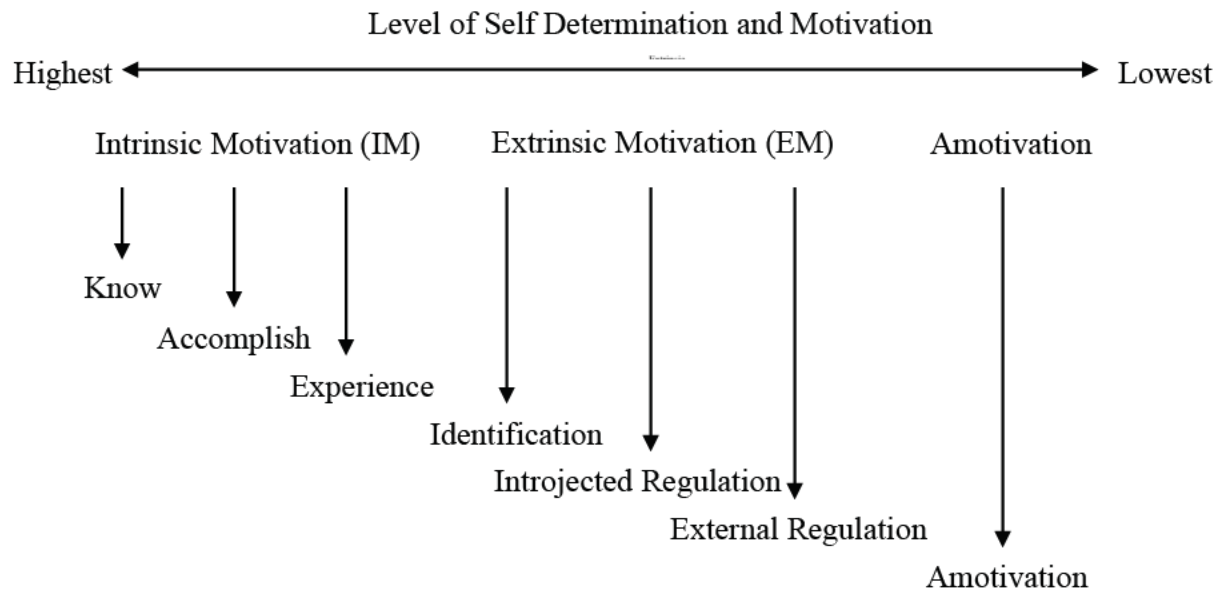


Figure 1. Conceptualization of motivational constructs according to Self Determination Theory

1.1.2 Measuring Academic Motivation with the Academic Motivation Scale

The level of intrinsic motivation, extrinsic motivation and amotivation in student populations has been examined in previous studies. Vallerand and Bissonnette (1992) tested the constructs of intrinsic motivation, extrinsic motivation and amotivation, finding that first year students' who persisted in their course of study reported higher levels of intrinsic motivation, higher levels of extrinsic motivation facets *identification* and *introjected* with lower levels of amotivation. Females were more intrinsically motivated, and less amotivated than males. Further work culminated in the Academic Motivation Scale (Vallerand et al., 1992) finding good concurrent and construct validity for academic motivation (Vallerand et al., 1993). Good gender and time invariance has also been reported (Grouzet, Otis, & Pelletier, 2006).

The Academic Motivation Scale has been used to test motivation in a range of educational settings finding validity in a range of studies including with Malaysian undergraduates (Chong & Ahmed, 2012) mathematics motivation in Chinese students' (Lim & Chapman, 2015), Chinese, Malay and Indian students' (Caleon et al., 2015) Turkish students' (Karagüven, 2012) Iranian students' (Taghipour et al., 2012), Turkish sports students' (Haslofça & Korkmaz, 2016) Greek high school students' (Barkoukis, Tsorbatzoudis, Grouios, & Sideridis, 2008) Pakistan business school students' (Husain, 2014), Argentine high schools and college students' (Stover et al., 2012) and graduate students' (Hegarty, 2010). Only recently have studies using structural equation modelling aimed to identify weaknesses in the academic motivation scale questionnaire and subsequently use this information to improve the validity of academic motivation scale over conventional factor analysis (Guay, Morin, Litalien, Valois, & Vallerand, 2014; Tóth-Király et al., 2017) though models have typically supported the motivation continuum proposed by SDT (Litalien et al., 2017)

Overall the academic motivation scale has shown good internal consistency, test-retest reliability, factor validity, gender invariance, construct validity and concurrent validity with other motivational scales across a range of studies (Alivernini, 2012).

1.2 Variables with relationships to academic motivation

Academic motivation has been observed to vary across a variety of domains with inconsistent findings. With regard to gender, females have typically been found to have higher academic motivation than males with females higher in intrinsic motivation and males higher in extrinsic motivation and amotivation (Martin, 2003b, 2004; Vallerand & Bissonnette, 1992; Vecchione, Alessandri, & Marsicano, 2014) though the opposite has also been found (Hakan &

Münire, 2014). Motivation can vary by year and domain of study with Hakan and Münire (2014) finding first year students' and students' in social sciences lower in amotivation and higher intrinsic and extrinsic motivation than fourth year undergraduates and applied science undergraduates. Age affects academic motivation where intrinsic motivation can decrease significantly in mid primary school (Corpus, Haimovitz, & Wormington, 2012; Lepper, Corpus, & Iyengar, 2005) though Nishimura and Sakurai (2017) report an proportionate increase in extrinsic motivation at this time. In contrast mature students' may perform better due to their experience (Clifton, Perry, Roberts, & Peter, 2008) and the intrinsic interest mature students' develop in the subject matter as without this they are likely to spend their time on other competing demands (McKenzie & Gow, 2004).

As each of these variables impact on academic motivation it has been suggested researchers constrain the potential range of individual differences in the participant sample to help make relationships with academic motivation clearer (Komarraju et al., 2009).

1.2.1 Intellectual Ability and Academic Achievement

There is significant evidence that intellectual ability predicts academic achievement (Deary, Strand, Smith, & Fernandes, 2007; Furnham, Mosen, & Ahmetoglu, 2009) with the relationship between intellectual ability and academic achievement replicated in a wide variety of studies (Furnham & Mosen, 2009; Furnham et al., 2009; Rohde & Thompson, 2007) where intelligence is a causal influence on achievement (Watkins, Lei, & Canivez, 2007). While intelligence shows a reliable relationship with academic achievement the relationship varies according to age as the strength of the relationship is lower in older students' (Chamorro-Premuzic & Furnham, 2005). As students' progress through their studies the proportion of

variance in academic achievement intelligence accounts for drops to less than 50% indicating the presence of other factors influencing achievement (Chamorro-Premuzic & Furnham, 2008; O'Connor & Paunonen, 2007). There is also evidence of sex differences in intelligence with Steinmayr, Bipp, and Spinath (2011) finding boys had higher cognitive ability but lower academic achievement than girls. Spinath, Eckert, and Steinmayr (2014) indicated that girls are more adapted to the current western academic environment which may explain why they outperform boys in academic achievement. Sorić, Penezić, and Burić (2017) found girls achieve higher chemistry grades than boys and girls performed better than boys in exam performance even when boys had average higher intellect scores and conscientiousness scores were the same (Furnham & Monsen, 2009). While this review did not find specific studies examining motivation and intelligence there is good evidence that intelligence and the personality trait Conscientiousness are negatively correlated (Chamorro-Premuzic & Arteché, 2008). As Conscientiousness and intrinsic motivation are positively correlated (Komarraju et al., 2009) it seems plausible that intrinsic motivation and intelligence may also have a negative association.

1.2.2 Personality Factors and Academic Achievement

The Five Factor model of personality by Costa and McCrae (1992) is the most established personality model at present (Heinstrom, 2012) and describes personality based on five main traits which include Conscientiousness, Openness to experience, Extraversion, Agreeableness and Neuroticism. Of the five traits Conscientiousness has a consistent positive association with academic achievement across a range of studies (Chamorro-Premuzic & Furnham, 2003a; Chamorro-Premuzic & Furnham, 2008; Hakimi, Hejazia, & Lavasani, 2011; O'Connor & Paunonen, 2007; Trapmann, Hell, Hirn, & Schuler, 2007). This association is due to

its motivational nature to succeed, persistence when facing learning difficulties, achievement focus and good time management (Furnham et al., 2009; Heinstrom, 2012).

The association Openness has with academic achievement is mixed (Furnham et al., 2009; Trapmann et al., 2007) but when a correlation exists it tends to be positive (Chamorro-Premuzic & Furnham, 2008; Hakimi et al., 2011; O'Connor & Paunonen, 2007) as Openness to experience is identified by an intrinsic motivation to explore, intellectual curiosity, self-reflection and meaning oriented learning (Heinstrom, 2012). The relationship between academic achievement and Extroversion, Agreeableness and Neuroticism is mixed, with Agreeableness mostly un-associated with achievement (O'Connor & Paunonen, 2007) and Extroversion and Neuroticism typically have had a small negative relationship if an association is found (Chamorro-Premuzic & Furnham, 2003a, 2003b; Hakimi et al., 2011; O'Connor & Paunonen, 2007) with the only positive associations to specific aspects of coursework (De Feyter, Caers, Vigna, & Berings, 2012; Rosander, Backstrom, & Stenberg, 2011).

Extroversion indicates the amount of spontaneous and relational interaction an individual seeks, with high extroversion individuals being more spontaneous, talkative and social (Heinstrom, 2012). With those low in extroversion more independent, less spontaneous, thoughtful (Furnham, Jackson, & Miller, 1999) with analytical dispositions (Heinstrom, 2012). Studies on extraversion and academic achievement are mixed though associations tend to be negative (Hakimi et al., 2011; O'Connor & Paunonen, 2007) with positive associations on course work that requires greater communication (De Feyter et al., 2012; Rosander et al., 2011).

The scale of neuroticism indicates how emotionally sensitive and reactive a person may be with those high in neuroticism more sensitive and reactive than those who score low. High scoring neurotics can become anxious about their studies and particular final exams inhibiting

their performance (Furnham et al., 2009). They may also learn by memorization rather than by deeper reflective learning (Heinstrom, 2012). Neuroticism is sometimes positively associated with academic achievement (Rosander et al., 2011) but is predominantly negative (Chamorro-Premuzic & Furnham, 2003a, 2003b; Hakimi et al., 2011; O'Connor & Paunonen, 2007).

The Agreeableness scale aims to capture how agreeable a person is with high agreeableness indicates a more caring and compassionate disposition but also a willingness to attend to academic demands such as classes. However disagreeable individuals may develop higher general knowledge as compensation for the social impediment of disagreeableness (Heinstrom, 2012). Agreeableness is mostly unassociated with academic achievement (O'Connor & Paunonen, 2007).

When surveying personality it is common to use the McCrae and Costa (2010) short form trait level personality measures such as the NEO-FFI. However personality measures such as the more complete NEO-PI-R, also developed by (McCrae & Costa, 2010), examine personality using facets which are a subset of measures for each trait. The NEO-PI-R measures the same five factor personality traits as the short measures but does this by measuring 6 facets thought to underlie each trait. As the number of survey questions for the NEO-PI-R are significantly greater than for the short form measures, it has better validity and reliability (McCrae & Costa, 2010). Unsurprisingly facets also correlate with achievement in a range of studies and meta-analyses particularly the Conscientiousness facets *achievement striving*, *self-discipline* and *dutifulness* (Chamorro-Premuzic & Furnham, 2003b; O'Connor & Paunonen, 2007; Rosander et al., 2011) The Openness facet *ideas* shows a positive association with academic achievement while facets *fantasy* and *aesthetics* showing negative associations (O'Connor & Paunonen, 2007). Facets can

significantly improve predictions of achievement (Zupančič & Kavčič, 2011) with Paunonen and Ashton (2013) arguing the use of trait, instead of facet measures, is detrimental to predicting achievement.

1.2.3 The Interaction of Academic Motivation and Personality and its Influence on Academic Achievement

The variable most correlated to motivational constructs is personality with Conscientiousness measures in particular showing overlap with motivation measures (Roberts et al., 2014) and studies finding significant shared variance between them (Bipp, Steinmayr, & Spinath, 2008; Richardson & Abraham, 2009).

In particular Clark and Schroth (2010) and Komarraju et al. (2009) found that intrinsic motivation was correlated to Conscientiousness and Openness while extrinsic motivation was only linked to Conscientiousness. A number of studies have reported mediation effects between personality and motivation though the direction of the mediation is not consistent some researchers arguing Conscientiousness mediates achievement through intrinsic motivation while others argue intrinsic motivation mediates achievement through Conscientiousness (Hazrati-Viari et al., 2013; Komarraju et al., 2009; Richardson & Abraham, 2009). Conscientiousness has typically been found to explain more variance in academic achievement than academic motivation (De Feyter et al., 2012) though some studies find incremental validity of motivation over personality measures (Komarraju et al., 2009; Steinmayr et al., 2011) and others do not (Dumfart & Neubauer, 2016)

1.2.4 Limitations in Previous Research

While some research has examined the interaction of personality and motivation on academic achievement there have been criticism of certain methodological practises within these studies. Perhaps one of the most important limitations as noted by Komarraju et al. (2009) is the common use of self-reported GPA as a measure of academic achievement. It is well documented that students' overestimate their GPA scores particularly lower achieving students' (Caskie, Sutton, & Eckhardt, 2014; Cole & Gonyea, 2010; Kuncel, Crede, & Thomas, 2005) and females (Caskie et al., 2014) with some studies arguing GPA is a primary factor in affecting correlational relationships between personality and motivation (Cetin, 2015a, 2015b). In response, it has been recommended future studies use an objective measure for academic achievement such as course or exam grade rather than GPA (Komarraju et al., 2009; Komarraju, Karau, Schmeck, & Avdic, 2011).

Another limitation of studies examining relationships between academic motivation and academic achievement is the omission of either intelligence or conscientious measures from analysis (Komarraju et al., 2009; Richardson & Abraham, 2009; Steinmayr & Spinath, 2009). As both intelligence and Conscientiousness account for significant variance in academic achievement even in the presence of each other (Chamorro-Premuzic & Furnham, 2008; O'Connor & Paunonen, 2007) it is important for both to be included when trying to account for variance in academic motivation to accurately determine its influence.

It has also been noted that participant attributes differ considerably between studies with some arguing this may explain some of the differences observed between study results in the literature (Chamorro-Premuzic & Furnham, 2003a). Komarraju et al. (2009) recommended

selecting students' from a narrower range of disciplines to reduce participant variability and to potentially strengthen the relationships between variables.

While personality studies often use short form trait level measures of personality O'Connor and Paunonen (2007) suggest utilising personality facet measures rather than traits as there is evidence they improve correlation strength between personality and academic achievement (Rosander et al., 2011; Smrtnik - Vitulić & Zupančič, 2012). Personality facets are also more sensitive to specific personality attributes, more sensitive to individual differences than trait measures, and allow researchers to use internal validation techniques (McCrae & Costa, 2010). Using trait measures may be detrimental to studies examining relationships with academic achievement and it would be recommended to use facet measures where possible (Paunonen & Ashton, 2013).

A final limitation in studies examining personality and motivation is the issue of Socially Desirable Responding where participant survey responses can be biased in socially desirable ways (Berry, Page, & Sackett, 2007). Socially desirable responding can bias results of both short and long form personality measures (Holden, 2007; Holden & Passey, 2010). One particular form of socially desirable responding, self-deceptive enhancement, is a form of overconfidence related to narcissism (Paulhus, 1998) The higher an individual scores on self-deceptive enhancement the less valid are the self-reports of personality (Berry et al., 2007). Measures of Conscientiousness are particularly susceptible to socially desirable responding though measures of Openness are more resistant (Paulhus, Bruce, & Trapnell, 1995). Berry et al. (2007) recommends measures of self-deceptive enhancement are included when collecting personality survey data to account for the validity of self-reported surveys.

1.3 Study Aims

This study has three main aims. The first aim is to explore the relationships present between trait and facet measures of Conscientiousness, Openness, intrinsic motivation, extrinsic motivation, amotivation and intelligence.

The second aim will be to determine whether trait level intrinsic motivation, extrinsic motivation and amotivation measures have incremental validity in predicting academic achievement above what is predicted by intelligence and the personality traits Conscientiousness and Openness.

The third aim will be to determine whether facet level intrinsic motivation, extrinsic motivation and amotivation measures have incremental validity in predicting academic achievement above what is predicted by intelligence and Conscientiousness and Openness facets. In order to achieve these aims methodological improvements suggested by the literature will be adopted. These include the use of facet level measures of personality and motivation, use of objective course grade assigned rather than self-reported GPA, including measures of both intelligence and Conscientiousness in regression analysis, use of a homogeneous participant sample and a measure of self-deceptive enhancement to identify bias in survey data.

2 Method

2.1 Participants

All level one psychology students' enrolled in Psychology IA at the University of Adelaide were invited to participate through the online study portal. Students' were required to be enrolled in Psychology IA as it was assumed by enrolling in a tertiary level course they would be proficient in English.

2.2 Materials

Two self-report questionnaires were provided to students'. The first questionnaire contained two measures of intellectual ability, the Ravens Progressive Matrices short form (APM), and the Comprehensive Test Battery (CAB). The second questionnaire contained measures for the NEO-PI-3 Conscientiousness and Openness facets, Academic Motivation Scale (AMS) and the Self Deceptive Enhancement (SDE) short form measure. The scales used are described in more detail below.

2.2.1 Academic Motivation

Academic Motivation Scale (AMS) – This scale developed by Vallerand et al. (1992) uses principles of self-determination theory (Ryan & Deci, 2000) to operationalize academic motivational constructs. Participants are asked the question “why do you go to University?” and respond by ranking 28 responses to the question from 1 (does not correspond at all) to 7 (Corresponds exactly) that measure the facets of intrinsic motivation, extrinsic motivation and the trait amotivation. Higher scores indicate the type of motivation is of higher importance, with

low scores indicative of lower importance. This scale has been found to have good reliability and validity when measuring academic motivation (Alivernini, 2012).

2.2.2 Intellectual Ability

The Raven's Advanced Progressive Matrices developed by Bors and Stokes (1998) is a short form of the advanced progressive matrices used to test intellectual ability and gives similar results to the full APM when used with first year university students' (Bors & Stokes, 1998). Participants are shown a matrix containing a pattern. The lower right corner is always empty and participants are asked to determine from a list of 8 possibilities which alternative best fits the matrix pattern. Participants are given two practise questions to familiarise themselves with the procedure before attempting the 12 questions. Participants receive a score out of 12 with higher scores indicating higher intellectual ability.

The Comprehensive Test Battery (CAB developed by Hakstian and Cattell (1978) is similar to the Raven's APM in that it is a test of intellectual ability. Participants are shown a row of five groups of letters. Each row of letter groups follows a certain rule except one. Participants are asked to find the letter group that doesn't follow the rule. As with the Raven's APM participants are given a practise question before responses are recorded with 12 questions to compete. Participants receive a score out of 12 with higher scores indicating higher intellectual ability. Tests of intellectual ability are important when examining relationships with academic achievement as they are not subject to socially desirable responding that may affect other measures of academic achievement (Berry et al., 2007).

2.2.3 Personality Traits

The NEO-PI-3 (McCrae & Costa, 2010) is the one of the main instruments used in personality research to identify components of the big five in a person's personality (Heinstrom, 2012). It is a self-rated scale consisting of 240 items, 48 items for each of the Big five factors. Each factor is separated into 6 facets. The scale requires participants to answer questions such as "I am efficient and effective at my work" or "I have a very active imagination". The ratings are on likert scale of 1(Strongly agree) to 5 (strongly disagree). Only the facets of Conscientiousness and Openness to experience were used in the survey. The six facets for Conscientiousness are *Competence, Order, Dutifulness, Achievement Striving, Self-Discipline, and Deliberation*. The six facets for Openness to experience are *Fantasy, Aesthetics, Feelings, Actions, Ideas and Values*. The traits of Conscientiousness and Openness are composed of the sum of the 6 facets.

2.2.4 Academic Achievement

The measure of academic achievement is represented by course grade from the subject Psychology IA. This was used instead of GPA based on recommendations from other studies that course grade is a more reliable metric of academic achievement (Komarraju et al., 2009; Komarraju et al., 2011). Participants course grade was the total marks achieved for the combined assessment of the course from assignments, quiz questions and an exam with the grade out of a 100 percent.

2.2.1 Self-Deceptive Enhancement

Self-Deceptive Enhancement is a scale from The Balanced Inventory of Desirable Responding (BIDR) (Paulhus, 1984) uses two scales to identify socially desirable responding .

The self-deceptive enhancement scale measures a response bias which is the tendency for participants to give honest but positively biased survey responses based on something other than survey content. This is considered to be a form of overconfidence related to narcissism (Paulhus, 1998). The second scale in the BIDR, The Impression Management scale measures participants tendency to deliberately present themselves to an audience due to temporary situation demands. As White, Young, Hunter, and Rumsey (2008) and Holden and Passey (2010) have suggested the degree of deliberate faking of personality survey's depends on whether the testing is low or high stakes (ie experimental testing vs job suitability). It is assumed participants have little motivation to fake their survey responses for this study and therefore only self-deceptive enhancement measure is used. The measure of self-deceptive enhancement of the BIDR short 24 as developed by (Asgeirsdottir, Vésteinsdóttir, & Thorsdottir, 2016) involves 12 questions such as "I never regret my decisions" with responses measured on a 7 point Likert scale ranging from Not True (1) to Very True (7). Responses of 6 or greater are given 1 point and as such only scores indicating extreme overconfidence are measured. Higher scores are indicative of greater bias (Berry et al., 2007).

2.3 Procedure

Participants undertook the surveys as part of the Psychology IA course to obtain credit for research participation. Students' were provided with a brief description of the intent of the survey's and what the research investigating. Participants were briefed on the ethics approval for the study and given contact details of the research ethics coordinator if they had any ethical concerns about the study. Participants were free to cease participation in the study at any time. The study survey was administered in two parts. Participants could complete either part in their

own time. participants complete part one of the survey which included the 12 item Ravens APM and 12 item CAB in an online survey format through the University Research Participation System (RPS). After completing part one the second part of the survey was also administered online at the participants discretion. The second survey contained the NEO-PI-facet measures of conscientiousness and openness to experience consisting of 96 items, the 28 item Academic Motivation Scale and the 12 item Self Deceptive Enhancement Scale from the BIDR short 24. The second part of the survey was estimated to take approximately 30 minutes. Participants also consented to give their demographic data (gender, age) and their assessment and course grades as recorded by the University of Adelaide in the course Psychology IA. The study was approved by the School of Psychology: Human Research Ethics Subcommittee (Code Number 15/05)

3 Results

3.1 Data Validation, Quality Control and Testing Assumptions

All data were subject to validation checks. Initial checks identified incomplete data on seven surveys with a further five surveys containing naysay bias and random responding sufficient to invalidate participants data (McCrae & Costa, 2010). Removal of data for these eleven participants left 106 valid survey responses. Data and regression models were tested for normality, homoscedasticity, collinearity and Cook's distance found to be within acceptable criteria as outlined by Field (2009) (Appendix A, D) . Cronbach's alpha values for personality and motivation measures were all above the acceptability criterion of .7 (Field, 2009) (Appendix B). The measure of self-deceptive enhancement had an mean of 2.5 ($SD = 1.97$, Range = 0 – 8) which is considered the average for the general population (Paulhus, 1998) and therefore contains no significant survey bias that would affect the results. A one sample t -test ($t[209] = -.93$, $p = .36$) and chi squared test ($\chi^2[1] = .06$, $p = .8$) showed neither age nor sex ratio in the sample were significantly different to that in the Psychology 1A population. Independent samples t -tests confirmed no significant differences between male and female survey responses that would affect the analysis and therefore the data are treated as one sample (Appendix C). The mean age of the sample was 20.6 years ($SD = 6.43$, Range = 17 – 62), with seventy-five percent female ($n = 80$) and twenty five percent male ($n=26$) participants.

3.2 A Priori Power Analysis

In order to provide a robust figure of required participants a power analysis was conducted based on the results from Komarraju et al. (2009). A linear regression with six predictors and an

expected $R^2 = .15$ ($\alpha = .05$, $1-\beta = .8$ with two tails) requires a minimum of 101 participants for significance which demonstrates the study has sufficient statistical power for the analysis.

3.3 Correlations between Intelligence, Conscientiousness, Openness and Motivation traits

Table 1 shows the correlations between the trait measures of Conscientiousness, Openness, intrinsic motivation, extrinsic motivation, amotivation, intelligence measures APM and CAB, and academic achievement. In line with the results of earlier studies, both Conscientiousness and Openness are positively and significantly related to academic achievement (Chamorro-Premuzic & Furnham, 2008). Interestingly, we can also see that only one of the measures of intelligence (the CAB) was significantly related to academic achievement even though both measures were moderately correlated. Furthermore, only one of the measures of motivation, amotivation was significantly related to academic achievement, something not reported in other studies (Komarraju et al., 2009).

Table 1

Correlation Analysis of Intelligence, Personality and Motivation Traits and Academic Achievement

	1	2	3	4	5	6	7
1. C:Total	—						
2. O:Total	0.04	—					
3. IM:Total	0.40**	0.25**	—				
4. EM:Total	0.29**	0.03	0.57**	—			
5. Amotivation	-0.20*	-0.13	-0.47**	-0.35**	—		
6. Intelligence APM	-0.07	0.08	-0.06	-0.23*	0.06	—	
7. Intelligence CAB	0.14	0.16	0.00	-0.09	-0.16	0.50**	—
8. Academic Achievement	0.33**	0.20*	0.17	-0.05	-0.28**	0.01	0.32**

Note *= $<.05$, **= $<.01$,

Unexpectedly no correlation with academic achievement and either intrinsic motivation or extrinsic motivation was found as reported elsewhere (Hazrati-Viari et al., 2013; Lim & Chapman, 2015). Intrinsic motivation was significantly positively correlated to both Conscientiousness and Openness while extrinsic motivation was correlated to conscientious which has been corroborated previously (Clark & Schroth, 2010; Hazrati-Viari et al., 2013). There was no indication that intrinsic motivation was negatively related to intelligence as speculated.

3.4 Predicting Academic Achievement based on Intelligence, Conscientiousness, Openness and Motivation Traits

One of the primary aims of this study is to determine if the measures of motivation are able to explain the variance in academic achievement above and beyond intelligence and the personality traits Conscientiousness and Openness. To achieve this comparisons were made between a series of regression models. Based upon the results of previous studies the baseline regression model will predict academic achievement using intellectual ability and the personality traits Conscientiousness and Openness. Given that intelligence APM was not significantly related to academic achievement only the scores for intelligence CAB will be employed as a measure of intelligence. In order to determine if motivation has incremental validity, a trait regression model that includes trait level motivation measures will be compared to the baseline regression model. Given that the correlations in Table 1 indicate only amotivation was significantly related to academic achievement it is the only motivation predictor included in the trait regression model.

Table 2

Comparison of Baseline and Trait Linear Models Predicting Academic Achievement

	Baseline Model		Trait Model	
	Beta	RI	Beta	RI
	F[3,102] = 8.9** R ² = .21		F[4, 101] = 7.7** R ² = .23	
Predictor	Beta	RI	Beta	RI
Intelligence CAB	.91**	.40	.84**	.32
Conscientiousness	.14**	.45	.13**	.35
Openness	.11	.15	.10	.12
Amotivation	-	-	-.30	.21

Note * = <.05, ** = <.01, beta weights are unstandardized. RI = relative proportion of model explained variance attributable to individual regressor. R² change is a function Baseline model minus the current model.

Table 2 shows the results of the regression analysis. As expected the baseline regression model was significant and explained 21% of the variance in academic achievement. Both intelligence and Conscientiousness were significant predictors, explaining 85% of variance in the model with Conscientiousness explaining approximately 5% more variance than intelligence. Openness was not a significant predictor though it accounted for 15% of the variance. The trait regression model was also significant explaining 23% of the variance in academic achievement with Conscientiousness and intelligence again the significant predictors, though Openness and amotivation were not though they combined to explain 33% of the variance. ANOVA analysis indicated that the trait regression model was not significantly different to the baseline regression model ($F[1,101]=3.4, p = .07$) which indicates amotivation does not have incremental validity over Conscientiousness, Openness and intelligence at the trait level. Interestingly the relative importance (RI) of amotivation (21%) is greater than that of Openness (12%).

3.5 Correlations between Intelligence, Conscientiousness, Openness and Motivation Facets

The secondary aim of this study is to see if facet level measures of personality and motivation have incremental validity over trait measures of personality and motivation. As can be seen in Table 3 a second correlation matrix was constructed that compares facets of Conscientiousness and Openness with facets of intrinsic and extrinsic motivation, amotivation, intelligence CAB and academic achievement.

Table 3

Correlation Analysis of Intelligence, Facet Level Conscientiousness, Openness and Motivation, and Academic Achievement

	<u>Intrinsic Motivation</u>			<u>Extrinsic Motivation</u>			<u>Amotivation</u>	<u>Academic Achievement</u>
	Know	Accomplish	Experience	Identified	Introjected	External		
C:Competence	0.39**	0.40**	0.25**	0.32**	0.28**	0.13	-0.26**	0.23*
C:Order	0.22*	0.27**	0.13	0.14	0.18	-0.05	-0.08*	0.21*
C:Dutifulness	0.25*	0.32**	0.12	0.30**	0.25*	0.03	-0.09	0.24*
C:Achievement	0.40**	0.43**	0.24*	0.30**	0.30**	0.14	-0.21*	0.36**
C:Self-Discipline	0.30**	0.33**	0.30**	0.27**	0.14	0.10	-0.18	0.26**
C:Deliberation	0.22*	0.26**	0.11	0.28**	0.19	0.01	-0.11	0.19
C:Total	0.39**	0.44**	0.26**	0.35**	0.29**	0.08	-0.20*	0.33**
O:Fantasy	-0.18	-0.18	-0.17	-0.26**	-0.16	-0.08	0.02	0.01
O:Aesthetics	0.38**	0.28**	0.31**	0.11	0.21*	0.00	-0.09	0.23*
O:Feelings	0.03	0.04	-0.02	-0.04	0.11	0.03	0.07	0.28**
O:Actions	0.23*	0.19*	0.11	0.04	-0.03	-0.18	-0.28**	-0.01
O:Ideas	0.30**	0.21*	0.27**	0.09	0.06	-0.00	-0.16	0.16
O:Values	-0.09	0.06	0.13	-0.00	0.20*	0.15	0.10	-0.17
O:Total	0.26**	0.21*	0.22*	-0.02	0.11	-0.04	-0.13	0.20*
Intelligence CAB	0.09	-0.05	-0.04	0.02	-0.11	-0.11	-0.16	0.32**
Achievement	0.20*	0.15	0.10	0.08	-0.03	-0.15	-0.28**	-

Notes: * p<.05, ** p<.01

Table 3 shows similar patterns to that found in Table 1. Intelligence, most facets of Conscientiousness except *deliberation* and Openness facets *aesthetics* and *feelings* are significantly positively related to academic achievement. Conscientiousness facet *achievement striving* showed a stronger correlation to academic achievement than Conscientiousness trait measure C.Total as has been previously reported (O'Connor & Paunonen, 2007). Openness facets *feelings* and *aesthetics* showed stronger correlation to academic achievement than Openness trait measure O.Total though only facets *aesthetics* and *ideas* have previously showed any relationship to academic achievement (O'Connor & Paunonen, 2007; Trapmann et al., 2007). Intrinsic and extrinsic motivation facets show significant positive correlations with Conscientiousness and Openness facets which is broadly consistent with findings from Clark and Schroth (2010) and Hazrati-Viari et al. (2013). The exception was extrinsic motivation facet *external* which was not correlated with either Conscientiousness or Openness. Interestingly amotivation was negatively correlated with three of the Conscientiousness facets including *achievement striving*.

Two motivational measures showed significant relationships to academic achievement. Intrinsic motivation facet *know* showed a weak positive correlation while amotivation showed the same small negative correlation to academic achievement as in Table 1. This differs from the finding of Komarraju et al. (2009) where intrinsic motivation facet *accomplish* was significantly associated with academic achievement and no association with amotivation was reported.

3.6 Predicting Academic Achievement based on Intelligence, Conscientiousness, Openness and Motivation Facets

In order to determine if facet measures of motivation are able to explain the variance in academic achievement beyond intelligence and facets of Conscientiousness and Openness a facet regression model was made to compare with the baseline and trait regression models. The facet regression model was constructed from all predictors with a significant correlation to academic achievement as found in Table 3. Non-significant predictors were systematically removed from the facet regression model (Appendix E, F) leaving 4 significant predictors as shown in Table 4. ANOVA showed a significant difference between the baseline regression model and the facet regression model ($F[1,101] = 12.22, p < .001$) indicating the facet regression model is an improvement over both baseline and trait regression models in predicting academic achievement. Facet *achievement striving* was the most important predictor of academic achievement in the facet regression model followed by intelligence which is consistent with other studies (Chamorro-Premuzic & Furnham, 2008; Furnham & Mosen, 2009; O'Connor & Paunonen, 2007). Amotivation is also a significant predictor in the facet regression model, accounting for 19% of the variance in academic achievement.

Table 4

Comparison of Baseline, Trait and Facet Linear Models Predicting Academic Achievement

Predictor	Baseline Model		Trait Model		Facet Model	
	Beta	RI	Beta	RI	Beta	RI
	F[3,102] = 8.9** R ² = .21		F[4, 101] = 7.7** R ² = .23		F[4,101] = 10.52** R ² = .29	
Intelligence CAB	0.91**	0.4	0.84**	0.32	0.92**	0.28
Conscientiousness	0.14**	0.45	0.13**	0.35		
Openness	0.11	0.09	0.1	0.12		
Amotivation	-	-	-0.3	0.21	-0.36*	0.19
C.Achievement.Striving					0.48**	0.30
O.Feelings					0.58**	0.23

Notes: * p<.05, ** p<.01, , Beta weights are unstandardized. RI = relative proportion of model explained variance attributable to individual regressor. R2 change is a function model 1 minus the current model.

While the facet *feelings* was a significant predictor in the facet regression model to the author's knowledge there is no current empirical evidence to support a relationship between facet *feelings* and academic achievement as studies have thoroughly explored this relationship (O'Connor & Paunonen, 2007; Trapmann et al., 2007). Due to the lack of empirical evidence for facet *feelings* in predicting academic achievement there are plausible reasons to remove it and examine what impact this has on the facet regression model's predictions of academic achievement. The results of the new baseline, trait and facet regression models without Openness are shown in Table 5.

Table 5

Comparison of Baseline, Trait and Facet Linear Models Predicting Academic Achievement Without Openness Traits or Facets

Predictor	Baseline Model		Trait Model		Facet Model	
	Beta	RI	Beta	RI	Beta	RI
	F[2,103] = 11.78** R ² = .19		F[3, 102] = 9.44** R ² = .22		F[3,102] = 10.79** R ² = .24	
Intelligence CAB	1**	.49	.91**	38	.95**	.35
Conscientiousness	.14**	.51	.12**	38		
Amotivation	-	-	-.33	24	-.3	.20
C.Achievement.Striving					.59**	.44

Notes: * p<.05, ** p<.01, , Beta weights are unstandardized. RI = relative proportion of model explained variance attributable to individual regressor.

All models significantly predicted academic achievement however the variance explained was lower than when Openness was included. ANOVA showed a significant difference between the baseline model and the trait model ($F[1,102] = 4.1, p = .05$) and a significant difference between the baseline model and the facet model ($F[1, 102] = 7.35, p = .008$), with the facet model predicting slightly more variance than the trait model. This difference between regression models appears to be due to the additional variance explained by facet *achievement striving*. The variance explained by intelligence in all models was also significant but amotivation was not a significant predictor in either trait or facet models when Openness was removed, though it contributed to explaining approximately 20% of the variance in academic achievement. Interestingly Komarraju et al. (2009) also found motivation to explain a significant amount of variance (5%) in regression models but predominantly due to intrinsic motivation facet *accomplish*.

These results show that amotivation and intrinsic motivation facet *know*, while correlated to academic achievement, have not been shown to have incremental validity over intelligence and Conscientiousness in this study.

3.7 Post Hoc Power Analysis

Based on our results in order for amotivation to be a significant predictor in the trait and facet regression models, with $R^2 = .04$ ($\alpha = .05$, $1-\beta = .8$ with two tails), the total number of participants required for a regression study would be approximately 270. This is similar to the number of participants found in Komarraju et al. (2009) ($n \sim 250$) though significantly less than the one thousand participants surveyed by Vallerand and Bissonnette (1992)

4 Discussion

Investigating student motivation and its influence on academic achievement is of practical importance as academic achievement has highly significant implications for students' future life outcomes. The main purpose of this study was to explore the influence academic motivation may have on students' academic achievement, including an examination of whether personality and motivation facet measures can add incremental validity to the relationship between motivation, personality and achievement. While other studies have attempted to quantify the relationship between motivation, personality and academic achievement many of these studies suffer from limitations resulting in differing interpretations on the role of motivation. This study incorporated a number of improvements to the research method, based on suggestions from previous literature, to help increase the power of the study and improve the interpretability of results. While motivation measures were not statistically significant in predicting academic achievement the results do support the view that academic motivation, particularly the trait amotivation, is an important influence of first year students' academic achievement. Facet measures of motivation and personality had stronger correlations to academic achievement than trait measures, while Conscientiousness and Openness facet measures had incremental validity over Conscientiousness and Openness trait measures. The main implications from this study as well as the studies strengths and weaknesses are discussed in the sections below.

4.1 The contribution of Conscientiousness and Openness Traits to Explaining Academic Achievement

The first aim of the study was to explore the role that trait level motivation, personality and intelligence measures may have in influencing first year student academic achievement and

particularly whether motivation has incremental validity over intelligence and personality measures.

Trait level Conscientiousness was moderately correlated with academic achievement and the regression predictor which explained the most variance in academic achievement as previously identified (Chamorro-Premuzic & Furnham, 2003a; O'Connor & Paunonen, 2007). However Conscientiousness was as significantly correlated with intrinsic motivation, extrinsic motivation and amotivation as with academic achievement similar to that observed by Komarraju et al. (2009). This result supports the claims by Roberts et al. (2014) of a lack of conceptual clarity between Conscientiousness and motivation traits making it difficult to determine which trait is the major influence on academic achievement. Research in this area is not consistent in regard to which trait should be the major influence on academic achievement with some favoring Conscientiousness as a mediator of motivation on academic achievement (Komarraju et al., 2009) while others prefer motivation as a mediator of Conscientiousness (Richardson & Abraham, 2009). Future researchers should employ use a range of motivational constructs not just those based on self-determination theory (Martin, 2008; Richardson & Abraham, 2009; Steinmayr et al., 2011; Steinmayr & Spinath, 2009) to decide what components of motivation can legitimately be considered constructs with incremental validity over Conscientiousness without significant correlations to it.

Trait Openness did show a significant correlation with academic achievement but did not explain significant variance in academic achievement in the trait regression model. Results for Openness have been mixed at best with not all studies finding correlations with achievement (O'Connor & Paunonen, 2007; Trapmann et al., 2007). One possible reason for the lack of explained variance with academic achievement in this study may be due to selecting participants

only from psychology, a narrow scientific domain. Previous studies have noted the association between Openness and achievement may be more likely to hold where students' required more creativity and imagination in studies rather than for systematic and organized performance such as in psychology (Chamorro-Premuzic & Furnham, 2003a, 2003b). In addition it may also be an artifact of the low power of this study, as Openness accounted for an amount of variance that would be considered significant in a study with higher power such as with the study of Komarraju et al. (2009).

4.2 The contribution of Intelligence and Motivation Traits to Explaining Academic Achievement

Intelligence was correlated with academic achievement as previously reported (Furnham & Monsen, 2009; Furnham et al., 2009; Rohde & Thompson, 2007) however only the intelligence CAB measure was correlated with academic achievement, not intelligence APM. This was surprising as APM is a well validated measure for intelligence testing (Bors & Stokes, 1998). One possible explanation for this result is the online survey version of the APM was not timed as is normally the case when administering the test in person (Bors & Stokes, 1998). By not timing the intelligence APM students' participants may be able to improve their responses. Future research should incorporate a timing mechanism into the APM component of the study to ensure students' responses are an accurate reflection of their intelligence.

Of the motivational traits only amotivation correlated with achievement, but did not explain a significant amount of variance in the trait regression model. Some previous research studies have had similar findings with neither correlational significance or incremental validity of motivational traits (Cetin, 2015a; Cokley et al., 2001) on academic achievement. The conceptual

overlap between Conscientiousness and motivation discussed in Section 4.1 is likely to partially explain this outcome particularly due to the use of the NEO-PI-3 in this study which has greater validity and reliability than short form measures (McCrae & Costa, 2010). The conceptual overlap particularly with intrinsic and extrinsic motivation may have resulted in more variance being explained by Conscientiousness rather than motivation due to the use of these measures.

Interestingly however the amount of variance explained by motivation in the trait regression model (~19%) was greater than that reported by Komarraju et al. (2009) for intrinsic motivation which explained 5% of the variance in GPA. This difference is particularly noteworthy due to Komarraju et al. (2009) neglecting to include intelligence in their study and that if included may have reduced the amount of variance explained by intrinsic motivation. Therefore motivation may indeed be a significant influence on first year students' academic achievement though, as indicated by the post-hoc power analysis, this study lacked the power to show it.

4.3 The Contribution of Conscientiousness and Openness Facets to Explaining Academic Achievement

In both correlational analysis and the facet regression model Conscientiousness facet achievement striving had the most significant correlation and explained the most variance with academic achievement above that explained by the Conscientiousness trait measure. This supports the view held in the literature that facet personality measures can improve upon the results of trait measures particularly regarding academic achievement (O'Connor & Paunonen, 2007; Rosander et al., 2011; Trapmann et al., 2007; Zupančič & Kavčič, 2011). Trait and facet

measures of Conscientiousness predicted a greater amount of variance than intelligence in this study which has also be observed (Poropat, 2009).

However Poropat (2009) caution's the use of Conscientiousness for predicting academic achievement in the place of intelligence due to the greater possibility of socially desirable responding such as faking in personality assessments. As self-deceptive enhancement was the only measure of socially desirable responding in this study, future studies should also include the impression management scales to detect for faking in personality survey responses.

Correlations between the facet measures of Conscientiousness and motivation produced similar results to that found for traits. Intrinsic motivation facets *accomplish* and *know* and extrinsic motivation facet *identification* correlated strongly with most Conscientiousness facet measures. Intrinsic motivation facet *experience*, extrinsic motivation facet *introjected* and amotivation were also correlated to some Conscientiousness measures while extrinsic motivation facet *external* was not correlated. (Komarraju et al., 2009) found extrinsic motivation facet *external* also correlating with Conscientiousness. This again highlights the overlap of motivational constructs with Conscientiousness (Roberts et al., 2014) particularly with intrinsic motivation which has already been discussed in section 4.1.

Openness to experience facets *feelings* and *aesthetics* were both correlated with academic achievement, while facet *feelings* was a significant predictor in the facet regression model. However Openness has a mixed history of predicting academic achievement (Chamorro-Premuzic & Furnham, 2003a, 2003b; O'Connor & Paunonen, 2007) and Openness facet *ideas* the only facet measure reliably correlated to achievement (Hakimi et al., 2011; O'Connor & Paunonen, 2007). It is therefore surprising that this study identified a correlation between Openness and academic achievement that was primarily driven by the facet feelings, and to a

lesser degree the facet aesthetics, something not previously reported in the literature. How this correlation may be explained is unclear, but it may be an artefact of the low power of the study. If this study were to be repeated the participant numbers should be above that suggested in the post hoc power analysis in order to be confident of the result.

4.4 The contribution of Intelligence and Motivation Facets to Explaining Academic Achievement

As with the trait measures intelligence CAB was significantly correlated to and explained a significant amount of variance in academic achievement scores showing those with higher intelligence have higher academic achievement as previously reported (Deary et al., 2007; Furnham et al., 2009).

In contrast to the trait measures, intrinsic motivation facet *know* showed a small positive correlation to academic achievement but was not a significant predictor of academic achievement. While this facet has not previously been associated with academic achievement it is theoretically related (Hazrati-Viari et al., 2013; Vallerand & Bissonnette, 1992) and the intrinsic motivation trait as well as other facets of intrinsic motivation have been correlated with achievement (Komarraju et al., 2009; Vallerand & Bissonnette, 1992). Its strong correlation to Conscientiousness may explain why intrinsic motivation is not a significant predictor in the facet regression model as discussed in Section 4.2 while the low power of the study may have also impacted the ability to detect incremental validity for intrinsic motivation.

Amotivation was the most significant motivational construct in this study when considering correlations with achievement. It also predicted a greater percentage of variance (~20%) when compared to intrinsic motivation facet accomplish (5%) as reported by (Komarraju et al., 2009).

In fact the facet regression model developed in this study with intelligence, amotivation and achievement striving as the only predictors, accounted for more variance in achievement than that accounted for by Komarraju et al. (2009). This was predominantly due to the inclusion of intelligence and the facet achievement striving. As noted in section 4.1 the most probable reason amotivation was not a significant predictor in the facet regression model was the low power of the study.

4.5 Implications of the Study

Due to the very specific homogeneous sample the study results should be used cautiously when generalizing beyond first year students', particularly as motivation appears to vary as a function of year level of study (Hakan & Münire, 2014). However the results still contain important implications for first year students'. The results show that those students' with higher intelligence and high in Conscientiousness, particularly the facet *achievement striving* tend to show higher academic achievement. While students' may be unable to significantly improve their intelligence, they can learn to act in more Conscientious ways regarding their study. If students' low in Conscientiousness, particularly the facet achievement striving, can be identified interventions to improve their Conscientiousness would be likely to have the most significant impact on their academic achievement. This could also be said for interventions on students' intrinsic motivation, as intrinsic motivation facet *know* was related both Conscientiousness and to academic achievement. However the most important motivational trait identified in this study was amotivation with results suggesting first year students' higher in amotivation are more likely to have lower levels of academic achievement. These results imply that targeted strategies to

increase levels of Conscientiousness and/or lower amotivation may be the most successful in improving academic achievement in first year students’.

4.6 Strengths and weaknesses of the Study

This study contained a number of methodological strengths. The greater validity and reliability of facet level personality constructs was particular useful in identifying correlations and explaining variance in academic achievement. To further improve the validity of facet measures the addition of peer reported personality surveys as outlined by (McCrae & Costa, 2010) would give further validity to study outcomes and potentially improve correlations with academic achievement (Smrtnik - Vitulić & Zupančič, 2011).

Measuring academic achievement based on course grade is a better measure than self-reported GPA however the improvements in the measure of academic achievement may be offset by poorer study sampling techniques. The main difficulty with the study sample was the relatively low number of participants. While the direct effects of this have been discussed in section 4.1 there are other indirect effects of the low study sample. In particular there was a gender bias in our sample with females outnumbering males. While this did not appear to be an issue in this study, differences in motivation (Martin, 2003a, 2004) and differences in achievement (Steinmayr et al., 2011) between males and females indicate this is an important consideration to take into account in future research.

Another possible criticism is the way participants were selected to complete the survey. As first year students’ were self-selected into the study it seems plausible more conscientious students’ would be more likely to participate with those lower in Conscientiousness least motivated to participate. Future studies should try to randomise sampling of first year students’ to avoid these difficulties.

The advantage of using a homogenous cohort limited the number of confounding variables in the study, such as study domain and year of study, making the interpretation of the results easier. However it does limit the ability to generalise the results across different populations as assumptions need to be made which have not been tested in this study. However, this limitation could be addressed by applying the same methodology to similarly targeted student populations in different year levels to observe whether the relationship of motivation to academic achievement is the same.

Including a measure of self-deceptive enhancement is also considered a strength of this study and should be expanded to incorporate other socially desirable responding measures such as the impression management scale to account for as many biases in survey responses as possible.

4.7 Future Research Directions

The present study has provided support for the usefulness of facet measures of personality and measures of motivation in exploring relationships with academic achievement. A useful addition to future research would be the use of a mixed methods study on motivation where selected students' can be interviewed and give reasons for why they scored their motivation surveys in a particular way. This will provide context to the motivation survey responses and provide useful feedback that may guide the type of interventions required to help students' at risk of poorer academic achievement.

Research could then focus on investigating the types of interventions most effective at improving motivation for specific personalities. Other research programs could focus on the use facet level personality measures to identify aptitude in specific areas of an academic program

(Rosander et al., 2011) which would provide specific feedback for students' on how they could improve their academic achievement based on their personality.

Research could also consider designing a longitudinal study to observe how motivation changes in individuals through the course of their studies. As previous studies have indicated that level of student motivation changes as students' progress through their degree (Hakan & Münire, 2014) it would be helpful to explore whether these changes in motivation have the same effect on academic achievement as in first year students'.

4.8 Conclusion

These results provide a useful insight in to the role of intelligence, personality and academic motivation and its effect on the academic achievement of a first-year student sample. The significant role that Conscientiousness, and potentially amotivation, play in student's academic achievement, particularly if students' are low in Conscientiousness and high in amotivation can used to develop targeted programs helping students' improve their academic achievement. This type of research has the potential to help students' achieve their best at University by reducing their risk of poor academic achievement, helping them to reach their potential, and improving the long-term outcomes for their lives.

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Appendix A - Shapiro-Wilk Test of Normality

where 1 = normal distribution

Variable	W	p
C.Competence	0.97	0.01
C.Order	0.98	0.17
C.Dutifulness	0.99	0.28
C.Achievement.Striving	0.99	0.48
C.Self.Discipline	0.98	0.18
C.Deliberation	0.99	0.45
C.Total	0.98	0.07
O.Fantasy	0.98	0.10
O.Aesthetics	0.97	0.03
OFeelings	0.98	0.07
O.Actions	0.98	0.13
O.Ideas	0.98	0.09
O.Values	0.98	0.06
O.Total	0.99	0.80
IM.toward.accomplishment	0.98	0.20
IM.to.know	0.92	0.00
IM.to.experience.stimulation	0.97	0.02
EM.Identified	0.91	0.00
EM.introjected	0.96	0.01
EM.external.regulation	0.95	0.00
Amotivation	0.81	0.00
FINAL	0.98	0.23

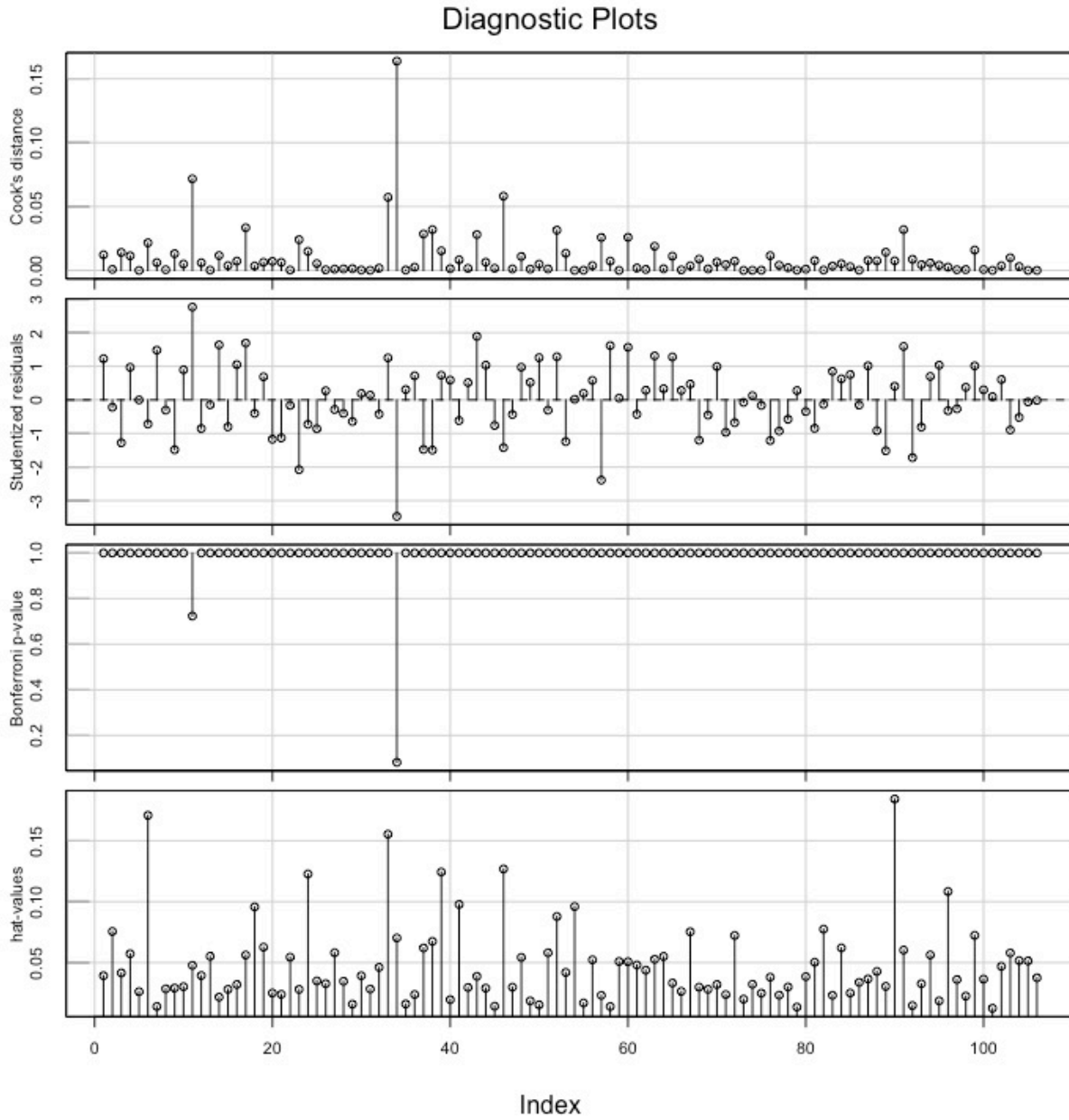
Appendix B – Descriptive Statistics of the Dataset

Variable	Alpha	<i>M</i>	<i>SD</i>	Min	Max
C:Order	.96	25.98	4.60	10	36
C:Competence	.96	27.28	3.74	19	34
C:Dutifulness	.98	29.21	3.79	19	39
C:Achievement Striving	.98	27.99	4.99	17	40
C:Self-Discipline	.98	24.25	5.34	11	40
C:Deliberation	.99	26.20	4.04	15	35
O:Fantasy	.96	26.96	4.82	13	37
O:Aesthetics	.98	27.64	5.50	13	38
O:Feelings	.94	30.66	4.01	22	38
O:Actions	.94	24.70	3.95	15	34
O:Ideas	.91	28.15	5.16	17	40
O:Values	.95	23.89	2.93	17	30
IM:To know	.96	21.09	4.85	4	28
IM:Accomplishment	.83	18.01	5.52	4	28
IM:experience	.76	14.32	5.55	4	28
EM:identified	.94	22.24	4.61	4	28
EM:introjected	.92	19.19	5.70	4	28
EM:external	.87	19.95	5.02	4	28
Amotivation	.97	8.80	5.59	4	28
SDE	.96	2.47	1.97	0	8
Intelligence CAB	N/A	9.23	2.8	0	12
Intelligence APM	N/A	7.48	2.53	2	12
FINAL	N/A	75.39	9.88	50	96

Appendix C - Mean Values and t-tests of Personality, Motivation and Academic Success
measures by Gender

Variable	Mean		<i>t(df)</i>	<i>p</i>	<i>d</i>
	M (n = 26)	F (n = 80)			
C:Order	27.46	27.11	-1.55 (43)	.13	.34
C:Competence	24.73	26.33	.42 (45)	.68	.09
C:Dutifulness	27.96	29.60	-1.56 (32)	.13	.39
C:Achievement	26.62	28.30	-1.33 (36)	.19	.32
C:Self-Discipline	23.23	24.43	-.97 (41)	.34	.22
C:Deliberation	25.35	26.40	-1.22 (47)	.23	.27
O:Fantasy	26.96	26.76	.18 (42)	.86	.04
O:Aesthetics	27.42	28.00	-.46 (40)	.65	.1
O:Feelings	29.62	31.04	-1.66 (47)	.1	.36
O:Actions	25.77	24.15	1.99 (49)	.05	.43
O:Ideas	30.69	27.18	3.25 (47)	.002	.71
O:Values	23.15	24.31	-1.8 (43)	.08	.4
IM:know	21.58	20.91	.7 (57)	.49	.15
IM:Accomplishment	17.54	18.25	-.62 (48)	.54	.14
IM:experience	14.04	14.35	-.25 (44)	.8	.06
EM:identified	21.38	22.68	-1.31 (46)	.2	.29
EM:introjected	18.19	19.60	-1.18 (48)	.24	.26
EM:external	17.81	20.68	-2.44 (40)	.02	.56
Amotivation	9.15	8.53	0.49 (41)	.63	.11
SDE	2.46	2.33	0.32 (41)	.75	.07
Age	21.5	20.3	.69(33)	.5	.17
Intelligence CAB	9.27	9.21	.082(37)	0.94	0.02
Intelligence APM	8.54	7.14	2.63(46)	0.01	0.58
FINAL	74.04	75.83	-.76 (39)	.45	.18

Appendix D – Diagnostic Plot of Facet Regression Model



Appendix E – Stepwise Elimination of Regressors for Facet Model with Openness

	Model 1		Model 2		Model 3		Model 4		Model 5	
	F[10,95] = 4.24*** R2 = .31		F[9,96] = 4.67*** R2 = .30 R2 change = .004, p = .44		F[8,94] = 5.22*** R2 = .30 R2 change = .008, p = .58		F[7,98] = 5.91*** R2 = .30 R2 change = .01, p = .66		F[6,99] = 6.96*** R2 = .30 R2 change = .01, p = .8	
	Beta	Ri	Beta	RI	Beta	RI	Beta	RI	Beta	RI
C.Achievement.Striving	0.42	0.16	0.39	0.16	0.38	0.17	0.40	0.19	0.39	0.20
Intelligence CAB	0.91**	0.25	0.92**	0.25	0.9**	0.25	0.92**	0.26	0.92**	0.26
O.Feelings	0.5*	0.17	0.52*	0.18	0.55*	0.19	0.61**	0.22	0.61**	0.22
Amotivation	-0.42*	0.15	-0.35*	0.16	-0.35*	0.16	-0.36*	0.17	-0.35*	0.17
C.Self.Discipline	0.11	0.06	0.12	0.06	0.15	0.07	0.15	0.07	0.14	0.08
C.Dutifulness	-0.02	0.04	-0.03	0.04	0.01	0.05	-0.02	0.05	-0.03	0.05
C.Competence	-0.11	0.03	-0.12	0.04	-0.08	0.04	-0.05	0.04		
O.Aesthetics	0.19	0.07	0.14	0.07	0.13	0.07				
C.Order	0.17	0.04	0.15	0.04						
IM.to.know	-0.18	0.03								

Notes: *p<.05, **p<.01, ***p<.001, Beta weights are unstandardized. RI = relative proportion of model explained variance attributable to individual regressor

Appendix F – Stepwise Elimination of Regressors for Facet Model with Openness

	Model 6		Model 7	
	F[5,100] = 8.44***		F[4,101] = 10.52***	
	R2 = .30		R2 = .29	
	R2 change = .01, p = .89		R2 change = .01, p = .91	
	Beta	RI	Beta	RI
C.Achievement.Striving	0.38	0.22	0.48**	0.30
CAB.Tot	0.91**	0.27	0.92**	0.28
O.Feelings	0.61**	0.23	0.58**	0.23
Amotivation	-0.35*	0.18	-0.36*	0.19
C.Self.Discipline	0.13	0.10		
C.Dutifulness				
C.Competence				
O.Aesthetics				
C.Order				
IM.to.know				

Notes: *p<.05, **p<.01, ***p<.001, Beta weights are unstandardized. RI = relative proportion of model explained variance attributable to individual regressor. R2 change is a function model 1 minus the current model.