Personality, Vocational Interests, Cognitive Abilities and Personal Values for the Prediction of Academic Performance and Academic Satisfaction

Annamaria Rossana Quaresima

Bachelor of Arts, Bachelor of Health Science (Honours)

A thesis submitted in fulfillment of the requirements for the degree of
Doctor of Philosophy

School of Psychology,
Faculty of Health and Medical Sciences, University of Adelaide
November 2021

Table of Contents

List of Figures

List of Tables

List of Abbreviations

AcSat	Academic Satisfaction with Psychology scale
CHC theory	Cattell-Horn-Carroll theory
ETS kit	Educational Testing Service kit
GPA	Grade Point Average
MRT	Mental Rotation Test
NEO-PI-R	Neuroticism Extraversion Openness Personality Inventory Revised
P-E fit	Person Environment fit
RIASEC	Realistic Investigative Artistic Social Enterprising Conventional
SDS-R	Self Directed Search Revised
SVS	Schwartz Values Survey
TIE	Typical Intellectual Engagement

Abstract

Attrition from Australian universities comprises almost one quarter of enrolments. Providing students at risk of attrition with effective career counselling is consequently a priority. Attrition is often due to poor academic performance and/or satisfaction. Identifying individual differences to predict these would improve applied career counselling. Person-Environment Fit theory holds that the fit between an individual's traits, abilities and academic environment affects their academic achievement and satisfaction. Increasing the variety and specificity of traits could improve predictions over the use of a single individual difference domain or broader traits.

Participants (N=358) completed an individual differences test battery comprising self-report measures of the Five Factor Model personality traits, cognitive abilities, vocational interests, and values, and reported their satisfaction with undertaking psychology. Upon completion of the semester, psychology course grade and Grade Point Average for all subjects were reported.

The first study investigated prediction of academic satisfaction using these individual differences. Personality traits and vocational interests predicted academic satisfaction with psychology. Narrow personality facets were stronger predictors than broader personality factors. Cognitive abilities demonstrated some potential for predicting academic satisfaction with psychology.

The second study similarly examined the prediction of academic performance. Personality traits, cognitive abilities and vocational interests were significant predictors of psychology course grade and GPA. Whilst personality facets were strong predictors of academic performance, personality factors only predicted overall GPA. Values predicted psychology course grade but not overall GPA.

The third study reported an exploratory factor analysis which utilised personality factors, cognitive abilities, vocational interests and values to produce ten factors. Factor scores predicted psychology course grade, overall GPA and academic satisfaction with psychology. Notably, different factor scores were predictors of different academic outcomes.

The fourth study improved on this by utilising narrow personality facets instead of broader personality factors to produce eight factors. Factor scores predicted psychology course grade, GPA, and academic satisfaction with psychology. Different factor scores were significant predictors of different academic outcomes.

The fifth study optimised prediction by increasing specificity between independent variables and academic outcomes, potentially enabling a reduction in assessment time for career counselling. Academic outcome parsimony was prioritised over the use of a single set of predictive factor scores;

three sets of factor scores were produced to predict each of the three academic outcomes. Optimised factor scores demonstrated strong prediction and a parsimonious approach.

Prediction of academic performance and academic satisfaction can be improved by using a wider variety of individual differences domains in combination, narrow traits, and factor scores optimised for the prediction of single specific outcomes. Specificity of outcome was important as well as specificity of academic domain. Differing factor scores were relevant to the prediction of poor and high academic performance and academic satisfaction with psychology. Practical implications include defining which variables lead to increased and decreased psychology grades, GPA, and satisfaction with psychology. The specificity of optimised variables suggests career counselling assessment could be streamlined. These studies highlight the need for research focused on breadth of individual differences and specificity of prediction.

Declaration

I certify that this work contains no material which has been accepted for the award of any other degree or diploma in my name, in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. In addition, I certify that no part of this work will, in the future, be used in a submission in my name, for any other degree or diploma in any university or other tertiary institution without the prior approval of the University of Adelaide and where applicable, any partner institution responsible for the joint-award of this degree.

I give permission for the digital version of my thesis to be made available on the web, via the University's digital research repository, the Library Search and also through web search engines, unless permission has been granted by the University to restrict access for a period of time.

I acknowledge the support I have received for my research through the provision of an Australian Government Research Training Program Scholarship and a Faculty of Health Sciences Divisional scholarship from the University of Adelaide, South Australia.

Annamaria R. Quaresima

26 November 2021

List of conference presentations based on this thesis

Quaresima, A.R. & Sarris, A. (2009, July). *Personality, vocational interests, cognitive abilities and values: Relationships and potential personality complexes.* Paper presented at the 14th Conference of the International Society for the Study of Individual Differences (ISSID), Evanston, Illinois.

Quaresima, A.R. (2008, November). *Personality, vocational interests, cognitive abilities and values, and the possibility of underlying personality complexes.* Paper presented at the 7th Australian Conference on Personality and Individual Differences (ACPID), Gold Coast, Australia.

Quaresima, A.R. (2008, November). *Mature Love and its relationships with personality, cognitive abilities and vocational interests.* Paper presented at the 7th Australian Conference on Personality and Individual Differences (ACPID), Gold Coast, Australia.

Acknowledgements

I have measured out my life with coffee spoons – T.S. Eliot

I want to thank and acknowledge everyone who has helped and supported me with completing the thesis.

Firstly, a big thank you to my PhD supervisors Dr. Neil Kirby and Dr. Aspa Sarris, for their perpetual support and encouragement over the years. Thank you both for your patience, and for your insightful edits and contributions.

I want to thank Dr. Anna Chur-Hansen, for her encouragement and support during completion of the thesis. Your kindness and encouragement towards the finish line has been crucial.

Also, a big thank you to the Australian and New Zealand Student Services Association for their grant, which allowed me to purchase relevant assessment materials that would have otherwise been unavailable.

I wish to thank Bob Willson and Dr. Nick Burns for their statistical advice and assistance, Wanda Prokopiak for her assistance with assessment materials and Dr. Julia Harries for her advice on putting together a thesis.

Thank you also to all the students who spent a gruelling couple of hours participating in this research.

Thank you to my family and friends for quietly supporting me, whether by not asking when I would complete it, or by showing their confidence in me getting there! Thank you to my parents for always supporting me in my career endeavours and special thanks to my mother for many cups of tea and coffee and lending a sympathetic ear during data collection and thesis writing.

Finally, thank you to my beloved partner Jared for his unwavering support and confidence in me. Words cannot express how much I appreciate your help; you have been both my biggest practical and emotional support throughout the PhD.

Dedication

To my father, who was proud of me for starting this thesis, but who never saw its completion. Here it is, Dad.

Chapter 1: Introduction

1.1 Improving Academic Outcomes

Research has indicated that with tertiary attrition rates increasing from the 1990's, and approximately 25% of students enrolled in four-year college and university degrees not persisting beyond their first year, high attrition rates are among the most significant challenges facing institutions of higher education (Bowles & Brindle, 2017; Kahn, Nauta, Gailbreath, Tipps, & Chartrand, 2002). Current attrition rates are up to 21% within Australian universities, and as high as 50% within American universities (Bowles & Brindle, 2017).

Although the decision to leave university may be voluntary, it is also often directly attributable to poor academic performance (Kahn et al., 2002; Napoli, 1996) or to lack of academic satisfaction (Edwards & Waters, 1982; Strahan & Credé, 2015). Academic achievement has a major impact on future opportunities for students (Laidra, Pullmann, & Allik, 2007), and "dropping out" or persistence with low levels of achievement can result in severe disruption of vocational progress and significant economic disadvantages to both the students and the universities (Kahn et al., 2002). Additionally, academic satisfaction has a major impact on students' well-being and life satisfaction, and poor academic satisfaction has been found to have relationships with poor life outcomes, such as general life satisfaction (Lounsbury, Saudargas, Gibson, & Leong, 2005a). Consequently, the early identification of students at risk of, or experiencing poor academic performance and low levels of academic satisfaction with a particular course of study - and therefore at risk of attrition - is an issue of great importance to counselling and career service providers within institutions of higher education. Further, the identification of factors that are associated with academic achievement has important implications for structuring the educational environment and processes in order to improve the academic performance of students (Vitulic & Zupancic, 2010).

1.2 Academic Performance

Academic performance has been measured in a variety of different ways (scores on assignments, seminar performance, absenteeism) but the two most commonly employed measures are Grade Point Average (GPA) and grades on specific academic courses of study (Busato, Prins, Elshout, & Hamaker, 2000; Farsides & Woodfield, 2003; Furnham & Chamorro-Premuzic, 2004; Lounsbury, Sundstrom, Loveland, & Gibson, 2003; Pullmann & Allik, 2008).

GPA can be measured at the completion of a tertiary degree, or at an ongoing stage within a degree, due to its flexibility. The nature of GPA, with its weighted average of all grades received on a variety of specific courses is both flexible and general and largely accounts for its popularity; a GPA can be calculated at any point beyond one semester of study, and summarises results for all courses undertaken, making it more appropriate as a measure of general academic performance.

However, specific course grades are also relevant as a narrower measure of academic performance within varied academic fields because relative success in different majors or academic disciplines has been shown to be influenced by individual aspects such as different personality factors or narrower facets (De Fruyt & Mervielde, 1996; Vedel, Thomsen, & Larsen, 2015). Often, measures of individual differences that predict or correlate with high academic performance in one academic discipline are irrelevant or even negatively correlated with or predictive of low academic performance in another discipline (Busato et al., 2000; Chamorro-Premuzic & Furnham, 2008; Pozzebon, Ashton, & Visser, 2014; Vedel et al., 2015; Vitulic & Prosen, 2012). For example, a study showed that Economics students received higher GPAs as their level of Extraversion increased, whilst Psychology students received lower GPAs with the same increase in Extraversion (Vedel et al., 2015). Similar results were additionally found for facets; O3 Openness to Feelings was a significant negative predictor of GPA, but only for Medical students (Vedel et al., 2015), and such a result suggests the varying importance of professional detachment within specific areas of study.

A third approach is that of academic majors, although their actual measurement can vary. Academic majors are disciplines of study which a student has elected to be the focus of their degree. A major largely determines the choice of specific courses, and shows a student's current career intentions, although majors can be changed. In terms of measurement, some researchers have utilized major-specific GPA; this is the weighted average of all grades within the academic discipline of the major (for example, Vedel, Thomsen & Larsen, 2015). Other researchers have used the term interchangeably with course grades when all courses belong within an academic discipline.

There is additional research demonstrating that the level of measurement utilized for academic outcomes as criterion variables requires an equivalent level of measurement for the independent variables (Vedel et al., 2015; Wittmann & Süβ, 1999). This implies, for example, that the use of the Big Five personality facets, narrow stratum I cognitive abilities, and other fine-grained independent variables may be more important for providing an accurate prediction when using specific course grades and academic majors as the dependent variables.

Although psychologists and educators have been researching the prediction of academic success since psychometric instruments were first developed (Andrieu, 2011; Busato, Prins, Elshout, & Hamaker, 1999; Harris, 1940), the complexity of interactions between individual differences and academic performance has ensured that it is still a field where significant work remains to be done before individuals' performance can be reliably predicted in a variety of academic situations. For example, it is only relatively recently that research has focused on predicting individual differences in academic performance and academic satisfaction using non ability measures such as personality and vocational interests (Vedel, 2014; Vedel et al., 2015).

1.3 Academic Satisfaction

Relative to academic achievement, academic satisfaction with a course of study or major is a comparatively under-researched field (Cox, Bjornsen, Krieshok, & Liu, 2016; Logue, Lounsbury, Gupta, & Leong, 2007; Milsom & Coughlin, 2017). It is an important area of research, however, if students are to be provided with the necessary support to pursue their studies effectively, and for career guidance to select academic courses that will suit them as individuals. Academic dissatisfaction is known to be one of the main reasons for changing academic majors or simply dropping out from tertiary studies (Allen, Robbins, Casillas, & Oh, 2008; Pascarella, 2006; Pozzebon et al., 2014; Wolniak & Pascarella, 2005), which is a disruptive and time consuming process for both the individual student and the tertiary institution. Additionally, a weak yet positive relationship has been found between academic satisfaction and academic performance (Guan, Shiye, Liu, & Yum, 2006), whilst academic satisfaction has been shown to be related to students' over-all wellbeing and life-satisfaction (Feldman & Newcomb, 1969; Logue et al., 2007; Strahan & Credé, 2015). In turn, well-being and life satisfaction are known to be associated with students' propensity to withdraw or drop out from academic courses (Edwards & Waters, 1982, 1983; Tyler & Small, 1990). This suggests that academic satisfaction may have an important yet largely unexplored role in keeping students enrolled, emotionally healthy, and performing well academically.

Another reason that tertiary institutions are likely to take an interest in the students' academic satisfaction is that it is a frequent outcome on student surveys in which students are asked to rate tertiary institutions. These ratings are then used as the basis for making comparisons between institutions; those institutions that take an interest in ensuring that students are satisfied with their courses of study are likely to see this reflected in survey results that will attract new students (Logue et al., 2007).

Measurement of academic satisfaction has largely utilised single item measures (Strahan & Credé, 2015). Notable exceptions with multiple items are the Academic Major Satisfaction Scale (Nauta, 2007), a six item measure with good validity, that has been shown to distinguish between students

that remained in their academic course from those that changed academic course; a seven item scale developed for specific academic domains by Lent, Singley, Sheu, Schmidt & Schmidt (2007) (Lent, Singley, Sheu, Schmidt, & Schmidt, 2007) and a 20 item Satisfaction with College measure developed by Strahan & Credé (Strahan & Credé, 2015), whose research demonstrated that academic satisfaction may be best represented as a hierarchical structure, with between three to five narrow factors subsumed by a single general factor.

A number of measures of individual differences have been investigated in relation to academic satisfaction; prominent among these are the Big Five personality factors (Harrington & Loffredo, 2001; Lounsbury et al., 2005a) and Holland's RIASEC (Realistic Investigative Artistic Social Enterprising Conventional) vocational theory (Hansen & Tan, 1992; Morrow, 1971; Nafziger, Holland, & Gottfredson, 1975; Spokane & Derby, 1979). In particular, a central tenet of Holland's vocational theory is that people flourish where there is a good fit between their interests and the occupational environment in which they function, with a good fit leading to satisfaction and a bad fit leading to dissatisfaction (Holland, 1980; Holland & Gottfredson, 1976; Holland, Gottfredson, & Baker, 1990). While ability measures have not been well-examined in relation to academic satisfaction, RIASEC theory posits that abilities shape vocational interests via success at tasks encouraging further involvement (Holland, Shears, & Harvey-Beavis, 2001).

1.4 Person-Environment fit

Person-Environment (P-E) fit comprises many diverse theories, but the central tenants of each involve the concept that individuals have certain traits which are better suited to some careers over others, whilst careers, organisations and specific jobs have distinct environments that foster some traits over others; individuals will seek out those environments that align more closely with their own traits and experience a better interaction between their traits and the environment than individuals whose traits have less in common with their environment (Rounds & Tracey, 1990; Su,

Murdock, & Rounds, 2015). Additionally, individuals within an environment will tend to shape it, just as the environment will affect the individuals within it (Rounds & Tracey, 1990). Recent meta-analytic research on academic outcomes suggests that P-E fit does contribute to performance outcomes such as grades and persistence within a major (Nye, Su, Rounds, & Drasgow, 2017).

Traits important to fit are also shown to vary at different levels and involve more than simply matching up environmental and personal traits (Su et al., 2015). Aside from similarity between a person's traits and the characteristics of the environment, some researchers have conceptualised P-E fit as additionally involving the fit between abilities and demands (abilities-demands fit) of the job, and fit between the needs to be fulfilled by the job and how well the job fulfils those needs (needs-supplies fit). While the former is largely linked to academic performance and job performance, the latter is more closely related to academic satisfaction and job satisfaction (Su et al., 2015).

The Attraction-Selection-Attrition (ASA) framework is one of the key theories developed to explain P-E fit (Schneider, 1987). This theory proposes that individuals are attracted to environments that they believe will allow them to fulfil their goals, actively participate within these environments and leave when the level of fit is not considered close enough. If a close fit exists between the person and environment, the individual will generally stay longer and experience increased satisfaction (Su et al., 2015).

Holland's theory of vocational interests (Holland, 1997) is a prominent theory of P-E fit. Central to this theory is the idea of six vocational interest types which a person may have in varying degrees. It also involves the concept of congruence – that an individual will have a unique combination of their three strongest vocational interest types and be attracted to environments with a corresponding combination of vocational interest types, and that a closer fit will provide improved job or academic performance, and increased job or academic satisfaction respectively (Su et al., 2015). This theory is discussed in further detail in section 1.4.3.

Integrative research has often used Holland's theory as a framework for incorporating diverse individual differences for career counselling because it is a well-established, empirically supported

structure which fundamentally involves the incorporation of traits (Armstrong & Rounds, 2010; Holland, 1997; Su et al., 2015). One such framework is the Atlas model of individual differences which provides a spatial structure of integration (Armstrong, Day, McVay, & Rounds, 2008; Armstrong & Rounds, 2010), and another with a focus on intelligence is the Process Personality Intelligence & Knowledge (PPIK) theory with its four trait complexes for prediction of educational outcomes (Ackerman & Heggestad, 1997; Toker & Ackerman, 2012). Both involve integration of abilities, personality and vocational interests, whilst other P-E fit theories such as ASA theory have focused on values and goals. Su, Murdock & Rounds (Su et al., 2015) emphasise the importance of integrative models of P-E fit:

> "Individual differences are multidimensional, however, and a comprehensive view of P-E fit needs to incorporate different dimensions of individual differences constructs, such as interests, abilities, values, and personality traits. Whether it is in a career counselling session or an assessment center, the question often arises of how to best combine a variety of assessments to describe an individual and to predict the kinds of environments that best fit that individual and allow for the greatest career success". (p.92)

The following section will discuss measures of personality, vocational interests, cognitive abilities and values and their utilisation for academic outcomes.

1.5 Measures of Individual Differences

1.5.1 Personality

Personality traits are a framework for understanding situationally and temporally consistent patterns of thoughts, emotions, and behaviour (McAbee & Oswald, 2013). Although an individual's personality can change over time, once a person reaches adulthood, changes tend to be minimal (Graham & Lachman, 2012; Klimstra, Bleidorn, Asendorpf, van Aken, & Denissen, 2013). Historically, research into personality has been frustrated by the lack of an overarching framework which

resulted in great diversity of findings, theories, constructs and measures being investigated (Poropat, 2009; Trapmann, Hell, Hirn, & Schuler, 2007). However, from the 1990s onwards personality research has advanced significantly due to research coalescing around the Five Factor model of personality, also known as the "Big Five" (Poropat, 2009). The "Big Five" factors are five broad personality domains which group behavioural traits within five broad scales, each containing six narrow personality facets existing beneath each factor. These five factors are Neuroticism, Extraversion, Openness to Experience, Agreeableness and Conscientiousness. The most well-known measure of the Big Five is the NEO-PI-R, a self-report inventory of these five factors and 30 facets (Costa & McCrae, 1992a).

The Neuroticism factor is a measure of emotional instability, and its inverse form can be presented as emotional stability. Neuroticism involves the experience of negative emotional states and can result in people responding ineffectively to stress and with reduced adaptability; for example, when dealing with a time-specific deadline or an unexpected adversity (Corulla & Coghill, 1991; Costa & McCrae, 1980). The facets of Neuroticism are N1 Anxiety, N2 Angry Hostility, N3 Depression, N4 Self-consciousness, N5 Impulsivity, and N6 Vulnerability (Costa & McCrae, 1992a).

Extraversion can be defined as a strong desire for quantity and intensity of social interaction, and increased need for stimulation and excitement; its inverse form can be presented as Introversion which is defined by reserved, withdrawn behaviour and a reduced need for social interactions. The facets of Extraversion are E1 Warmth, E2 Gregariousness, E3 Assertiveness, E4 Activity, E5 Excitement seeking, and E6 Positive emotion (Costa & McCrae, 1992a).

Openness to Experience, also known as intellect or culture (Trapmann et al., 2007), involves imaginativeness, broad-mindedness, and intellectual and artistic sensibilities (Poropat, 2009). People with low Openness to experience tend to be less creative, less open to feelings and experiences, and more close-minded in opinions. The facets of Openness to experience are O1 Fantasy, O2 Aesthetics, O3 Feelings, O4 Actions, O5 Ideas, and O6 Values (Costa & McCrae, 1992a).

Agreeableness comprises a person's friendliness, flexibility, trust, and tolerance in social situations (Poropat, 2009; Trapmann et al., 2007), and its inverse form is Tough Mindedness. The facets of Agreeableness are A1 Trust, A2 Straightforwardness, A3 Altruism, A4 Compliance, A5 Modesty, and A6 Tender-mindedness (Costa & McCrae, 1992a) .

The final factor of the Big Five is Conscientiousness. Conscientiousness involves a person's dependability and will to achieve, and much research has found that it is related to successful life outcomes. The facets of Conscientiousness are C1 Competence, C2 Order, C3 Dutifulness, C4 Achievement striving, C5 Self-discipline and C6 Deliberation (Costa & McCrae, 1992a).

1.5.2 Cognitive Abilities

General cognitive ability, also known as intelligence, can be defined as the distinguishing construct between the ability of individuals on cognitive tasks (McDaniel & Banks, 2010). Cognitive abilities in specific terms can be defined as basic, fine-grained skills and processes that can complete cognitive tasks. Cognitive ability in relation to others has been shown to remain generally stable across the lifespan from early adulthood, or even from childhood (Deary, Whalley, Lemmon, Crawford, & Starr, 2000; Larsen, Hartmann, & Nyborg, 2008), and was one of the earliest areas of individual differences research to develop, starting with Spearman's (Spearman, 1904) *g* factor theory of general intelligence as the theoretical ancestor to all later models of ability (Kaufman, Kaufman, & Plucker, 2013). The central tenant of this theory is an overarching basic construct of intelligence subsuming and summarising all performance on cognitive tasks, developed via factor analytic methods. Two main contentions that have historically played a part in the development of various models of ability are the extent to which ability is genetic or developmentally acquired, and whether ability can be conceptualized as a single or multifaceted construct (Sackett, Lievens, Van Iddekinge, & Kuncel, 2017). In regards to the latter contention, the dominant concept of ability in the last decade has been one that includes both; a hierarchical structure with a broad, general factor of ability, and a series of narrower, specific abilities nested within – similar to the currently

accepted structure of personality with broad factors, each containing narrower facets (Sackett et al., 2017).

The most well-known model of cognitive ability is the Cattell-Horn-Carroll (CHC) theory (Schneider & McGrew, 2012). This model of intelligence is an amalgam of two previously independent theories. The first of these integrated models is the *Gf-Gc* theory (Cattell, 1941, 1963), which separates ability into two broad factors of fluid intelligence (defined by reasoning, problem solving and a focus on innate ability applied in novel situations) and crystallised intelligence (defined by the use of acquired skills and knowledge, and a reliance on long term memory to recall such skills and knowledge). It was later built upon by Horn (Horn, 1968, 1991; Horn & Noll, 1997) because of the *g* factor related origins of both theories. Horn extended the model to include ten broad abilities, but without any nested structure (Kaufman et al., 2013). The second of these models is the Three-stratum theory and comprises three hierarchical strata of ability ranging from a general ability factor, to eight broad factors, to 70 narrow abilities, developed via factor analytic methods (Carroll, 1993). The close relationships between the *Gf-Gc* and Three-stratum theories was acknowledged by these researchers and gradually developed, although a consensus on hierarchal structure and general ability could not be reached until McGrew and colleagues' unifying model of CHC theory was proposed (Flanagan, 2000; Flanagan, Alfonso, & Reynolds, 2013; McGrew, 2005, 2009; Schneider & McGrew, 2012). The original CHC model involved ten factors, but after various refinements, the current model of CHC theory involves a two-stratum hierarchical structure; there is an implicit but unacknowledged *g* factor, 16 broad factors, and over 80 narrow abilities (Flanagan et al., 2013; Schneider & McGrew, 2012).

The 16 broad ability factors are Fluid Intelligence (*Gf*), Crystallized Intelligence (*Gc*), General (domain specific) Knowledge (*Gkn*), Quantitative Knowledge (*Gq*), Reading/Writing Ability (*Grw*), Short-Term Memory (*Gsm*), Long-Term Storage and Retrieval (*Glr*), Visual Processing (*Gv*), Auditory Processing (*Ga*), Olfactory Abilities (*Go*), Tactile Abilities (*Gh*), Psychomotor Abilities (*Gp*), Kinesthetic Abilities (*Gk*), Processing Speed (*Gs*), Decision Speed/Reaction Time (*Gt*), and

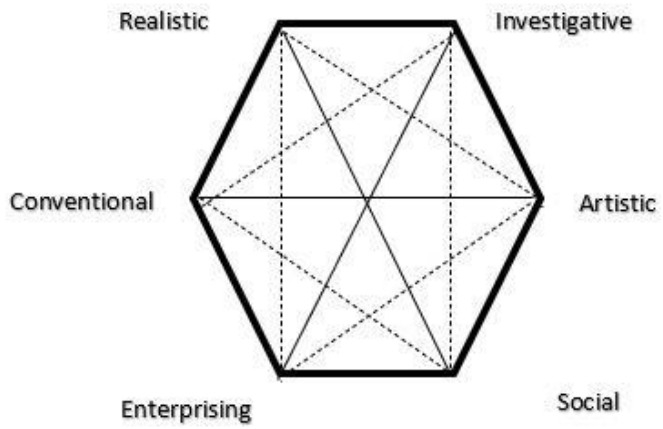
Psychomotor Speed (*Gps*). A detailed description of each broad ability factor is provided by Flanagan (Flanagan et al., 2013).

The ETS Kit of Factor Referenced Cognitive Tests (Ekstrom, French, Harman, & Dermen, 1976) is a comprehensive test battery of 72 narrow ability measures. It is not widely used and was developed prior to the current status of CHC theory. However, it is flexible with each measure being independent and able to be administered separately, and it corresponds to Stratum I of Carroll's Three Stratum theory (Carroll, 1993) meaning that it shares significant overlap with narrow stratum I abilities in current CHC theory.

1.5.3 Vocational Interests

Vocational interests are work related activities that are preferred by an individual over other such activities and are utilized within specific occupational groups. They have been conceptualized in order to match individuals to satisfying occupational choices with the aim of producing greater work productivity and job satisfaction (Gregory, 1996). As such, the use of vocational interests in the prediction of academic performance and academic satisfaction has potential practical value for career counselling advice.

Holland's RIASEC theory of vocational interests, also known as the hexagonal theory for its structure, has been the dominant theory within vocational research since the 1970's (Larson, Rottinghaus, & Borgen, 2002) and there has been much research supporting its basic ideas (Kelso, 1986). There are six vocational interest types in the hexagonal model, as shown in Figure 1.



Legend: Bold line = Cohesive vocational interests, Dotted line = Neutral vocational interests, Plain line = Contrasting vocational interests.

Figure 1: Holland's Hexagonal RIASEC theory of vocational interests

These are: Realistic interests (preference for practical and tangible tasks that work with objects or animals over socially interactive tasks), Investigative interests (preference for intellectual and scientific tasks that work with ideas over socially persuasive tasks), Artistic interests (preference for creative and artistic tasks that involve creating and expressing ideas over tasks that involve data organization and repetitive activities), Social interests (preference for social interaction and tasks that involve helping people over practical tasks that involve working with objects), Enterprising interests (preference for social influence and tasks that involve persuading people over intellectual and scientific tasks), and Conventional interests (preference for tasks that involve organization, repetition and working with data over creative and expressive tasks). These descriptions of the interest types highlight the hexagonal structure involved; each vocational interest is closer in its preferences to the surrounding interests, and diametrically opposed in the structure to its most dissimilar interest type. For example, Realistic interests' preference for working with objects over social interaction is both related to the detail and structure of Investigative and Conventional interests' preferences for ideas and data over social influence or artistic expression, respectively,

and in opposition to the interaction with people and helping behaviour preferred by the Social interests type.

Despite the contrary nature of oppositional interest types, oppositional vocational interest types are not mutually exclusive. However, RIASEC theory proposes that an individual whose strongest interest types are close together within the structure will experience more internal consistency in their preferences.

Another principle of RIASEC theory is that of congruence. Occupational environments can have dominant interest types expressed in the activities involved, and the related occupational theory of Person-Environment Fit (Schneider, 1987) suggests that when there is a match between a person and their environment, that they will experience increased satisfaction within that environment. This idea is furthered within RIASEC theory, with the degree of match between an individual's interests in occupational tasks and the occupational tasks within an environment being referred to as congruence (Holland, 1997). It is assumed that high levels of congruence similarly lead to higher levels of satisfaction within an occupational environment. A final assumption of this theory is that individuals will actively seek out environments that are considered congruent with their interests.

One of the key measures of vocational interests developed using Holland's RIASEC theory is the Self Directed Search (Holland, Powell, & Fritzsche, 1985). This measure is divided into four sections (Activities, Competencies, Occupations and Self-Estimates) with each section containing items pertaining to all six vocational interests scales, and answered with forced choice responses for the first three sections and a seven-point Likert scale for the Self-Estimates section. Responding involves choosing items which relate to activities that the person enjoys performing, personal skills the person has, occupations the person is interested in, and their estimations of ability in specific cognitive-related areas.

1.5.4 Values

Values are concepts that reflect what is important to people in their lives in terms of both thoughts and behaviour (Schwartz, 2006). The degree of importance attached to the different values varies from person to person. Study of personal values is a comparatively new area of research, with Rokeach's (Rokeach, 1973) Terminal Values (personal end state goals) providing the basis for early research. However, it was not until the development of Schwartz' (Schwartz, 1992b) theory, which has since become the dominant theory of personal values, that personal values gained momentum as an area of research.

The Theory of Basic Human Values (Schwartz, 1992b, 2006; Schwartz & Bardi, 2001) defines values as desirable, trans-situational goals, that vary in importance, and that serve as guiding principles in individuals' lives. There are five features which are held to be common to all values (Schwartz, 2006); they are beliefs tied to emotion rather than objective ideas, they are motivational constructs that relate to the desirable goals that people work to obtain, they are abstract – transcending specific actions and situations, which separates them from norms and attitudes – and they serve as guiding criteria for selecting and evaluating people and events. Finally, they form a circumplex structure, with values theoretically nearest to each other being closest in the structure, and opposing values arranged opposite to each other, as shown in Figure 2.

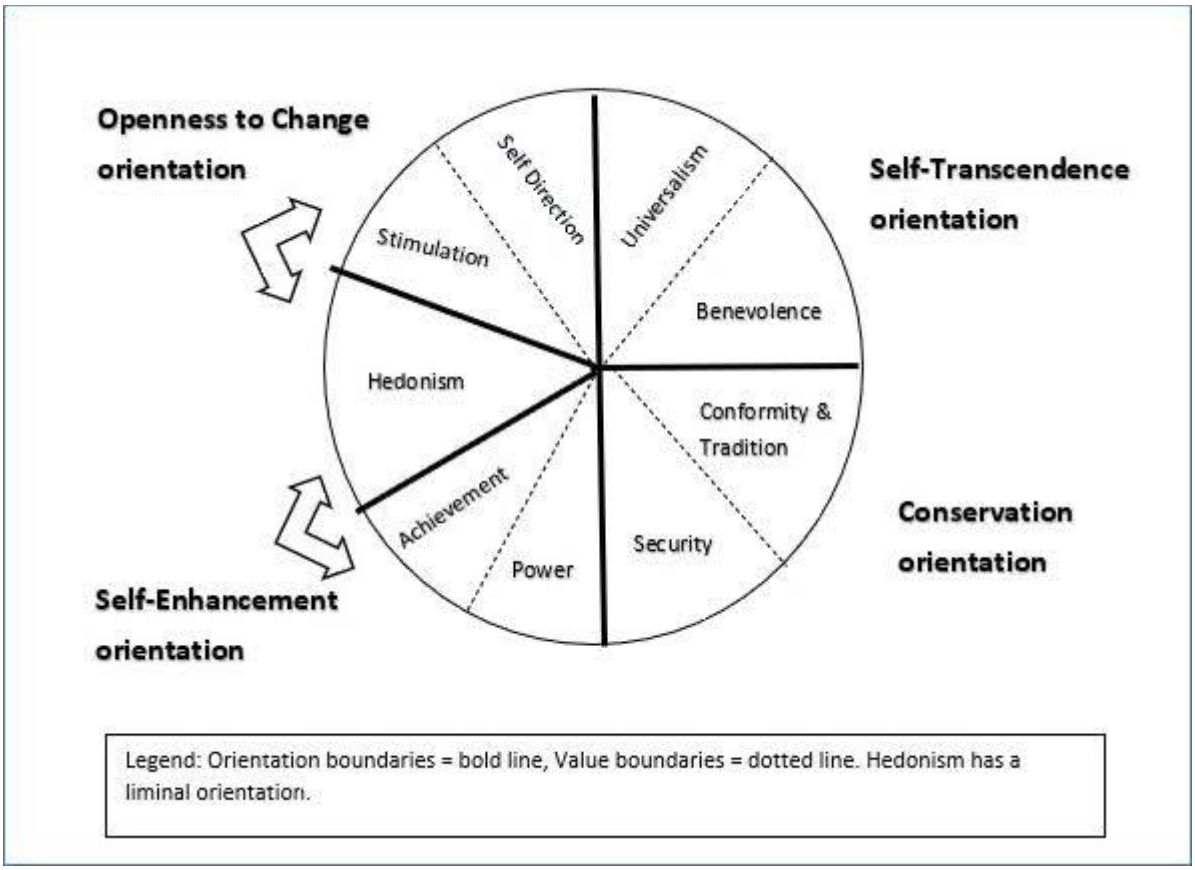


Figure 2: Schwartz's Circumplex Theory of Basic Human Values

Ten basic values derived from the three universal human requirements – people's needs as biological organisms, their need for coordinated social interaction, and for group survival and welfare – have been defined and research has shown that they include all of the core values recognized around the world as universal (Schwartz, 1994, 2006; Schwartz et al., 2001). These ten basic values are: Self Direction (valuing independent thought and action), Stimulation (valuing excitement, novelty and challenge in life), Hedonism (valuing pleasure and sensuous self-gratification), Achievement (valuing personal success through the demonstration of competence within societal standards), Power (valuing social status and prestige as well as control or dominance), Security (valuing safety, harmony, and stability in society, relationships and self), Conformity (valuing the restraint of actions, inclinations and impulses that are likely to upset or harm others as well as violate social expectations or norms), Tradition (valuing respect, commitment and the acceptance of customs and ideas that traditional culture/religion provide), Benevolence (valuing the preservation and enhancement of the welfare of frequent personal

contacts), and Universalism (valuing the understanding, appreciation, tolerance and protection of the welfare of all people, and of nature) (Schwartz, 2006).

These ten values are further organized into four value orientations. These are Openness to Change (Self Direction, Stimulation) which groups together values that prioritize novelty and personal choice, Self-Transcendence (Universalism, Benevolence) which groups together values that prioritize social needs over self-focused needs, Conservation (Conformity, Tradition, Security) which groups together values that prioritize preserving the state of society and self, and Self-Enhancement (Power, Achievement) which groups together values that prioritize self-focused improvement. Hedonism, with its focus on self and sensory pleasure fits partially between the adjoining orientations of Openness to Change and Self-Enhancement. Due to the circumplex structure of the ten values, Openness to Change and Conservation are diametrically opposed, as are Self-Transcendence and Self-Enhancement.

One of the important aspects of values theory is that the different values described above conflict or are congruent with one another in relation to their position in the circumplex structure. More specifically, the pursuit of a particular value is likely to have consequences (psychological, practical and/or social) that conflict with, or are congruent with other values. For instance, the pursuit of Power values is likely to conflict with holding Benevolence or Universalism values; however, it is likely to be congruent with holding Security values. Alternatively, highly valuing and seeking Hedonism is likely to lead to the violation of Conformity values. Unlike vocational interests, the nature of values and their measurement requires that an individual give priority to some values over others.

Further support for the validity of the values theory is found in the fact that the different values have been found to relate to one another in the same pattern of the circumplex structure across samples from 67 culturally diverse nations (Schwartz, 1992a, 1994, 2006). Consequently, the values that a person holds and the importance which they assign to them have been found to have a

strong influence on their actions and behaviours (Pozzebon & Ashton, 2009a; Smith et al., 2002; Torelli & Kaikati, 2009).

1.6 Interrelationships between Personality, Cognitive Abilities, Vocational Interests and Values

The four domains of personality, cognitive abilities, vocational interests and values have consistently demonstrated low yet significant relationships with each other which suggest that the domains are related without overlapping entirely. In terms of their utility, this result makes them ideal for predicting academic outcomes and potentially accounting for more of the variance than could occur individually, while lesser studied domains, such as values, also have a greater possibility of significantly predicting academic performance and academic satisfaction due to their relationships with other variables which do so. The following sections detail the relationships between these four domains of individual differences.

1.6.1 Personality and Cognitive Abilities

There have been many attempts to examine how personality traits and cognitive abilities interact. Although they have historically developed independently of each other, there are also early examples of researchers drawing connections between the two areas (Lounsbury, Welsh, Gibson, & Sundstrom, 2005b). For example, Spearman investigated the relationship between *g* (general ability) and character traits and found that traits similar to aspects of Conscientiousness and Extraversion had positive relationships with *g* (Spearman, 1927). Cognitive abilities and personality traits have overall been shown to interact to some degree, whilst still being conceptually separate; such interaction often comes to the fore in examination of job performance and academic performance due to their shared contribution to behaviour. An individual's abilities can lead to success in academic contexts, but so too can an individual's personality traits which influence their chosen actions and success in academic contexts.

The Seattle Longitudinal Study conducted Ordinal Least Squares regression to determine the proportions of variance that the Big Five personality factors accounted for within cognitive abilities; overall they found small but significant amounts accounted for in Inductive Reasoning (10%), Spatial Orientation (6%), Perceptual Speed (12%), Numeric Facility (2%), Verbal Comprehension (16%) and Verbal memory (12%) (Schaie, Willis, & Caskie, 2004).

Neuroticism was positively related to Verbal Comprehension in this research, whilst other studies have found that it has negative relationships with abilities (Lounsbury et al., 2005b). This was largely presumed to be a result of emotional lability impacting upon behaviour, and supported by research demonstrating that Neuroticism's relationship with abilities is mediated by test anxiety (Moutafi, Furnham, & Tsaousis, 2006). Extraversion has been shown to have small, positive relationships with various cognitive abilities (Lounsbury et al., 2005b; Schaie et al., 2004) which may potentially demonstrate that positive emotions gained from satisfying stimulation-seeking needs (say, for example, the challenge of learning a subject or acquiring a skill) impacting upon behaviour in a similar way. Agreeableness' small but positive relationships with cognitive abilities may reflect this as well (Moutafi et al., 2006; Schaie et al., 2004).

Openness to Experience and its many positive relationships with cognitive abilities, as well as its ties to general ability overall are both well studied in the literature, and consistently lean towards being of moderate strength; being open minded consistently and directly relates to having higher levels of both specific and general cognitive abilities (Moutafi et al., 2006; Schaie et al., 2004; Soubelet & Salthouse, 2011). Again, Conscientiousness has been well studied and subsequently has demonstrated consistent, positive relationships of moderate strength with cognitive abilities; in a manner similar to Extraversion, Conscientious traits are expressed in behaviours which lead to better academic performance (Schaie et al., 2004; Soubelet & Salthouse, 2011).

Personality and cognitive abilities have also shown important relationships at the facet level, providing more specific information which might provide more plausible explanations for the relationships than those of the more general personality factors (Rammstedt, Lechner, & Danner,

2018). In a study using a German adaption of the Big Five Inventory-2, facets were found to demonstrate relationships with cognitive abilities which provided greater insight into why certain relationships might exist than their broader factors; specific facets within the same factor demonstrated both relationships with different cognitive abilities and varying levels of relationship with the same cognitive ability (Rammstedt et al., 2018). For example, Openness to Experience showed small positive relationships with both fluid and crystallised intelligence. However, upon examining the facets, it could be seen that Aesthetic Sensitivity (comparable to O2 Openness to Aesthetics) demonstrated a negligibly small relationship with fluid ability but a modest positive relationship with crystallised intelligence, and also that whilst Aesthetic Sensitivity and Imagination (comparable to O1 Openness to Fantasy) displayed similar negligible but slightly negative relationships with fluid intelligence, Curiosity (comparable to O5 Openness to Ideas) showed a small positive relationship with fluid intelligence (Rammstedt et al., 2018).

1.6.2 Personality and Vocational Interests

From the mid twentieth century, researchers have investigated vocational interests at greater depth and in relation to personality traits. That there should be connections between an individual's behavioural traits and the vocational tasks which interest them is self-evident. However, relationships between the two domains of research, and between the Big Five and RIASEC theory are far more intrinsically intertwined, with Holland's RIASEC theory having its basis in personality traits (Holland, 1997; McKay & Tokar, 2012).

Meta-analytic research has demonstrated that overlap between these individual differences domains ranges from 4% to 23% (Larson et al., 2002; McKay & Tokar, 2012), with Openness to Experience related to Investigative and Artistic interests, Extraversion related to Social and Enterprising interests, Agreeableness with Social interests, and Conscientiousness related to Enterprising and Conventional interests (Larson et al., 2002).

Noticeably, Realistic interests consistently demonstrate an absence of relationships with personality traits; research examining these low level and absent relationships discovered that combinatory patterns of personality traits were of greater importance, with aspects of Realistic interests demonstrating connections with increased Openness and decreased Extraversion, and also with decreased Agreeableness and increased Extraversion (Wiernik, 2016). Not only are personality and vocational interests closely related in this way, but the interaction between them has been shown to improve prediction of academic performance beyond either used independently (Fritzsche, McIntire, & Yost, 2002).

Personality facets have also been shown to have important relationships with vocational interests. A study involving the use of property vector fitting has demonstrated that Conscientiousness facets aligned with Conventional interests and Extraversion facets with Enterprising interests, and no facets were oriented towards Realistic interests while Openness to Experience, Neuroticism, and Agreeableness facets were all aligned with Artistic interests (Armstrong & Anthoney, 2009).

1.6.3 Personality and Values

Personality traits and personal values have historically been distinct areas of research, without much investigation into how they interact (Parks & Guay, 2009), but the emergence of Schwartz' Theory of Basic Values (Schwartz, 1992b) and its usage within a large number of international studies created a new standard for measurement of personal values and led to research investigating it in combination with other domains of individual differences including personality. Whilst both values and personality influence behaviour, they involve different aspects of behaviour. Personal values involve allocation of perceived worth to behaviours, have a conflicting structure in which values support or are in opposition to other values and can change over time, while personality traits involve the expression of behaviours and specific traits that can occur mutually without conflict, and in general are constant over time (Parks & Guay, 2009). These differences, in

addition to personality's influence upon the acquisition of values (Olver & Mooradian, 2003) suggest that there may be merit in investigating these domains of individual differences in combination.

Despite the dearth of studies, a 2007 meta-analysis found small to moderate consistent relationships between the Big Five personality factors and the Schwartz values (Parks, 2007; Parks & Guay, 2009). Emotional Stability, Neuroticism's opposing aspect, showed small positive relationships with the Openness to Change orientation (Stimulation), and both positive (Conformity) and negative (Security) relationships with the Conservation orientation, lending support to the investigation of narrowly defined aspects of individual differences. Extraversion displayed relationships with the Self Enhancement (Power, Achievement) and Openness to Change (Stimulation) orientations, Openness to Experience demonstrated moderate, positive relationships with Openness to Change (Stimulation, Self Direction) and Self Transcendence (Universalism) orientations, and equally moderate negative relationships with Conservation (Conformity, Tradition). Agreeableness displayed positive relationships of varying strength with the Self Transcendence (Universalism, Benevolence) and Conservation (Tradition, Security) orientations, and a moderate negative relationship with Self Enhancement (Power), while Conscientiousness showed positive relationships with the Conservation (Conformity, Security) and Self Enhancement (Achievement) orientations. Another study using the HEXACO model of personality found similar patterns of relationships and relationship strengths, with Emotionality (comparable to Neuroticism) showing negative relationships with Openness to Change (Self Direction, Stimulation) and positive ones with Conservation (Conformity, Security), and Extraversion demonstrating a positive relationship with Self Enhancement (Power) and negative ones with Conservation (Conformity, Security) (Pozzebon & Ashton, 2009b). As expected, Openness to Experience showed positive relationships with Openness to Change (Self Direction) and Self Transcendence (Universalism) and negative relationships with Conservation (Conformity, Security); Agreeableness displayed positive relationships with Self Transcendence (Universalism, Benevolence) and Conservation (Conformity, Tradition), as well as moderate to strong negative relationships with Self Enhancement (Power,

Achievement). Interestingly, Conscientiousness showed positive relationships with Self Enhancement (Achievement) and Conservation (Security), and negative relationships with the Openness to Change orientation (Stimulation), including Hedonism, which occupies a liminal space between this orientation and Self Enhancement (Schwartz, 2012).

1.6.4 Vocational Interests and Cognitive Abilities

Although much of the literature suggests that career counselling and individual differences research should examine both vocational interests and cognitive abilities, much less research exists which investigates their interaction, although their interaction has been accounted for within various theories of individual differences.

Within Holland's RIASEC theory of vocational interests, cognitive abilities both influence the direction of vocational interests, and are influenced by them (Holland, 1997). For example, having higher levels of initial numerical ability may allow an individual to competently perform a mathematical task, experience positive emotions due to their success, and prioritize this task in future behaviour, leading to interest in mathematics, and interest in Investigative tasks overall. Additionally, having interest in mathematics may encourage an individual towards competence and the development of specific abilities. PPIK (Process, Personality Interests & Knowledge) is another such theory which considers vocational interests and cognitive abilities together (Ackerman, 1996). This theory of intelligence posits that personality traits and vocational interests interact with fluid intelligence and guide its expression in terms of both effort and direction, transforming intelligence-as-process (G*f)* into intelligence-as-knowledge. A meta-analysis undertaken to provide evidence of relationships between these individual difference domains for the development of this theory found small to moderate relationships between vocational interests and cognitive abilities (Ackerman & Heggestad, 1997). In the studies surveyed, Realistic interests demonstrated small to moderate positive correlations with spatial and mathematical ability, in addition to a small positive relationship with verbal ability. Investigative interests demonstrated positive relationships with spatial, numerical and verbal ability and Artistic interests showed positive relationships with verbal

and spatial ability. Conversely, Social interests were negatively related to spatial and numerical ability, Enterprising interests displayed negative relationships with verbal ability, but also to a lesser extent with spatial and numerical ability. Conventional interests demonstrated both positive relationships with numerical ability and perceptual speed, and negative relationships with verbal ability.

More contemporary research has supported these findings (Päßler & Hell, 2012). In this research study Realistic and Investigative interests displayed small to moderate relationships with verbal, numerical and spatial ability, Artistic interests showed a small positive relationship with verbal ability, but small negative relationships with both numerical and spatial ability, while Social interests demonstrated small to moderate negative relationships with all three of the cognitive ability measures. Enterprising interests showed small, negative relationships with verbal and spatial abilities, while Conventional interests displayed a small positive relationship with numerical ability.

1.6.5 Values and Cognitive Abilities

Very few studies have examined the relationships between personal values as typified by the Theory of Basic Values (Schwartz, 2012) and cognitive abilities. Of the individual difference domains included within this research, these two perhaps have the least inherent overlap. However, it can be expected that cognitive abilities have some influence upon the acquisition of values in much the same way as personality traits, although to a smaller degree. Further, these areas are indirectly related via shared relationships with personality and vocational interests.

A study utilising a sample of career counselling clients found that values predicted client behaviour over and above ability, suggesting that the usage of cognitive abilities does not ameliorate the utility of personal values in practical career counselling situations (Sagiv & Schwartz, 2004). Another study involving various factors which were comprised of personality, values, social norms and attitudes found that the Conservatism factor, including both Conscientiousness and the Conservatism values orientation, showed moderate negative relationships with measures of general

and crystallised ability (as operationalized by the SAT test and measures of vocabulary)(Stankov, 2009).

1.6.6 Vocational Interests and Values

Despite the shared inherent motivational aspects of being interested in vocational activities and prioritizing certain actions and ideas over others, often conceptualized as the difference between preferences for activities and preferences for outcomes, few studies have investigated the relationships between vocational interests and personal values (Hansen & Wiernik, 2016). A study involving a career counselling client sample found that Realistic interests did not have any relationships with personal values, while Investigative and Artistic interests both were positively related to the Openness to Change and Self Transcendence orientations (specifically Self Direction and Universalism) and negatively related to the Conservation orientation (Conformity, Tradition, Security); Social interests were related to the Self Transcendence orientation (specifically Benevolence), Enterprising interests with the Self Enhancement orientation (Achievement, Power) and negatively with Universalism from the Self Transcendence orientation, while Conventional interests were related to personal values within the Conservation orientation (Sagiv, 2002).

1.6.7 Personality, Cognitive Abilities, Vocational Interests and Values

To date, no study has investigated the structure of interrelationships between all four domains of personality, cognitive abilities, vocational interests and values in combination, nor has any study examined the NEO-PI-R, ETS Kit of Factor Referenced Cognitive Abilities, MRT, SDS-R, and SVS in combination.

1.7 Individual Differences for the prediction of Academic Outcomes

Personality, cognitive abilities, vocational interests and values are distinct yet related areas of individual differences, demonstrating relationships of varying strengths, which suggests that they may have a similarly shared applicability as predictors of academic performance and academic satisfaction. However, each of the individual differences merits inclusion independently.

Personality involves the enactment of consistent behaviours and emotions, which can affect studying methods and examination experiences, and determine how satisfied an individual feels with studying the course content of any given academic discipline.

Cognitive abilities determine the level of difficulty experienced and effort needed by an individual in order to accomplish tasks, and as such, directly influence graded academic performances. Although seemingly less closely related to satisfaction, cognitive abilities may influence academic satisfaction via the level of challenge inherent in tasks; if a student feels capable of completing tasks within an academic course, they may feel more satisfied with undertaking it, than if the level of challenge and effort needed exceeded their capabilities.

Vocational interests are inherently relevant to tertiary vocational training provided by universities, and as such, interest in the content of academic courses may sustain attention throughout the learning process, influencing effort in completing assignments and undergoing examinations, while engendering positive emotions towards the experience of the academic course.

Values may seem indirectly related, yet the differential valuation of behaviours can greatly influence academic outcomes; an individual may prioritise diligence when studying over having fun due to their chosen values, thus increasing their academic performance, and if an individual's values align with those inherent within the tasks of an academic course (for example, valuing helping others and undertaking a medical course) they may experience greater satisfaction when engaged in the course's tasks, particularly when compared to someone holding contrary values.

It can be seen that there are compelling reasons to investigate the applicability of personality, cognitive abilities, vocational interests and values as predictors of academic performance and academic satisfaction, which are supported by the findings of previous research, as detailed in the following subsections. In these subsections, and additionally in Chapter 3, there will be a discussion of research on variables predicting academic outcomes. When variables are identified as being significant predictors, it can be assumed that they are positive predictors; as variable A increases, so does variable B. Negative predictors will be labelled as such in brackets.

1.7.1 Personality Factors for the prediction of Academic Performance and Academic Satisfaction

The rationale behind the hypothesis that personality can predict academic performance stems from the idea of behavioural tendencies within personality traits, and the relationships between personality and motivation influencing both study and assessment, thus predicting typical academic performance (Fonteyne, Duyck, & De Fruyt, 2017). Indeed, this seems to be accurate; personality factors have been shown to predict academic performance beyond that predicted by cognitive ability, suggesting that they are providing something that pairs with the prediction of maximal academic performance, rather than something that is subsumed by it. Whilst ignored as an area of research for many decades, the relationship between personality and academic performance has in more recent years been an area of focus with meta-analyses and systematic reviews undertaken to synthesise the findings. Personality factors have been shown to predict academic performance over and above cognitive ability alone, as indicated in Chamorro-Premuzic & Furnham (Chamorro-Premuzic & Furnham, 2008). Further, recent research using a high school sample suggests that personality has differential associations with academic performance in various high school subjects (Brandt, Lechner, Tetzner, & Rammstedt, 2019).

In terms of the major personality factors, the meta-analysis by Trapmann et al. (Trapmann et al., 2007) – conducted on 58 studies published between 1980 and 2004 – found that Conscientiousness significantly correlated with increased grades, but that Neuroticism, Extraversion, Agreeableness

and Openness to experience did not. Interestingly, they also investigated academic satisfaction and found that Neuroticism had a significant negative correlation with academic satisfaction, while the other personality factors had no association.

O'Connor and Paunonen's (O'Connor & Paunonen, 2007) meta-analysis also found that Conscientiousness was strongly related to academic achievement, while noting that findings were mixed for Openness to experience (which demonstrated positive to neutral relationships with academic performance), and Neuroticism (which demonstrated neutral to negative relationships with academic performance).

Poropat's (Poropat, 2009) meta-analysis demonstrated low but consistent correlations between academic grades with Conscientiousness, Openness and Agreeableness, and also demonstrated that the correlations between Conscientiousness and grades existed independently of cognitive ability.

McAbee and Oswald's (McAbee & Oswald, 2013) systematic review covered the period from 1992 to 2012, and ultimately included 51 studies. These authors found that for tertiary students Conscientiousness had the strongest validity for predicting GPA out of all the Big Five factors – a finding that was consistent with the meta-analyses which have been performed on the relationship between personality and academic performance and satisfaction (McAbee & Oswald, 2013; O'Connor & Paunonen, 2007; Trapmann et al., 2007). An additional finding of this systematic review was that the validity of Conscientiousness was consistent across multiple measures of personality, including the NEO Personality Inventory-Revised (NEO-PI-R), the NEO Five-Factor Inventory (NEO-FFI), the Big Five Inventory (BFI), the unipolar Big Five Factor Markers (Markers), and the Big Five International Personality Item Pool (IPIP) (McAbee & Oswald, 2013). In contrast the validities of Neuroticism, Extraversion, Openness to experience, and Agreeableness were generally low (r<.10).

The latest systematic review to date is by Vedel (Vedel, 2014). This systematic review covers 20 studies from 1996 to 2013, and found that for tertiary education, Conscientiousness was a robust predictor of GPA (r=.26) with low positive relationships additionally found with Openness to experience and Agreeableness (r<.10). They found that academic major moderated the relationship

between Conscientiousness and GPA, with psychology students having a much stronger relationship between the two than for other academic majors (Vedel, 2014).

These meta analyses suggest that assessment of personality, particularly Conscientiousness, has an established role in the prediction of academic achievement and satisfaction, and should form part of the foundation of any attempt at an inclusive investigation of successful academic outcomes.

1.7.2 Personality Facets for the prediction of Academic Performance and Academic Satisfaction

The narrow specificity of personality facets, when compared to their larger factors, suggests that they may be able to provide stronger predictive ability for academic performance and academic satisfaction as well as greater detail and insight into the reasons for successful and unsuccessful outcomes (Anglim & Grant, 2016; Anglim, Knowles, Dunlop, & Marty, 2017; Anglim & O'Connor, 2019; Paunonen, Rothstein, & Jackson, 1999). Conversely, the use of broader factors alone may be obfuscating the relationships; as discussed by Kausel and Slaughter (Kausel & Slaughter, 2011) a personality factor score can be obtained by a variety of different scoring profiles, some of which may counteract or negate the influence of others, whilst facet specificity encourages predictive validity. In turn, facet specificity may contribute to improving future career guidance by identifying narrowly defined but relevant aspects of personality for successful outcomes within a degree. A further reason that suggests there are benefits to using personality facets in the prediction of academic success is Brunswik Symmetry (Wittmann & Süβ, 1999). Brunswik Symmetry is the theory that in order to discern true levels of relationships between variables, the level of measurement of both needs to be matched; any mismatch will lower the apparent significance of results. As suggested by Vedel, Thomsen & Larsen (Vedel et al., 2015) a mismatch between narrow measurement of course grades and GPA with broader personality factors may contribute to the small relationships often found – in which case, the use of personality facets may reduce the level of mismatch with its use of narrowly defined measurement. This is supported by the research of Paunonen & Ashton (Paunonen & Ashton, 2001a, 2001b, 2013) who found that personality facets

accounted for more of the variance beyond personality factors, even when combining Openness and Conscientiousness together (Paunonen & Ashton, 2001a). Another supportive finding was from a meta-analysis on the incremental validity of Conscientiousness facets beyond their wider factor; whilst they did not add incremental validity in the prediction of overall job performance, they became relevant when predicting job performance within specific occupations, demonstrating their suitability for narrow contexts (such as performance within specific academic courses and majors) (Dudley, Orvis, Lebiecki, & Cortina, 2006).

Even more crucially, both Trapmann et al.'s (Trapmann et al., 2007) systematic review and O'Connor and Paunonen's (2007) meta-analysis concluded that the narrow personality facets contained within the broader factors were important for the prediction of academic performance even when the broader personality factors showed no significant relationships. Trapmann et al . (Trapmann et al., 2007) found that although Openness to Experience wasn't significantly related to performance, the facet of O5 Openness to Ideas was significantly related, and similar findings were made by Paunonen & Ashton (Paunonen & Ashton, 2001a, 2013), who demonstrated that whilst Neuroticism was not correlated with overall academic performance, the facets of N3 Depression, N4 Self-consciousness, N5 Impulsiveness and N6 Vulnerability had small yet significant relationships with performance.

O'Connor and Paunonen's (O'Connor & Paunonen, 2007) meta-analysis showed that despite Conscientiousness' overall predictive validity, C4 Achievement Striving and C5 Self-Discipline were still stronger and more consistent predictors compared to the other Conscientiousness facets. Further, O'Connor and Paunonen (O'Connor & Paunonen, 2007) recommended that future studies should use facets when aiming to predict course grades specific to academic disciplines rather than overall GPA and concluded that facets are more accurate for predicting academic performance than factors.

Most interestingly, DeYoung, Quilty & Peterson (DeYoung, Quilty, & Peterson, 2007) have demonstrated a way of examining why facets have differential predictive ability and strength. They

discovered via factor analytic methods, ten aspects that mediate personality domains and personality facets, with two correlated but meaningfully separate aspects per domain. These aspects were Volatility and Withdrawal (Neuroticism), Enthusiasm and Assertiveness (Extraversion), Intellect and Openness (Openness to Experience), Compassion and Politeness (Agreeableness), and Industriousness and Orderliness (Conscientiousness).

Vedel, Thomsen & Larsen (Vedel et al., 2015) utilized the Big Five personality facets to predict academic performance in students overall, as well as in a variety of different academic majors (psychology, medicine, law, economics, political science, sciences, arts/humanities). For students overall, they found that all personality factors contributed significant facets to the prediction of GPA. These were N4 Self-Consciousness, E3 Assertiveness, O5 Ideas, O6 Values, A1 Trust, A2 Straightforwardness, C1 Competence, C4 Achievement Striving (negative predictor) and C5 Self-Discipline. In comparison, for the prediction of psychology students' GPA, only Neuroticism, Extraversion and Agreeableness were found to contribute significant facets. These facets were N2 Angry Hostility (negative predictor), N6 Vulnerability, E6 Positive Emotion (negative predictor) and A6 Tender-Mindedness. When viewed in combination, it appears that successful psychology students were slow to anger, unafraid to display their own weaknesses, perhaps more calm than cheerful, and sympathetic to others, all of which seem relevant to psychology as an occupation. Other academic majors displayed differing profiles of prediction. For example, high GPA for Political Science students was predicted by A3 Altruism (negative predictor), A6 Tender Mindedness, C4 Achievement Striving (negative predictor), C5 Self Discipline, and N5 Impulsiveness, suggesting that successful political students are potentially more self-oriented than altruistic, selfish but sympathetic to others, less interested in achievement for its own sake, internally motivated and making instant, instinctive decisions.

Even more recently, research has demonstrated that different personality facets within Conscientiousness have different relationships with broader cognitive abilities (Stratum II level within the CHC theory of intelligence) and additionally display different predictive validity for overall GPA (Rikoon et al., 2016). Cautiousness, an IPIP (International Personality Item Pool) analogue facet

for C6 Deliberation, was found to have weak yet significant positive relationships with cognitive ability, whereas Tidiness (an analogue for C2 Order) had no relationship with cognitive ability. Industriousness (an analogue for C1 Competence) had the strongest significant relationship with GPA at *r* =.28, whereas Tidiness once again had no relationship with GPA. This demonstrates that facets within a factor vary in their strength of relationship with other variables, and that different facets can show significant relationships with related variables.

1.7.3 Cognitive Abilities for the prediction of Academic Performance and Academic Satisfaction

The application of cognitive ability for the prediction of academic success has a long history from the early days of individual differences research (Chamorro-Premuzic & Furnham, 2008). However, research using cognitive abilities for prediction rather than one general *g* factor has been limited despite its potential (Gustafsson & Balke, 1993).

In terms of general cognitive ability, Deary, Strand, Smith and Fernandes' (Deary, Strand, Smith, & Fernandes, 2007) longitudinal study of academic performance involving over 70,000 secondary students found strong results for a general factor of ability predicting high General Certificate of Secondary Education (GCSE) exam scores overall with a correlation of approximately *r* =.81 between the two, whilst on average, studies report finding correlations between general cognitive ability and course grades ranging from *r* = 0.3 to *r* = 0.5 (Bergold & Steinmayr, 2018).

However, this does not diminish the usage of specific cognitive abilities; firstly, from a career counselling viewpoint, it is important to predict success within a specific academic course or discipline when a student might be choosing between potential academic courses or determining whether to change from one course to another. Secondly, despite the long-established relationship between broader cognitive ability and academic performance, cognitive ability has not been shown to account for more than 50% of the variance in

performance (Bergold & Steinmayr, 2018; Chamorro-Premuzic & Furnham, 2008; O'Connor & Paunonen, 2007), which raises the possibility of broad measurement of ability limiting the potential of specific, narrower abilities to individually account for additional variance in prediction (Gustafsson & Balke, 1993), as well as emphasising the importance of additional variables, such as personality, that may account for additional variance beyond cognitive ability.

Taub, Keith, Floyd and McGrew (Taub, Keith, Floyd, & McGrew, 2008) found that Mathematics specific academic performance could be significantly predicted by the Stratum II broad abilities of Fluid Reasoning, Crystallized Intelligence, and Processing Speed. Coyle, Snyder, Richmond & Little (Coyle, Snyder, Richmond, & Little, 2015) found that after removing *g* from their model, the non-g residuals of the SAT (Scholastic Aptitude Test) math and verbal sections were significant predictors of discipline-specific GPA. Coyle et al. (Coyle et al., 2015) note that these residuals correspond closely to broad Stratum II abilities. Cromley et al. (Cromley et al., 2017) found that the narrow Stratum I ability of mental rotation, from the Mental Rotations Test by Vandenberg & Kuse (1978) was able to explain 27% of the variance in Calculus performance, as measured by calculus exam items and tests of Calculus proficiency rather than grades.

1.7.4 Vocational Interests for the prediction of Academic Performance and Academic Satisfaction

Nye, Su, Rounds and Drasgow's (Nye, Su, Rounds, & Drasgow, 2012) meta-analysis of 60 studies from 1942 to 2011 found that vocational interests were related to academic performance. In particular, a *r* =.22 correlation was found between the interest scales of the Self Directed Search (Holland et al., 1985) and academic grades.

However, Pozzebon, Aston & Visser's (Pozzebon et al., 2014) research on a sample of undergraduate students from a variety of academic disciplines found that vocational interests were not predictive of overall major-specific GPA, academic satisfaction or academic major change. However, this study used a measure of congruence between vocational interests and disciplines rather than the vocational interests themselves.

Conversely, using two separate samples of technicians and industrial clerks undertaking vocational education training (VET) and measuring individual vocational interests, Volodina, Nagy & Koller (Volodina, Nagy, & Köller, 2015) found that vocational interests were predictive of satisfaction with VET. Specifically, for the technician sample, Realistic interests were predictive of VET satisfaction, whilst Artistic and Conventional interests were negatively predictive of VET satisfaction. For the industrial clerk sample, Conventional interests were predictive of satisfaction with VET. Further, additional results were found with regards to dropout intention for both samples; absence of the intention to dropout was positively predicted by Realistic interests for the technician sample, and Conventional interests for the industrial clerk sample.

1.7.5 Values for the prediction of Academic Performance and Academic Satisfaction

Values have been found to be closely linked to a range of behaviours, including education related behaviours. For example, there is a positive correlation between years of formal education and Self-Direction and Stimulation values, as well as negative correlations with Conformity, Tradition and Security values (Schwartz, 2006). Furthermore, Universalism has been shown to be substantially higher among those who attend university (Schwartz, 2006). These correlations, however, relate to level of education obtained or pursued.

Compared to other measures of individual differences there is a dearth of studies investigating how individuals' values impact the outcome of their participation in academic courses via academic performance. The theory of Basic Human Values and the inherent congruence involved in its circumplex ordering of the values would predict that individuals who highly value Achievement should take actions which they consider to be likely to result in academic success and satisfaction,

while those who highly value Hedonism are likely to avoid or be dissatisfied with a lifestyle of intensive study. Some values, however, do not lend themselves so readily to clear hypotheses. For example, Conformity has been shown, in students from both the USA (Olver & Mooradian, 2003) and China (Luk & Bond, 1993), to correlate strongly with Conscientiousness – a personality factor which has reliably been shown to correlate with and predict academic success (Poropat, 2009). A ready inference, therefore, is that Conformity should also predict academic success. However, as discussed above, Conformity has been found to correlate with a low level of education (Schwartz, 2006). The reconciliation of these seemingly disparate findings is difficult. Possibly highly valuing Conformity will make an individual less inclined to pursue higher education but motivated to approach their studies more dutifully if they do so. Still further complicating matters is that values have been shown to change over time as a result of studies pursued (Krishnan, 2008). These issues show that further research into the relationship between values and academic results and satisfaction is important and necessary.

1.8 Combined Prediction of Academic Outcomes

As described above, personality, cognitive abilities, vocational interests and values are four key variables which can be used to predict both academic performance and satisfaction. Although sharing considerable overlap in places, they are conceptually distinct variables, and it has therefore been hypothesised that their use in combination could help to explain variance in students' academic performance and satisfaction beyond what is achievable by using the individual variables separately.

Below is a summary of the findings of all identified studies which have used combinations of personality, vocational interests, cognitive abilities, and values for the prediction of academic performance and academic satisfaction. In particular, the studies mentioned focus upon the Big Five, RIASEC interests and Schwartz's Basic Human Values, as well as cognitive abilities more specific than *g.* No studies could be found for personality and values predicting academic performance and

satisfaction (specifically for correlational research), cognitive abilities and values predicting academic performance and satisfaction, or vocational interests and values predicting academic performance and satisfaction. For research involving three of the four domains, no studies could be found for personality, cognitive abilities and values predicting academic performance and satisfaction, nor cognitive abilities, vocational interests and values predicting academic performance and satisfaction. No studies could be found that used all four domains.

1.8.1 Personality and Cognitive Abilities

1.8.1.1 Correlations

Studies have investigated the use of personality and cognitive abilities to predict academic performance (Barchard, 2003; Chamorro-Premuzic & Furnham, 2008; Furnham & Chamorro-Premuzic, 2004; Vitulic & Prosen, 2012). Barchard's (Barchard, 2003) research assessed personality through a public domain measure of the Big Five model of personality. Openness and Conscientiousness significantly correlated with academic performance ($r = .17$, $p < .05$; and $r = .33$, $p < .01$; respectively). Academic performance was assessed through course grades, measured as the mean of all courses attempted in the academic year. Of the four measures of cognitive ability utilized from the ETS Kit investigated by this study (verbal ability, verbal closure, visualization, and inductive reasoning) only verbal ability had a significant correlation with academic performance ($r = .43$, $p < .01$) (Barchard, 2003).

In another study (Furnham & Chamorro-Premuzic, 2004), personality was assessed by the NEO-FFI, while cognitive abilities were assessed through the Wonderlic Personnel Test (general intelligence), Alice Heim 5 (Part 1; Verbal and Spatial Ability) and the S&M Test of Mental Rotation Ability (spatial ability). Academic performance was assessed through the results of two statistics examinations, with analysis performed on data for the first and second examinations individually, and the mean score. Extraversion had a significant negative correlation with exam score on the first statistics

exam, both before and after adjustment for cognitive abilities (r = -.22, p < .05; r = -.27, p < .05; respectively), but no other associations were found with personality. For the second exam, Extraversion was again negatively associated with exam score (r = -.21, p < .05), but only before adjustment for cognitive ability. However, Conscientiousness showed a significant positive correlation both before and after adjustment (r = .32, p < .01; r = .31, p < .01 respectively). When exam grades were averaged, both Extraversion (r = -.24, p < .05; r = -.26, p < .05) and Conscientiousness (r = .25, p < .05; r = .27, p < .05) showed significant associations before and after adjustment for cognitive ability. All three measures of cognitive abilities used in Furnham and Chamorro-Premuzic's study (Furnham & Chamorro-Premuzic, 2004) significantly correlated with results from the first statistics exam before adjusting for personality (r = .29, p < .01; r = .23 p < .05; r = .25, p < .05; respectively), while only the Wonderlic Personnel test (general cognitive ability) and the Alice Heim (verbal and spatial ability) showed a significant association after adjustment (r = .38, p < .01; r = .31, p < .01; respectively). For the second exam spatial ability correlated with results, but only before adjustment for personality (r = .21, p < .05) as did the Alice Heim, but only after adjustment (r = .29, p < .05). For the mean results of both exams only spatial ability correlated with results before adjustment for personality (r = .25, p < .05), whereas all three measures correlated with exam results after adjustment (r = .32, p < .01; r = .33, p < .01; r = .21, p < .05; for Wonderlic, Alice Heim and Spatial ability respectively). The authors of the study concluded that this indicated that cognitive abilities are particularly related to the results of statistics exams when individual differences in personality are controlled for (Furnham & Chamorro-Premuzic, 2004).

In another study by the same researchers, personality was assessed via the NEO-PI-R, cognitive ability via the Wonderlic Personnel test, as a measure of general IQ, and the Baddeley Reasoning test as a measure of logical reasoning (*Gf*) (Chamorro-Premuzic & Furnham, 2008). Academic performance was operationalized as the average of exams undertaken by second year undergraduate students. Significant correlations were found between academic performance and

Openness (r = .21, p < .01), Conscientiousness (r = .37, p < .01), general IQ (r = .24, p < .05) and logical reasoning (r = .27, p < .05).

Personality was assessed in the study by Vitulic and Prosen (Vitulic & Prosen, 2012) using a Slovene version of the Big Five Questionnaire, in which Neuroticism is labelled as Emotional Stability and Extraversion is labelled as Energy. The cognitive abilities measured were verbal ability (measured by 'Foreign words') and non-verbal ability (measured by 'Test of Series') and this study was conducted in two populations of students; students of Primary Education and students of Social Pedagogy. Interestingly, not only were the overall GPAs of these students assessed, but also subject specific GPAs. For the Primary Education students, the courses undertaken were Psychology & Didactics, Slovene language, and Natural Sciences & Mathematics, and for the Social Pedagogy students courses undertaken were Psychology & Education, Social Pedagogy and Methodology. Results showed that the only personality factor which correlated with the overall GPA of Primary Education students was Conscientiousness (r = .17, p < .01). When course specific GPAs were examined, the only significant results for students of Primary Education were again for Conscientiousness, with significant associations being found with course specific GPA for Psychology & Didactics (r = .33, p <.01) and Slovene language (r = .19, p < .01). For Social Pedagogy students, however, Energy (r = .36, p < .01), Openness (r =.30, p < .01) and Conscientiousness (r = .39, p < .01) correlated with overall GPA. Social Pedagogy students showed significant associations between the course specific GPA for Psychology & Education with Energy (r = .33, p < .01) and Conscientiousness (r = .27, p < .05) as well as between the course specific GPA for Social Pedagogy and Conscientiousness (r = .34, p < .01). The correlations between GPA and the cognitive abilities examined were low, with only a significant correlation between Test of Series (non-verbal ability) and course specific GPA for Natural Sciences & Mathematics (r = .18, p < .01) for Primary Education students, and Foreign words (verbal ability) and overall GPA for Social Pedagogy students (r = .31, p < .05) (Vitulic & Prosen, 2012).

Recently, research has examined a variety of non-cognitive abilities, in addition to cognitive abilities for the prediction of academic performance (Fonteyne et al., 2017). Small but consistent correlations were not only found between Conscientiousness and GPA (r = .12, p <.01) but also between GPA and the ability measures of Mathematics (r = .27, p <.01), Reading Comprehension (r = .20, p <.01) and Vocabulary Knowledge (r = .10, p <.01).

In a recent study, examination of personality facets of the Big Five and cognitive ability revealed a variety of correlations with GPA (Bergold & Steinmayr, 2018). As expected, GPA showed a very strong relationship with reasoning ability (r = .88, p <.001). For Neuroticism, GPA had a small negative relationship with the facet N1 Anxiety (r = .13, p <.05), and a small positive relationship with the facet N6 Vulnerability (r = .15, p <.05). For Extraversion, GPA had a small negative relationship with E2 Gregariousness (r = .14, p <.05), while for Openness to Experience, a positive relationship was found with the facet O5 Openness to Ideas (r = .28, p <.001). Agreeableness demonstrated a negative relationship with GPA as did its facet A5 Modesty (r = -.13, p <.05), and interestingly, no correlations were found between GPA with Conscientiousness facets.

1.8.1.2 Regression analysis

All of the studies that investigated the relationship between personality, cognitive abilities and academic results also performed hierarchal regression analyses (Barchard, 2003; Furnham & Chamorro-Premuzic, 2004; Vitulic & Prosen, 2012). In the study by Barchard (Barchard, 2003) personality and cognitive abilities were first used to predict academic success as individual domains by entering all of their available measures into separate multiple regression equations. Personality as a domain was a significant predictor of academic success (R^2 = .11, p < .01), as was cognitive ability (R^2 = .19, p < .01). Hierarchical regressions were then used to show that the addition of cognitive ability to personality significantly increased the model's ability to predict academic success (ΔR^2 = .15, p < .01).

In a series of hierarchical regressions Furnham and Chamorro-Premuzic (Furnham & Chamorro-Premuzic, 2004) showed that cognitive abilities accounted for 11% of the variance in score for the first statistics exam, with the Wonderlic Personnel test's cognitive ability score being the only significant predictor in the model (Adj. R^2 = .11, F(3,70)= 4.17, p < .01; β = .41, p < .05). When the Big Five personality factors were added as predictors, an additional 6% of the variance was accounted for, with Extraversion as a significant negative predictor (Adj. R^2 = .17, F (8,65) = 2.93, p < .05; β = -.31, p < .01). When the results of the second statistics exam were used as the criterion variable, the measures of cognitive abilities were not significant predictors. However, the Big Five personality factors accounted for 11% of the variance, with Conscientiousness being a significant positive predictor. When exam results were combined, the hierarchical regression found that cognitive abilities alone were not significant predictors of exam results overall, but that the addition of personality traits explained 15% of the variance with Extraversion as a negative predictor and Conscientiousness as a positive predictor of overall exam results (Adj. R^2 = .15, F(8,65) = 2.65, p < .01; β = -.27, p < .01; β = .30, p < .01).

In Vitulic and Prosen's research (Vitulic & Prosen, 2012) hierarchical regression was conducted with cognitive abilities (assessed by the 'Foreign words' and 'Test of Series' tests) entered as the first step. For Primary Education students, the percentage of variance explained was non-significant for overall GPA, but a significant percentage of variance in course specific GPA for Natural Sciences & Mathematics was accounted for (R^2 = .06, F(2,172) = 3.74 p < .01), with the non-verbal ability measure 'Test of Series' being a significant predictor (β = .22, p < .01). A significant percentage of the variance in course specific GPA for Psychology & Didactics was predicted when Big Five personality factors were added to the model, although this study did not examine personality facets. The inclusion of Conscientiousness into the model significantly improved the prediction of course specific GPA for Psychology & Didactics (R^2=.13, F(7,167) = 2.66 p <.01, β = .36, p <.01). For Social Pedagogy students a significant percent of variance was explained by the measures of cognitive abilities at the first step for overall GPA (R^2 = .10, F(2,72) = 3.22, p <.05) with the verbal

ability measure 'Foreign words' as a significant predictor (β = .30, p <.01). However, cognitive abilities alone did not significantly predict course specific GPA. When the measures of personality were added at the second step, however, the percent of variance explained was significantly improved for overall GPA (R^2=.50, ΔR^2=.40, p<.01), course specific GPA for Psychology & Education (R^2=.32, ΔR^2=.29, p<.01), course specific GPA for Social Pedagogy (R^2=.26, ΔR^2=.23, p<.05) and course specific GPA for Methodology (R^2=.32, ΔR^2=.29, p<.05). For overall GPA, significant predictors in the final model were the measure of verbal ability, "Foreign words" (β = .34, p <.01), the Extraversion factor of Energy (β = .45, p<.01), Agreeableness (β = -.28, p<.05) and Conscientiousness (β = .41, p<.01); for Psychology & Education they were "Foreign words"(β = .33, p<.01), Energy (β = .42, p<.01) and Conscientiousness (β = .35, p<.01); for Social Pedagogy they were "Foreign words" (β = .24, p<.01) and Conscientiousness (β = .49, p<.01); and for Methodology they were Energy (β = .42, p<.01) and Agreeableness (β = .-.33, p<.01).

The interaction between personality and cognitive abilities in relation to academic outcomes has also produced some recent, interestingly complex results. Research by Bergold & Steinmayr (Bergold & Steinmayr, 2018) involving hierarchical regressions and moderation analyses found interaction effects between personality and cognitive ability (assessed by the Intelligence-Structure-Test 2000 R) when predicting academic achievement (Bergold & Steinmayr, 2018). Chiefly, they found an interaction effect for Conscientiousness with cognitive ability when predicting GPA, demonstrating a stronger relationship when participants had higher levels of Conscientiousness. Further, the second study found a similar interaction effect for Neuroticism, with stronger relationships occurring between cognitive ability and GPA when participants had lower levels of Neuroticism. In terms of facets, they found that they varied considerably in the strength of their contribution to the interaction effect. Conscientiousness facets demonstrated a similar interaction effect upon cognitive ability and GPA to the greater factor, whilst for Neuroticism, N2 Angry Hostility, N5 Impulsiveness, and N6 Vulnerability showed the strongest impact upon the interaction, with lower levels improving the prediction of GPA by cognitive ability. In alignment with previous

research, the research found that facets could influence the relationship between intelligence and GPA even when their factors did not; despite no interaction effects shown for Openness to Experience or Agreeableness, intelligence showed stronger prediction of GPA when O4 Openness to Actions decreased, and when A3 Altruism and A4 Compliance increased.

The interpretation of the above studies in terms of the use of a combination of personality and cognitive abilities for predicting academic results was complicated by the inclusion of measures that were unrelated to the domains of interest (e.g. seminar leader assessment (Furnham & Chamorro-Premuzic, 2004) and emotional intelligence (Vitulic & Prosen, 2012). However, a consistent finding and conclusion of all the studies was that the use of personality assessment along with measures of cognitive abilities was effective for the prediction of academic results, with both domains having independent correlations with the outcome variable and with the combination of these variables increasing the variance accounted for. The contexts and characteristics of the analysed populations varied widely however, and as can be expected, the same or similar variables showed different effects across studies – and even within studies where distinct populations or testing periods were assessed separately. It is likely that different selection pressures contribute to these deviations; the researchers (Furnham & Chamorro-Premuzic, 2004) noted that a possible explanation for their study finding that cognitive abilities contributed only modestly to the prediction of academic results is that the mean score for their sample's cognitive abilities was higher than the population norm, and that the validity of measures of psychometric intelligence have been found to be limited in more homogenous samples with higher levels of cognitive ability. An interesting finding of the other study (Vitulic & Prosen, 2012) was that 'Energy' was a significant positive predictor of grades. This finding was unexpected as Energy was constructed from the Big Five Factor Extraversion, which at this level of education generally has a minor or negative correlation with academic results (Poropat, 2009). It could be explained however, by the fact that the factor 'Energy' was created by the removal of the dynamism and dominance facets from the Extraversion factor. This suggests that

when investigating the relationship between personality and academic results, it may be important to examine data from assessments of the Big Five at the facet level.

Recently, research has investigated the interaction of personality and cognitive abilities, as well the exploration of personality facets, for the prediction of academic performance in a sample of high school students (Bergold & Steinmayr, 2018). Cognitive ability and Conscientiousness together predicted 15.8% of the variance in GPA, but with the interaction explaining almost an additional 1%, and a stronger relationship expressed as Conscientiousness increased. In the second prediction utilizing personality facets and controlling for cognitive ability, it was found that Openness to Experience, and the facets O5 Openness to Ideas and O2 Openness to Aesthetics predicted GPA over cognitive ability but did not interact, while Conscientiousness, and the facets C3 Dutifulness, C5 Self Discipline, C4 Achievement Striving, and C1 Competence predicted GPA over cognitive ability with significant interaction effects. When personality facet interaction effects were considered overall, it could be seen that cognitive ability's prediction of GPA was increased when Neuroticism and its facets N2 Angry Hostility, N5 Impulsiveness and N6 Vulnerability were lower, as well as when the Openness to Experience facet of O4 Openness to Actions was lower. Further, cognitive ability's prediction of GPA was increased when the Agreeableness facets of A3 Altruism and A4 Compliance were higher, as well as when the Conscientiousness factor, along with the facets C1 Competence, C3 Dutifulness, C4 Achievement Striving, C5 Self-Discipline, and C6 Deliberation were higher. Such results demonstrate both the utility of combining personality and cognitive abilities for prediction of academic performance, and the utility of investigating personality facets and cognitive abilities in combination for prediction of academic performance.

1.8.2 Personality and Vocational Interests

1.8.2.1 Correlations

Two studies investigated the use of personality and vocational interests to predict tertiary academic success (De Fruyt & Mervielde, 1996; Kahn et al., 2002). The results of De Fruyt and Mervielde (De Fruyt & Mervielde, 1996), who examined results for two exam periods as well as overall grades, found that Neuroticism was negatively correlated with grades in the first exam period (r=-.16, p<.001), as was Openness to experience (r=-.016, p<.001). Conscientiousness positively correlated with grades in the first exam period (r=.35, p<.001), and final grades (r=.28, p<.001). Furthermore, Conscientiousness was significantly negatively correlated with number of re-exams taken (r=-.25, p<.001). The data for 'attainment of degree in the first examination period' were considered separately for students of Philosophy Languages & History, Law, Sciences, Applied Sciences, Economics, Psychology & Education, Applied Biological Sciences and Political & Social Sciences. Neuroticism, Extraversion, and Agreeableness did not have any significant correlations. Openness significantly negatively correlated with attainment of degree in first examination period in Philosophy, Languages and History (r=-.28, p<.001). Conscientiousness positively correlated with attaining degree at first examination in Philosophy, Languages and History (r=.30, p<.001), Law (r=.36, p<.001), Sciences (r=.44, p<.001), Applied Sciences (r=.30, p<.001), and Psychology and Education (r=.38, p<.001).

For vocational interests (assessed by the Self Directed Search) there was a positive correlation between Investigative interests and final grades in males (p<.001), and a negative correlation between grades at first examination and Artistic interests in females (p<.001). Females had a positive correlation between grades at first examination and Conventional interests (p<.001) as well. These results suggest that gender may be an important factor to take into account when predicting academic performance and satisfaction because differential relationships may be obscured if they are combined. There may also be important practical implications for vocational

guidance for males and females. For civil engineers Investigative correlated with grades from first examination (r=.27, p<.001) and final examination (r=.23, p<.001), and negatively correlated with number of re-examinations (r=-.25, p<.001). The reverse was true with the Artistic score, which negatively correlated with grades at first examination (r=-.35, p<.001), final examination (r=-.34, p<.001) and positively correlated with re-examination (r=.16, p<.001). The Conventional scale positively correlated with final grades (r=.25, p<.01). A group of industrial engineers were also examined. Their results closely followed the results of the civil engineers described above; Conscientiousness was the only personality factor that correlated significantly with final results (r=.28, p<.001) and it also significantly negatively correlated with number of re-examinations (r=-.20, p<.001). No significant findings were made for RAISEC measures in this sample of industrial engineers.

In another study, research involving correlations between personality (measured by the MBTI Form M) and vocational interests (measured by the personal styles scales of the SII) were calculated, but p values were not statistically assessed (Kahn et al., 2002). The three variables with the strongest correlations with GPA (and the only ones with r>.10) were the vocational interests – namely, Work Style (r=.11), Learning Style (r=.17) and Leadership Style (r=.12).

Utilizing a sample of university students from a business major, other research found small but significant correlations between satisfaction with one's major, personality traits and vocational interests (Logue et al., 2007). Interestingly, low levels of Realistic (r = -.26, p<.01), Investigative (r = -.16, p<.05), and Artistic interests (r = - .18, p<.05) were important to the satisfaction with a business major, but Enterprising interests were not positively correlated with major satisfaction. Further, Conscientiousness (r = .24, p<.01), Emotional Stability (r = .21, p<.01), and Extraversion (r = .27, p<.01) were all positively related to satisfaction with the major for business students.

1.8.2.2 Regression analysis

No regression analysis was performed in the study by De Fruyt and Mervielde which instead utilised discriminant analysis (De Fruyt & Mervielde, 1996). This study found that RIASEC interests correctly classified the academic majors of 25% of students, compared to only 11.7% for the Big Five personality factors. However, the Big Five personality facets correctly classified 27.7% of students. When used in combination, RIASEC interests and Big Five factors correctly classified 28.9%, compared to 43.7% by RIAEC interests and Big Five facets. Interestingly, the best classification of 50.9% occurred for individual use of the RIASEC subscales (3 subscales each per vocational interest - Activities, Competencies and Occupational Preferences) combined with the Big Five facets. Hierarchal regression analysis was conducted by Kahn et al. (Kahn et al., 2002) where ACT/SAT scores, which are not a focus of this review, were included at the first step and significantly predicted first year GPA (p<.01). All other domains were entered at the second step which included not only the measures of personality and vocational interest, but also social ability (SSI) and educational indecision (CFI). These domains significantly improved prediction of GPA, increasing the percent of variance explained by 9% (p<.01). From the personality and vocational interest variables, only Thinking-Feeling (personality) and Work Style (vocational interests) significantly contributed to the prediction of GPA (p<.05 in both cases). The total variance explained by the final model was 19%.

The authors (Kahn et al., 2002) concluded that the combination of vocational interest and personality assessment may help college counselling and career service staff to identify students at risk of poor academic performance, and in doing so ameliorate the risk. In De Fruyt and Mervielde (De Fruyt & Mervielde, 1996), however, prediction of the educational outcomes was differentiated by gender and major. For male students, higher levels of Investigative interests were correlated with final grade. For female students, higher levels of Artistic interests were negatively correlated with the first examination grade, whilst higher Conventional interests were positively related to the

first examination grade. For the civil engineering students, higher Investigative interests positively correlated with first and final exam grades, and negatively with the number of exams retaken, whilst higher levels of Artistic interests negatively correlated with first and final exam grades, but positively with number of exams retaken. Further, higher Conventional interests in civil engineering students positively correlated with final grades. The two studies demonstrate differing methods of analysis and results, but both the discriminant analysis and regression show the utility of the combination of vocational interests with personality for the prediction of academic outcomes. Also demonstrated is the importance of considering gender when investigating correlations between individual difference variables and academic performance. While further work is needed to fully establish how vocational interests makes a useful contribution to the prediction of academic outcomes, the literature suggests that vocational interests can indeed predict academic outcomes beyond personality.

Other research that has investigated personality traits and vocational interests for the prediction of satisfaction with academic major has found that Realistic interests were the only vocational interest that significantly predicted academic satisfaction, accounting for 6.8% of the variance whilst the Big Five personality factors of Extraversion and Conscientiousness explained 3.2% and 3.6% unique variance, respectively, in academic major satisfaction (Logue et al., 2007).

1.8.3 Personality and Values

1.8.3.1 Regression analysis

One study by Parks and Guay examined the prediction of academic performance, as measured by exam grades, using a combination of personality traits from the Big Five and relevant personal values from Schwartz's Theory of Basic Values (Parks & Guay, 2012). This research found that in a hierarchical regression, the Achievement value contributed 1.2% unique variance to the prediction

over and above personality traits. Further, Emotional Stability, Extraversion and Conscientiousness contributed 4.9% unique variance to the prediction.

1.8.4 Cognitive Abilities and Vocational Interests

1.8.4.1 Correlations

Only one study has investigated the use of cognitive abilities and vocational interests (without the inclusion of personality) for the prediction of academic results (Toker & Ackerman, 2012). Correlation analysis was not conducted for the RIASEC vocational interest measures that were applied in the study nor for the measures of cognitive abilities (ETS math, ETS spatial, ETS verbal) due to a focus on interest complexity. Instead, the vocational interest measures from the 'STEM Interest complexity scales' (Numeric, Symbolic, Spatial, Ideas and General) were investigated for their correlation with STEM (Science, Technology, Engineering & Maths) GPA. Numeric (r=.23, p<.05), Symbolic (r=.34, p<.01), and General (r=.22, p<.01) interests correlated with STEM GPA.

A second study was conducted within the article using the same population pool, but different participants (Toker & Ackerman, 2012). All of the STEM interest complexity scales (Numeric, Symbolic, Spatial, Ideas, General and Composite) significantly correlated with the STEM GPAs of students with STEM majors as well as the GPAs of students from the 60 various non-STEMs majors. This pattern was also seen when only students enrolled in a Calculus2 course, or a Physics1 course were examined. Overall, RIASEC vocational interests did not significantly correlate with STEM GPA (r=.017), whereas STEM interest complexity (r=.279, p<.01) did.

1.8.4.2 Regression analysis

Toker and Ackerman's study additionally utilised a hierarchical regression analysis, with the combination of Realistic interests, Investigative interests, Math Self-Concept and Science Self-

Concept explaining 5% of the variance in STEM GPA (Toker & Ackerman, 2012). The addition of the cognitive ability variable Math Abilities to the regression increased the variance accounted for to 10% (p<.05), and the addition of STEM Interest Complexity increased the variance accounted for by a further 4% (p<.05), taking the total variance explained to 14%. The authors of the study concluded that vocational interests were useful for predicting academic achievement, but that the RIASEC could be improved upon by adding the examination of occupational complexity – that is, the level of skills, ability and difficulty of activities within any given occupation.

1.8.5 Personality, Cognitive Abilities and Vocational Interests

1.8.5.1 Correlations

Only one study has reported correlations for the investigation of personality, ability and interests for the prediction of academic outcomes (Pozzebon et al., 2014). It found that Conscientiousness significantly correlated with overall GPA (r = .29, p < .01), as did Verbal Ability (r = .18, p < .01) and Mathematical Ability (r = .23, p < .01). Emotionality (comparable to Neuroticism), Extraversion, Agreeableness and Openness to Experience did not significantly correlate with overall GPA, nor did congruence between vocational interests and academic major. For major specific GPA, Conscientiousness (r = .14, p < .05), Verbal Ability (r = .18, p < .01) and Mathematical Ability (r = .32, p < .01) showed significant relationships. When examining the relationships with academic satisfaction, only personality traits were pertinent, with small positive correlations shown for Extraversion (r = .15, p < .01), Agreeableness (r = .14, p <.01) and Conscientiousness (r = .13, p < .05).

1.8.5.2 Regression

Multiple regressions were undertaken in Brown's study (Brown, 1994) to identify which combination of variables best predicted the first-semester GPAs of freshmen engineering students.

Starting from the level of prediction provided by SAT-Verbal scores (10%, p<.01), the cognitive abilities Symbolic and Logical Reasoning increased the prediction of variance to 16%. Vocational interests (the engineering part of the AAIS scale from the College Major Interest Indicator) increased the percent of covariance explained to 18%. Personality operationalised by the Adjective Checklist (Gough & Heilbrun, 1983) explained 60% of the variance in first semester GPA alone, while the addition of cognitive ability and vocational interest domains increased the percent of variance explained to 66%.

In the study by Pozzebon et al. (Pozzebon et al., 2014) multiple regression analysis showed that personality and cognitive ability when combined explained 22% of the variance in overall GPA and 18% of the variance in study major GPA. Conscientiousness, Verbal Ability and Mathematical Ability were significant predictors for overall GPA (p <.01), whereas only Conscientiousness and Mathematical Ability were significant predictors for major GPA (p <.01). When congruence between vocational interests and major (defined as the score representing level of match between an individual's vocational interest summary code and occupational vocational interest codes associated with their major), was entered at the second step of the respective regression equations for predicting overall GPA and major specific GPA, it did not make any addition to the prediction of either GPA variable. Further, the same study found that personality explained 6% of the variance in academic satisfaction, with Conscientiousness (p <.05) as the only significant variable in the first step, and the addition of Emotionality (Neuroticism) (p <.05) as a negative predictor in the second step (Pozzebon et al., 2014). Neither cognitive ability in the first step or vocational interest congruence in the second step had any bearing upon academic satisfaction.

The above studies suggest that the combination of personality with cognitive abilities increases prediction of academic results, but that only personality is pertinent to academic satisfaction. The findings for vocational interests remain inconsistent, with one study finding that they made a significant contribution to the predictive power of a model that already included personality and

cognitive abilities (Brown, 1994), while the other found that congruence between major and vocational interests did not contribute to a model for predicting academic outcomes (Pozzebon et al., 2014). These results lend support to the idea that any attempt to use individual differences to predict academic performance should include measures of personality and cognitive abilities, but also that the area of vocational interests is in need of additional research. When considering that congruence relies upon an accurate assessment of the nature of an environment as an additional step in comparison to vocational interest scales, it may be of greater importance to examine the individual vocational interest scales and how they relate to academic environments without classifying the environments themselves.

1.8.6 Personality, Cognitive Abilities, Vocational Interests and Values

To date, no studies have investigated the combination of personality, cognitive abilities, vocational interests and values for the prediction of academic performance or academic satisfaction.

1.9 Key Findings

There are promising results for the utility of combining multiple individual differences domains to improve the prediction of academic outcomes. Whilst individual variables demonstrated relatively weak predictive ability on their own, many of the studies demonstrated that combining these variables significantly improved prediction. In particular, the findings suggest that the combination of personality and cognitive abilities, and the combination of personality and vocational interests are useful for predicting a significant amount of the variance in academic outcomes. Following from this, the literature suggests that combining these variables for the prediction of academic outcomes may hold relevance for future career counselling and assisting students with their choice of major.

As expected, versions of the Big Five personality factors and Holland's RIASEC were mostly used for the assessment of personality and vocational interests, respectively. Methods of investigating

cognitive abilities were more varied, however. Some of the research utilized broader, more general measures of ability, and relatively few narrower cognitive ability measures (those that could be considered within Stratum I of the CHC (Cattell-Horn-Carroll) theory) were included in the analyses. It is possible that including a battery of Stratum I cognitive ability measures that are narrower and more precise could improve the predictive power of this domain, as such an effect was seen for personality in terms of specific facets rather than general factors in previous research (Logue et al., 2007; Vedel et al., 2015). Further, the use of narrower measures could have practical implications for career counselling; by including specific facets and abilities rather than broader ones, the testing time and batteries for assisting with career counselling would be greatly reduced.

Several further gaps in research were identified:

- No studies have investigated the combination of personality, cognitive abilities, vocational interests and values for the prediction of academic performance or academic satisfaction.
- No studies have investigated the use of values along with any of personality, cognitive abilities, or vocational interests for the prediction of academic performance or academic satisfaction.
- The extent to which vocational interests make a useful contribution beyond personality data for the prediction of academic performance requires further research.
- The use of multiple individual differences domains to predict academic satisfaction is currently an under researched field.

Due to the broad nature of the gaps within the extant literature, the similarly broad nature of the dependent and independent variables being investigated and the respectively lengthy testing procedure, it must be acknowledged that the aims and objectives of this thesis are exploratory and should be interpreted with caution; it is intended that the current research forge a pathway for future research to continue along, and as such, can only provide areas of interest for further investigation rather than definitive and widely applicable results.

1.10 Aims

The primary aim of this thesis was to address:

1. The need to provide effective career counselling for students.

Chapter 1 explores the relevance of this aim.
Chapter 6 discusses this aim in depth with suggestions for future addressal.

Chapters 2-5 investigate the issue via five secondary aims and fifteen objectives, and address:

1.1 The need to better understand variables that contribute to academic satisfaction

Chapter 2 addresses this aim via investigating:

1. the prediction of academic satisfaction individually from personality factors and facets, cognitive abilities, vocational interests and personal values.

1.2 The need to better understand variables that contribute to academic performance.

Chapter 3 addresses this aim via investigating:

2. The prediction of psychology course grades individually from personality factors and facets, cognitive abilities, vocational interests and personal values.
3. The prediction of overall GPA individually from personality factors and facets, cognitive abilities, vocational interests and personal values.

1.3 The importance of examining a wider range of variables, in combination, than what has been traditionally utilised.

Chapter 4 addresses this aim via investigating:

4. The structure of interrelationships between personality factors, cognitive abilities, vocational interests and personal values via exploratory factor analysis.

5. The use of factor scores involving personality factors, cognitive abilities, vocational interests and personal values to predict psychology course grades.
6. The use of factor scores involving personality factors, cognitive abilities, vocational interests and personal values to predict overall GPA.
7. The use of factor scores involving personality factors, cognitive abilities, vocational interests and personal values to predict academic satisfaction with psychology.

1.4 The importance of examining narrower variables, especially lower level personality facets

Chapter 5 addresses this aim via investigating:

8. The structure of interrelationships between personality facets, cognitive abilities, vocational interests and personal values via exploratory factor analysis.
9. The use of factor scores involving personality facets, cognitive abilities, vocational interests and personal values to predict psychology course grades.
10. The use of factor scores involving personality facets, cognitive abilities, vocational interests and personal values to predict overall GPA.
11. The use of factor scores involving personality facets, cognitive abilities, vocational interests and personal values to predict academic satisfaction with psychology.

1.5 The importance and practicability of combining facets and other variables in unique combinations, particularly course-specific and outcome-specific combinations.

Chapter 5 additionally addresses this aim via investigating:

12. The utility of streamlining and optimising factor scores for the prediction of academic outcomes.
13. The use of optimised factor scores involving personality facets, cognitive abilities, vocational interests and personal values to predict psychology course grades.
14. The use of optimised factor scores involving personality facets, cognitive abilities, vocational interests and personal values to predict overall GPA.

15. The use of optimised factor scores involving personality facets, cognitive abilities, vocational interests and personal values to predict academic satisfaction with psychology.

Overall, the aims of the five studies contained in Chapters 2-5 were to address a major gap in existing career counselling research by investigating the extent to which academic performance and satisfaction can be predicted by a combination of measures of personality, cognitive abilities, vocational interests and personal values, and how such measures could potentially be used effectively and efficiently to improve outcomes for students and tertiary institutions in terms of student selection of, and retention in, academic courses. Research on the financial costs of students failing to complete courses or delays due to students changing courses, suggests that such improved outcomes would be of considerable value to both students and tertiary institutions.

1.11 References

Ackerman, P. L. (1996). A theory of adult intellectual development: Process, personality, interests, and knowledge. *Intelligence, 22*(2), 227-257.

Ackerman, P. L., & Heggestad, E. D. (1997). Intelligence, personality, and interests: evidence for overlapping traits. *Psychological Bulletin, 121*(2), 219.

Allen, J., Robbins, S. B., Casillas, A., & Oh, I. S. (2008). Third-year college retention and transfer: Effects of academic performance, motivation, and social connectedness. *Research in Higher Education, 49*(7), 647-664. doi:10.1007/s11162-008-9098-3

Andrieu, B. (2011). Binet's archive of the Experimental Study of Intelligence 1899-1902. *L'Annee Psychologique, 111*(3), 509-532. doi:http://dx.doi.org/10.4074/S0003503311003046

Anglim, J., & Grant, S. (2016). Predicting psychological and subjective well-being from personality: Incremental prediction from 30 facets over the Big 5. *Journal of Happiness studies, 17*(1), 59-80.

Anglim, J., Knowles, E. R. V., Dunlop, P. D., & Marty, A. (2017). HEXACO personality and Schwartz's personal values: A facet-level analysis. *Journal of Research in Personality, 68*, 23-31.

Anglim, J., & O'Connor, P. (2019). Measurement and research using the Big Five, HEXACO, and narrow traits: A primer for researchers and practitioners. *Australian Journal of Psychology, 71*(1), 16-25.

Armstrong, P. I., & Anthoney, S. F. (2009). Personality facets and RIASEC interests: An integrated model. *Journal of Vocational Behavior, 75*(3), 346-359. doi:https://doi.org/10.1016/j.jvb.2009.05.004

Armstrong, P. I., Day, S. X., McVay, J. P., & Rounds, J. B. (2008). Holland's RIASEC model as an integrative framework for individual differences. *Journal of Counseling Psychology, 55*(1), 1.

Armstrong, P. I., & Rounds, J. B. (2010). Integrating individual differences in career assessment: The atlas model of individual differences and the strong ring. *The Career Development Quarterly, 59*(2), 143-153.

Barchard, K. A. (2003). Does emotional intelligence assist in the prediction of academic success? *Educational and Psychological Measurement, 63*(5), 840-858.

Bergold, S., & Steinmayr, R. (2018). Personality and intelligence interact in the prediction of academic achievement. *Journal of Intelligence, 6*(2), 27.

Bowles, T. V., & Brindle, K. A. (2017). Identifying facilitating factors and barriers to improving student retention rates in tertiary teaching courses: a systematic review. *Higher Education Research & Development*, 1-17. doi:10.1080/07294360.2016.1264927

Brandt, N. D., Lechner, C. M., Tetzner, J., & Rammstedt, B. (2019). Personality, cognitive ability, and academic performance: Differential associations across school subjects and school tracks. *Journal of personality*.

Brown, N. W. (1994). Cognitive, interest, and personality variables predicting first-semester GPA. *Psychological Reports, 74*(2), 605-606.

Busato, V. V., Prins, F. J., Elshout, J. J., & Hamaker, C. (1999). The relation between learning styles, the Big Five personality traits and achievement motivation in higher education. *Personality and Individual Differences, 26*(1), 129-140. doi:http://dx.doi.org/10.1016/S0191-8869%2898%2900112-3

Busato, V. V., Prins, F. J., Elshout, J. J., & Hamaker, C. (2000). Intellectual ability, learning style, personality, achievement motivation and academic success of psychology students in higher education. *Personality and Individual Differences, 29*(6), 1057-1068. doi:http://dx.doi.org/10.1016/S0191-8869%2899%2900253-6

Carroll, J. B. (1993). *Human cognitive abilities: A survey of factor-analytic studies*: Cambridge University Press.

Cattell, R. B. (1941). Some theoretical issues in adult intelligence testing. *Psychological Bulletin, 38*(592), 10.

Cattell, R. B. (1963). Theory of fluid and crystallized intelligence: A critical experiment. *Journal of Educational Psychology, 54*(1), 1.

Chamorro-Premuzic, T., & Furnham, A. (2008). Personality, intelligence and approaches to learning as predictors of academic performance. *Personality and Individual Differences, 44*(7), 1596-1603.

Corulla, W. J., & Coghill, K. R. (1991). Can Educational Streaming Be Linked to Personality - a Possible Link between Extroversion, Neuroticism, Psychoticism and Choice of Subjects. *Personality and Individual Differences, 12*(5), 367-374. doi:Doi 10.1016/0191-8869(91)90052-D

Costa, P. T., & McCrae, R. R. (1980). Influence of Extraversion and Neuroticism on Subjective Well-Being - Happy and Unhappy People. *Journal of Personality and Social Psychology, 38*(4), 668-678. doi:Doi 10.1037/0022-3514.38.4.668

Costa, P. T., & McCrae, R. R. (1992). Four ways five factors are basic. *Personality and Individual Differences, 13*(6), 653-665. doi:http://dx.doi.org/10.1016/0191-8869%2892%2990236-I

Cox, D. W., Bjornsen, A. L., Krieshok, T. S., & Liu, Y. (2016). Occupational Engagement and Academic Major Satisfaction: Vocational Identity's Mediating Role. *The Career Development Quarterly, 64*(2), 169-180. doi:10.1002/cdq.12049

Coyle, T. R., Snyder, A. C., Richmond, M. C., & Little, M. (2015). SAT non-g residuals predict course specific GPAs: Support for investment theory. *Intelligence, 51*, 57-66.

Cromley, J. G., Booth, J. L., Wills, T. W., Chang, B. L., Tran, N., Madeja, M., . . . Zahner, W. (2017). Relation of Spatial Skills to Calculus Proficiency: A Brief Report. *Mathematical Thinking and Learning, 19*(1), 55-68.

De Fruyt, F., & Mervielde, I. (1996). Personality and interests as predictors of educational streaming and achievement. *European Journal of Personality, 10*(5), 405-425. doi:http://dx.doi.org/10.1002/%28SICI%291099-0984%28199612%2910:5%3C405::AID-PER255%3E3.0.CO;2-M

Deary, I. J., Whalley, L. J., Lemmon, H., Crawford, J. R., & Starr, J. M. (2000). The Stability of Individual Differences in Mental Ability from Childhood to Old Age: Follow-up of the 1932 Scottish Mental Survey. *Intelligence, 28*(1), 49-55. doi:https://doi.org/10.1016/S0160-2896(99)00031-8

DeYoung, C. G., Quilty, L. C., & Peterson, J. B. (2007). Between facets and domains: 10 aspects of the Big Five. *Journal of Personality and Social Psychology, 93*(5), 880.

Dudley, N. M., Orvis, K. A., Lebiecki, J. E., & Cortina, J. M. (2006). A meta-analytic investigation of conscientiousness in the prediction of job performance: Examining the intercorrelations and the incremental validity of narrow traits. *Journal of Applied Psychology, 91*(1), 40.

Edwards, J. E., & Waters, L. K. (1982). Involvement, ability, performance, and satisfaction as predictors of college attrition. *Educational and Psychological Measurement, 42*(4), 1149-1152. doi:http://dx.doi.org/10.1177/001316448204200421

Edwards, J. E., & Waters, L. K. (1983). Predicting university attrition: A replication and extension. *Educational and Psychological Measurement, 43*(1), 233-236.

Ekstrom, R. B., French, J. W., Harman, H. H., & Dermen, D. (1976). *Manual for kit of factor-referenced cognitive tests*. Princeton, NJ:: Educational testing service.

Farsides, T., & Woodfield, R. (2003). Individual differences and undergraduate academic success: the roles of personality, intelligence, and application. *Personality and Individual Differences, 34*(7), 1225-1243. doi:Pii S0191-8869(02)00111-3

Feldman, K. A., & Newcomb, T. M. (1969). *The impact of college on students*. Piscataway, NJ: Transaction Publishers; US.

Flanagan, D. P. (2000). Wechsler-based CHC cross-battery assessment and reading achievement: Strengthening the validity of interpretations drawn from Wechsler test scores. *School Psychology Quarterly, 15*(3), 295-329. doi:10.1037/h0088789

Flanagan, D. P., Alfonso, V. C., & Reynolds, M. R. (2013). Broad and Narrow CHC Abilities Measured and Not Measured by the Wechsler Scales:Moving Beyond Within-Battery Factor Analysis. *Journal of Psychoeducational Assessment, 31*(2), 202-223. doi:10.1177/0734282913478047

Fonteyne, L., Duyck, W., & De Fruyt, F. (2017). Program-specific prediction of academic achievement on the basis of cognitive and non-cognitive factors. *Learning and Individual Differences, 56*, 34-48.

Fritzsche, B. A., McIntire, S. A., & Yost, A. P. (2002). Holland Type as a Moderator of Personality–Performance Predictions. *Journal of Vocational Behavior, 60*(3), 422-436. doi:https://doi.org/10.1006/jvbe.2001.1841

Furnham, A., & Chamorro-Premuzic, T. (2004). Personality and intelligence as predictors of statistics examination grades. *Personality and Individual Differences, 37*(5), 943-955.

Gough, H., & Heilbrun, A. L. (1983). The revised adjective checklist manual. In: Palo Alto, CA: Consulting Psychologists Press.

Graham, E. K., & Lachman, M. E. (2012). Personality stability is associated with better cognitive performance in adulthood: Are the stable more able? *The Journals of Gerontology: Series B: Psychological Sciences and Social Sciences, 5*(5), 545-554. doi:http://dx.doi.org/10.1093/geronb/gbr149

Gregory, R. J. (1996). *Psychological testing*. Boston: Allyn & Bacon.

Guan, G., Shiye, M., Liu, J., & Yum, G. (2006). *Relationship between satisfaction with major, academic performance, and congruence.*

Gustafsson, J. E., & Balke, G. (1993). General and specific abilities as predictors of school achievement. *Multivariate Behavioral Research, 28*(4), 407-434.

Hansen, J.-I. C., & Wiernik, B. M. (2016). Work preferences: vocational interests and values. In *The SAGE Handbook of Industrial, Work & Organizational Psychology: V1: Personnel Psychology and Employee Performance* (pp. 408).

Hansen, J. I. C., & Tan, R. N. (1992). Concurrent Validity of the 1985 Strong Interest Inventory for College Major Selection. *Measurement and Evaluation in Counseling and Development, 25*(2), 53-57.

Harrington, R., & Loffredo, D. A. (2001). The relationship between life satisfaction, self-consciousness, and the Myers-Briggs Type Inventory dimensions. *The Journal of Psychology: Interdisciplinary and Applied, 135*(4), 439-450. doi:http://dx.doi.org/10.1080/00223980109603710

Harris, D. (1940). Factors affecting college grades: a review of the literature, 1930-1937. *Psychological Bulletin, 37*(3), 125-166. doi:http://dx.doi.org/10.1037/h0055365

Holland, J. L. (1980). The Influence of Vocational-Interest Inventories - Some Implications for Psychological-Testing. *Counseling Psychologist, 9*(1), 83-86.

Holland, J. L. (1997). *Making vocational choices: A theory of vocational personalities and work environments, 3rd ed*. Odessa, FL, US: Psychological Assessment Resources.

Holland, J. L., & Gottfredson, G. D. (1976). Using a Typology of Persons and Environments to Explain Careers - Some Extensions and Clarifications. *Counseling Psychologist, 6*(3), 20-29. doi:Doi 10.1177/001100007600600306

Holland, J. L., Gottfredson, G. D., & Baker, H. G. (1990). Validity of Vocational Aspirations and Interest Inventories - Extended, Replicated, and Reinterpreted. *Journal of Counseling Psychology, 37*(3), 337-342. doi:Doi 10.1037//0022-0167.37.3.337

Holland, J. L., Powell, A. B., & Fritzsche, B. A. (1985). *The self-directed search (SDS). The career interest inventory for today...: a guide to educational and vocational planning*: Psychological Assessment Resources.

Holland, J. L., Shears, M., & Harvey-Beavis, A. (2001). *Self-Directed Search* (Australian ed.). Camberwell, Victoria: Australian Council for Educational Research.

Horn, J. L. (1968). Organization of abilities and the development of intelligence. *Psychological review, 75*(3), 242.

Horn, J. L. (1991). Measurement of intellectual capabilities: A review of theory. In K. S. McGrew, J. K. Werder, & R. W. Woodcock (Eds.), *Woodcock-Johnson technical manual* (pp. 197-232). Chicago, IL: Riverside.

Horn, J. L., & Noll, J. (1997). Human cognitive capabilities: Gf-Gc theory. In *Contemporary intellectual assessment: Theories, tests, and issues.* (pp. 53-91). New York, NY, US: Guilford Press.

Kahn, J. H., Nauta, M. M., Gailbreath, R., Tipps, J., & Chartrand, J. M. (2002). The utility of career and personality assessment in predicting academic progress. *Journal of Career Assessment, 10*(1), 3-23.

Kaufman, J. C., Kaufman, S. B., & Plucker, J. A. (2013). Contemporary theories of intelligence. In D. Reisberg (Ed.), *The oxford handbook of cognitive psychology* (pp. 811-822). New York: Oxford University Press.

Kausel, E. E., & Slaughter, J. E. (2011). Narrow personality traits and organizational attraction: Evidence for the complementary hypothesis. *Organizational Behavior and Human Decision Processes, 114*(1), 3-14.

Kelso, G. i. (1986). An orientation to Holland's theory. In J. J. Lokan & K. F. Taylor (Eds.), *Holland in Australia. A vocational choice theory in research and practice* (pp. xv-xxii). Melbourne: ACER.

Klimstra, T. A., Bleidorn, W., Asendorpf, J. B., van Aken, M. A., & Denissen, J. J. (2013). Correlated change of Big Five personality traits across the lifespan: A search for determinants. *Journal of Research in Personality, 47*(6), 768-777. doi:http://dx.doi.org/10.1016/j.jrp.2013.08.004

Krishnan, V. R. (2008). Impact of MBA Education on Students' Values: Two Longitudinal Studies. *Journal of Business Ethics, 83*(2), 233-246. doi:DOI 10.1007/s10551-007-9614-y

Laidra, K., Pullmann, H., & Allik, J. (2007). Personality and intelligence as predictors of academic achievement: A cross-sectional study from elementary to secondary school. *Personality and Individual Differences, 42*(3), 441-451. doi:DOI 10.1016/j.paid.2006.08.001

Larsen, L., Hartmann, P., & Nyborg, H. (2008). The stability of general intelligence from early adulthood to middle-age. *Intelligence, 36*(1), 29-34. doi:https://doi.org/10.1016/j.intell.2007.01.001

Larson, L. M., Rottinghaus, P. J., & Borgen, F. H. (2002). Meta-analyses of Big Six interests and Big Five personality factors. *Journal of Vocational Behavior, 61*(2), 217-239.

Lent, R. W., Singley, D., Sheu, H., Schmidt, J. A., & Schmidt, L. C. (2007). Relation of Social-Cognitive Factors to Academic Satisfaction in Engineering Students. *Journal of Career Assessment, 15*(1), 87-97. doi:doi:10.1177/1069072706294518

Logue, C. T., Lounsbury, J. W., Gupta, A., & Leong, F. T. L. (2007). Vocational interest themes and personality traits in relation to college major satisfaction of business students. *Journal of Career Development, 33*(3), 269-295. doi:10.1177/0894845306297348

Lounsbury, J. W., Saudargas, R. A., Gibson, L. W., & Leong, F. T. (2005a). An investigation of broad and narrow personality traits in relation to general and domain-specific life satisfaction of college students. *Research in Higher Education, 46*(6), 707-729. doi:Doi 10.1007/11162-004-4140-6

Lounsbury, J. W., Sundstrom, E., Loveland, J. M., & Gibson, L. W. (2003). Intelligence, "Big Five" personality traits, and work drive as predictors of course grade. *Personality and Individual Differences, 35*(6), 1231-1239. doi:http://dx.doi.org/10.1016/S0191-8869%2802%2900330-6

Lounsbury, J. W., Welsh, D. P., Gibson, L. W., & Sundstrom, E. (2005b). Broad and narrow personality traits in relation to cognitive ability in adolescents. *Personality and Individual Differences, 38*(5), 1009-1019.

Luk, C. L., & Bond, M. H. (1993). Personality Variation and Values Endorsement in Chinese University-Students. *Personality and Individual Differences, 14*(3), 429-437. doi:Doi 10.1016/0191-8869(93)90312-Q

McAbee, S. T., & Oswald, F. L. (2013). The criterion-related validity of personality measures for predicting GPA: A meta-analytic validity competition. *Psychological Assessment, 25*(2), 532-544. doi:http://dx.doi.org/10.1037/a0031748

McDaniel, M. A., & Banks, G. C. (2010). General cognitive ability. In J. C. Scott & R. D. H. (Eds.), *Handbook of Workplace Assessment* (Vol. 32, pp. 61): John Wiley & Sons.

McGrew, K. S. (2005). The Cattell-Horn-Carroll Theory of Cognitive Abilities: Past, Present, and Future. In D. P. Flanagan & P. L. Harrison (Eds.), *Contemporary intellectual assessment:Theories, tests,and issues* (2nd ed., pp. 136−181). New York: GuilfordPress.

McGrew, K. S. (2009). CHC theory and the human cognitive abilities project: Standing on the shoulders of the giants of psychometric intelligence research. *Intelligence, 37*(1), 1-10. doi:https://doi.org/10.1016/j.intell.2008.08.004

McKay, D. A., & Tokar, D. M. (2012). The HEXACO and five-factor models of personality in relation to RIASEC vocational interests. *Journal of Vocational Behavior, 81*(2), 138-149.

Milsom, A., & Coughlin, J. (2017). Examining Person–Environment Fit and Academic Major Satisfaction. *Journal of College Counseling, 20*(3), 250-262. doi:10.1002/jocc.12073

Morrow, J. M. (1971). *Satisfaction with choice of college major: A test of Holland's theory of vocational choice.* Morrow, James M : U North Carolina, Chapel Hill, Retrieved from http://ovidsp.ovid.com/ovidweb.cgi?T=JS&CSC=Y&NEWS=N&PAGE=fulltext&D=psyc2&AN=1971-29681-001

Moutafi, J., Furnham, A., & Tsaousis, I. (2006). Is the relationship between intelligence and trait Neuroticism mediated by test anxiety? *Personality and Individual Differences, 40*(3), 587-597.

Nafziger, D. H., Holland, J. L., & Gottfredson, G. D. (1975). Student-College Congruency as a Predictor of Satisfaction. *Journal of Counseling Psychology, 22*(2), 132-139. doi:Doi 10.1037/H0076340

Napoli, A. R. (1996). *Psychosocial factors related to retention and early departure of two-year community college students.* Napoli, Anthony R : State U New York at Stony Brook, US, Retrieved from http://ovidsp.ovid.com/ovidweb.cgi?T=JS&CSC=Y&NEWS=N&PAGE=fulltext&D=psyc3&AN=1996-95023-288

Nauta, M. M. (2007). Assessing college students' satisfaction with their academic majors. *Journal of Career Assessment, 15*(4), 446-462.

Nye, C. D., Su, R., Rounds, J. B., & Drasgow, F. (2012). Vocational interests and performance: A quantitative summary of over 60 years of research. *Perspectives on Psychological Science, 7*(4), 384-403.

Nye, C. D., Su, R., Rounds, J. B., & Drasgow, F. (2017). Interest congruence and performance: Revisiting recent meta-analytic findings. *Journal of Vocational Behavior, 98*, 138-151.

O'Connor, M. C., & Paunonen, S. V. (2007). Big Five personality predictors of post-secondary academic performance. *Personality and Individual Differences, 43*(5), 971-990. doi:http://dx.doi.org/10.1016/j.paid.2007.03.017

Olver, J. M., & Mooradian, T. A. (2003). Personality traits and personal values: a conceptual and empirical integration. *Personality and Individual Differences, 35*(1), 109-125. doi:Pii S0191-8869(02)00145-9

Parks, L. (2007). *Personality and values: A meta-analysis.* Paper presented at the annual conference for the society of industrial and organizational psychology, New York.

Parks, L., & Guay, R. P. (2009). Personality, values, and motivation. *Personality and Individual Differences, 47*(7), 675-684.

Parks, L., & Guay, R. P. (2012). Can personal values predict performance? Evidence in an academic setting. *Applied Psychology, 61*(1), 149-173.

Pascarella, E. T. (2006). How College Affects Students: Ten Directions for Future Research. *Journal of College Student Development, 47*(5), 508-520. doi:http://dx.doi.org/10.1353/csd.2006.0060

Päßler, K., & Hell, B. (2012). Do interests and cognitive abilities help explain college major choice equally well for women and men? *Journal of Career Assessment, 20*(4), 479-496.

Paunonen, S. V., & Ashton, M. C. (2001a). Big Five predictors of academic achievement. *Journal of Research in Personality, 35*(1), 78-90.

Paunonen, S. V., & Ashton, M. C. (2001b). Big five factors and facets and the prediction of behavior. *Journal of Personality and Social Psychology, 81*(3), 524.

Paunonen, S. V., & Ashton, M. C. (2013). On the prediction of academic performance with personality traits: A replication study. *Journal of Research in Personality, 47*(6), 778-781.

Paunonen, S. V., Rothstein, M. G., & Jackson, D. N. (1999). Narrow reasoning about the use of broad personality measures for personnel selection. *Journal of Organizational Behavior: The International Journal of Industrial, Occupational and Organizational Psychology and Behavior, 20*(3), 389-405.

Poropat, A. E. (2009). A meta-analysis of the five-factor model of personality and academic performance. *Psychological Bulletin, 135*(2), 322-338. doi:http://dx.doi.org/10.1037/a0014996

Pozzebon, J. A., & Ashton, M. C. (2009a). Personality and Values as Predictors of Self- and Peer-Reported Behavior. *Journal of Individual Differences, 30*(3), 122-129. doi:Doi 10.1027/1614-0001.30.3.122

Pozzebon, J. A., & Ashton, M. C. (2009b). Personality and values as predictors of self-and peer-reported behavior. *Journal of Individual Differences, 30*(3), 122-129.

Pozzebon, J. A., Ashton, M. C., & Visser, B. A. (2014). Major changes: Personality, ability, and congruence in the prediction of academic outcomes. *Journal of Career Assessment, 22*(1), 75-88.

Pullmann, H., & Allik, J. (2008). Relations of academic and general self-esteem to school achievement. *Personality and Individual Differences, 45*(6), 559-564. doi:http://dx.doi.org/10.1016/j.paid.2008.06.017

Rammstedt, B., Lechner, C., & Danner, D. (2018). Relationships between Personality and Cognitive Ability: A Facet-Level Analysis. *Journal of Intelligence, 6*(2), 28.

Rikoon, S. H., Brenneman, M., Kim, L. E., Khorramdel, L., MacCann, C., Burrus, J., & Roberts, R. D. (2016). Facets of conscientiousness and their differential relationships with cognitive ability factors. *Journal of Research in Personality, 61*, 22-34.

Rokeach, M. (1973). *The nature of human values*: Free press.

Rounds, J. B., & Tracey, T. J. (1990). From trait-and-factor to person-environment fit counseling: Theory and process. In W. B. Walsh & S. J. Osipow (Eds.), *Career Counseling: Contemporary Topics in Vocational Psychology* (pp. 1-44). Hillsdale, NJ: Erlbaum.

Sackett, P. R., Lievens, F., Van Iddekinge, C. H., & Kuncel, N. R. (2017). Individual differences and their measurement: A review of 100 years of research. *Journal of Applied Psychology, 102*(3), 254.

Sagiv, L. (2002). Vocational interests and basic values. *Journal of Career Assessment, 10*(2), 233-257.

Sagiv, L., & Schwartz, S. H. (2004). Values, intelligence and client behavior in career counseling: A field study. *European Journal of Psychology of Education, 19*(3), 237-254.

Schaie, K. W., Willis, S. L., & Caskie, G. I. L. (2004). The Seattle Longitudinal Study: Relationship Between Personality and Cognition. *Neuropsychology, development, and cognition. Section B, Aging, neuropsychology and cognition, 11*(2-3), 304-324. doi:10.1080/13825580490511134

Schneider, B. (1987). The people make the place. *Personnel psychology, 40*(3), 437-453.

Schneider, W. J., & McGrew, K. S. (2012). The Cattell-Horn-Carroll model of intelligence. In D. P. Flanagan & P. L. Harrison (Eds.), *Contemporary intellectual assessment: Theories, tests, and issues* (pp. 99-144). New York: Guilford Press.

Schwartz, S. H. (1992a). Universals in the content and structure of values: Theoretical advances and empirical tests in 20 countries. In *Advances in experimental social psychology, Vol 25* (pp. 1-65). San Diego, CA: Academic Press; US.

Schwartz, S. H. (1992b). Universals in the content and structure of values: Theoretical advances and empirical tests in 20 countries. *Advances in experimental social psychology, 25*, 1-65.

Schwartz, S. H. (1994). Are There Universal Aspects in the Structure and Contents of Human-Values. *Journal of Social Issues, 50*(4), 19-45.

Schwartz, S. H. (2006). Basic human values : theory, measurement, and applications. *Revue Francaise De Sociologie, 47*(4), 929-+.

Schwartz, S. H. (2012). An overview of the Schwartz theory of basic values. *Online readings in Psychology and Culture, 2*(1), 11.

Schwartz, S. H., & Bardi, A. (2001). Value hierarchies across cultures: Taking a similarities perspective. *Journal of Cross-Cultural Psychology, 32*(3), 268-290.

Schwartz, S. H., Melech, G., Lehmann, A., Burgess, S., Harris, M., & Owens, V. (2001). Extending the cross-cultural validity of the theory of basic human values with a different method of measurement. *Journal of Cross-Cultural Psychology, 32*(5), 519-542. doi:Doi 10.1177/0022022101032005001

Smith, P. B., Peterson, M. F., Schwartz, S. H., Ahmad, A. H., Akande, D., Andersen, J. A., . . . Yanchuk, V. (2002). Cultural values, sources of guidance, and their relevance to managerial behavior - A 47-nation study. *Journal of Cross-Cultural Psychology, 33*(2), 188-208. doi:Doi 10.1177/0022022102033002005

Soubelet, A., & Salthouse, T. A. (2011). Personality–cognition relations across adulthood. *Developmental psychology, 47*(2), 303.

Spearman, C. (1904). " General Intelligence," Objectively Determined and Measured. *The American Journal of Psychology, 15*(2), 201-292.

Spearman, C. (1927). *The abilities of man*. London: Macmillan.

Spokane, A. R., & Derby, D. P. (1979). Congruence, Personality Pattern, and Satisfaction in College-Women. *Journal of Vocational Behavior, 15*(1), 36-42. doi:Doi 10.1016/0001-8791(79)90016-2

Stankov, L. (2009). Conservatism and cognitive ability. *Intelligence, 37*(3), 294-304.

Strahan, S., & Credé, M. (2015). Satisfaction With College Re-Examining Its Structure and Its Relationships with The Intent to Remain in College and Academic Performance. *Journal of College Student Retention: Research, Theory & Practice, 16*(4), 537-561.

Su, R., Murdock, C. D., & Rounds, J. B. (2015). Person-environment fit. *APA handbook of career intervention, 1*, 81-98.

Toker, Y., & Ackerman, P. L. (2012). Utilizing occupational complexity levels in vocational interest assessments: Assessing interests for STEM areas. *Journal of Vocational Behavior, 80*(2), 524-544. doi:http://dx.doi.org/10.1016/j.jvb.2011.09.001

Torelli, C. J., & Kaikati, A. M. (2009). Values as Predictors of Judgments and Behaviors: The Role of Abstract and Concrete Mindsets. *Journal of Personality and Social Psychology, 96*(1), 231-247. doi:Doi 10.1037/A0013836

Trapmann, S., Hell, B., Hirn, J. W., & Schuler, H. (2007). Meta-analysis of the relationship between the Big Five and academic success at university. *Zeitschrift fur Psychologie/Journal of Psychology, 215*(2), 132-151. doi:http://dx.doi.org/10.1027/0044-3409.215.2.132

Tyler, D., & Small, J. M. (1990). Persistence of College Transfer Students. *Alberta Journal of Educational Research, 36*(2), 181-188.

Vedel, A. (2014). The Big Five and tertiary academic performance: A systematic review and meta-analysis. *Personality and Individual Differences, 71*, 66-76. doi:10.1016/j.paid.2014.07.011

Vedel, A., Thomsen, D. K., & Larsen, L. (2015). Personality, academic majors and performance: Revealing complex patterns. *Personality and Individual Differences, 85*, 69-76. doi:10.1016/j.paid.2015.04.030

Vitulic, H. S., & Prosen, S. (2012). PERSONALITY AND COGNITIVE ABILITIES AS PREDICTORS OF UNIVERSITY STUDENTS' ACADEMIC ACHIEVEMENT. *Drustvena Istrazivanja, 21*(3), 715-732. doi:10.5559/di.21.3.06

Vitulic, H. S., & Zupancic, M. (2010). Robust and mid-level personality traits as predictors of adolescents' academic achievement in secondary school. *Suvremena Psihologija, 13*(2), 203-219.

Volodina, A., Nagy, G., & Köller, O. (2015). Success in the first phase of the vocational career: The role of cognitive and scholastic abilities, personality factors, and vocational interests. *Journal of Vocational Behavior, 91*, 11-22.

Wiernik, B. M. (2016). Intraindividual personality profiles associated with Realistic interests. *Journal of Career Assessment, 24*(3), 460-480.

Wittmann, W. W., & Süβ, H. M. (1999). Investigating the path between working memory, intelligence, knowledge, and complex problem-solving performances via Brunswik symmetry. In P. L. Ackerman, P. C. Kyllonen, & R. D. Roberts (Eds.), *Learning and individual differences: Process, trait, and content determinants* (pp. 77–104). Washington, DC: American Psychological Association.

Wolniak, G. C., & Pascarella, E. T. (2005). The effects of college major and job field congruence on job satisfaction. *Journal of Vocational Behavior, 67*(2), 233-251. doi:10.1016/j.jvb.2004.08.010

Chapter 2: Personality, Vocational Interests, Cognitive Abilities and Values as predictors of Academic Satisfaction

2.1 Statement of Authorship

Statement of Authorship

Title of Paper	Personality, vocational interests, cognitive abilities and values as predictors of academic satisfaction.
Publication Status	☐ Published ☐ Accepted for Publication ☐ Submitted for Publication ☑ Unpublished and Unsubmitted work written in manuscript style
Publication Details	

Principal Author

Name of Principal Author (Candidate)	Annamaria R. Quaresima
Contribution to the Paper	Designed the study, compiled the test battery, designed the satisfaction survey, collected the data, analysed and interpreted data, and wrote the manuscript.
Overall percentage (%)	80%
Certification:	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.
Signature	Date 11/08/2020

Co-Author Contributions

By signing the Statement of Authorship, each author certifies that:

i. the candidate's stated contribution to the publication is accurate (as detailed above);

ii. permission is granted for the candidate in include the publication in the thesis; and

iii. the sum of all co-author contributions is equal to 100% less the candidate's stated contribution.

Name of Co-Author	Dr. Neil Kirby
Contribution to the Paper	Supervised work, assisted in study design, reviewed and edited manuscript.
Signature	Date 31/08/2020

Name of Co-Author	Dr. Aspa Sarris
Contribution to the Paper	Supervised work, assisted in study design, reviewed and edited manuscript.
Signature	Date 27/08/2020

Please cut and paste additional co-author panels here as required.

2.2 Abstract

Academic satisfaction has been shown to be important for assisting students in their career choices, yet little is known about the factors that determine academic satisfaction in undergraduate students. A sample of 358 undergraduate students in Psychology completed an individual differences test battery involving self-report measures of personality, vocational interests, values, and academic satisfaction, as well as timed measures of cognitive ability. Results showed that Big Five personality facets and vocational interests significantly predicted academic satisfaction, and that personality facets were found to have greater predictive ability than the Big Five factors. Specific cognitive ability variables were predictive of specific academic satisfaction items, but overall, they were not significantly predictive when controlling for gender and age. Personal values were not predictive of academic satisfaction. The results highlight the extent to which academic career counsellors could use measures of personality and vocational interests to help students identify the types of courses that better suit them, and the extent to which detailed personality measures may be more useful than brief measures of the broader Big Five factors.

Keywords

Academic satisfaction; Big Five; personality facets; Vocational interests; Cognitive abilities; Values;

2.3 Introduction

The prediction of academic satisfaction, particularly in tertiary education, is important for assisting students to achieve positive life outcomes. Academic dissatisfaction is known to be one of the main reasons for switching an academic major (Wolniak & Pascarella, 2006; Pozzebon, Ashton, & Visser, 2014), which is a disruptive and time-consuming process for the student and the educational institution. Additionally, academic satisfaction has been found to be related to both academic performance and students' wellbeing and life satisfaction (Lounsbury, Saudargas, Gibson & Leong, 2005), which may influence students' likelihood of attrition from tertiary education (Edwards & Waters, 1982). A final reason for institutions of higher education to take an interest in students' academic satisfaction is that it is used as a basis for making comparisons between institutions for attracting students (Lounsbury et al., 2007). The number of students who change academic majors or leave tertiary education, which is over 20% in Australia, suggests that many students would benefit from support in choosing a course of study that suits them (Harvey & Luckman, 2014; McMillan, 2005; O'Keefe, 2013).

Relative to academic achievement, academic satisfaction is a comparatively under-researched field (Logue, Lounsbury, Gupta, & Leong, 2007). It has been widely recognized that single domains of individual differences are generally insufficient for constructing informative profiles of individuals that can predict academic outcomes and be of use for vocational guidance. However, there is an apparent dearth of research on the use of multiple domains of individual differences for the prediction of academic satisfaction. To date, only two studies have examined two or more domains (Logue et al., 2007; Pozzebon et al., 2014), and no study has utilised values as a predictor. Pozzebon et al. (2014) found that personality and cognitive abilities combined explained 7% of the variance in satisfaction with an academic major, but that vocational interests did not have an additional effect on the prediction of satisfaction. Logue et al. (2007) investigated fewer domains (personality and vocational interests) and found that Realistic interests was the only vocational interest scale of the Self Directed Search (Holland, 1994) that significantly predicted academic satisfaction, accounting for 7% of the variance. However, Logue et al. (2007) additionally found that the Big Five personality

factors explained 38% of the variance in academic major satisfaction; significant predictors were Neuroticism, Extraversion and Conscientiousness. When vocational interests were combined with personality, 49% of the variance in satisfaction with academic major was explained. Finally, Toker & Ackerman (2012) investigated cognitive abilities and vocational interests but utilised an interest complexity measure specific to Science, Technology, Engineering and Mathematics (STEM) courses rather than a broader measure of vocational interests to predict academic satisfaction. Their research found that levels of interest complexity correlated strongly with satisfaction in specific STEM majors, but also that Holland's RIASEC interest scales shared significant but low correlations with general satisfaction with an academic major.

To date, no studies have investigated the combination of personality, cognitive abilities, vocational interests and personal values for the prediction of academic satisfaction in tertiary education. That these domains of individual differences research have arisen separately within the study of psychology, and have been separately linked with career satisfaction (Judge, Heller & Mount, 2002; Judge, Higgins, Thoresen & Barrick, 2006), suggests that using them in combination could be beneficial to understanding which traits impact upon academic satisfaction (Ackerman, 1997).

Overall, the use of multiple domains to predict academic satisfaction is an under researched field. This study aimed to address this research gap by investigating personality, vocational interests, cognitive abilities and personal values for the prediction of academic satisfaction in undergraduate psychology students studying at an Australian university. The current study utilized the Big Five personality factors of the NEO-PI-R (Costa & McCrae, 1992) including the domain facets, Holland's vocational interests (Holland, 1994), cognitive abilities drawn from the Educational Testing Service Kit of Factor Referenced Cognitive Tests (Ekstrom, French & Harman, 1989), and Schwartz's basic human values (Schwartz, 1992) to predict academic satisfaction within undergraduate psychology. It was hypothesised that each of the domains would contribute to an explanation of academic satisfaction. Further, this study aimed to explore whether the Big Five domain facets have better utility in the prediction of academic satisfaction than the Big Five factors.

2.4 Methods

2.4.1 Participants

A total of 358 participants were recruited from an Australian university; 103 were male, 255 were female, and the mean age was 20.5 years (SD = 5.56, range 16-53). All participants were enrolled in one or more psychology courses and the sample was approximately representative of the psychology student population; 321 were first year undergraduates, 22 were second year undergraduates, and 15 were in their third year. Participants were recruited via the university's website for research participation and were compensated with partial course credit and entered to win one of five $100.00 cash prizes as a participation incentive. They completed a battery of timed and untimed measures of personality, vocational interests, cognitive abilities, and values in a classroom testing situation.

2.4.2 Measures

2.4.2.1 Personality

The NEO Personality Inventory Revised (NEO-PI-R, Costa & McCrae, 1992) was used to measure the Big Five personality factors and the personality facets within these. The NEO-PI-R is a widely used self-report measure of the Five Factor Model of personality and has been shown to have high structural validity and reliability (Costa & McCrae, 1992). The test uses 240 items to measure five broad personality factors (Neuroticism, Extraversion, Openness, Agreeableness, Conscientiousness), each with six facets, and is rated on a five point Likert scale from 0 "strongly disagree" to 4 "strongly agree". The NEO-PI-R professional manual has reported coefficient alpha reliabilities ranging from .86 to .92 for each of the factors, and good construct validity (Costa and McCrae, 1992).

2.4.2.2 Vocational Interests

The Self Directed Search Second Australian Edition (SDS-R, Holland et al., 2001) was used to measure vocational interests. The SDS-R is a widely used and quick to administer self-report

measure of Holland's RIASEC vocational interest theory that has been adapted for Australian participants. It measures six vocational interest factors (Realistic, Investigative, Artistic, Social, Enterprising, Conventional) with 228 items divided into six interest scales, each containing 38 items. For each interest factor, four subscales are used in measurement. A Likert scale from 1 "Low ability" to 7 "High ability" measures self-reported ability (Self Estimates). A forced choice response is used for Activities ("like" or "dislike"), Competencies ("Yes, can do the activity well" or "No, have never done the activity or do it poorly") and Occupations ("Yes, an occupation that interests me" or "No, an occupation that I dislike or find uninteresting"). Coefficient alpha reliabilities in an Australian tertiary sample ranged from .87 to .91 and validity of the SDS-R is supported by research demonstrating the conformity between an individual's actual score and their ideal occupation (Holland et al., 2001).

2.4.2.3 Cognitive Abilities

Nine timed tests from the Educational Testing Service's (ETS) Kit of Factor Referenced Cognitive Tests (Ekstrom, French, Harman, & Dermen, 1976) were selected to measure Stratum I type cognitive abilities (Schneider & McGrew, 2012) because they are inexpensive and adaptable, offering a wide range of brief Stratum I measures that can be conducted independently of each other. Each test involves timed conditions and contains two parts; participants completed part one of each test under halved time limits. The ETS Kit has had long-established reliability and validity within cognitive abilities research (Ekstrom et al., 1976).

The Vandenburg Mental Rotation test (Vandenburg and Kuse, 1978), a timed measure of the Stratum I cognitive ability of Speeded Rotation (SR) from the broader ability grouping of Visual Processing (*Gv*), was additionally selected due to similar reasons; it is inexpensive and adaptable, and measures three-dimensional Speeded Rotation, which is not included within the ETS Kit. This measure has been widely used for this purpose and has demonstrated good reliability and validity (Vandenburg and Kuse, 1978).

For this exploratory study, the ability measures were drawn from five broad Stratum II groupings of ability; these were Fluid Reasoning (*Gf*), Long Term Storage & Retrieval (*Glr*), Comprehension-Knowledge (*Gc*), Visual Processing (*Gv*), and Processing Speed (*Gs*). They were chosen to sample a range of cognitive abilities of relevance to enhanced task success within academic courses, which may relate to academic satisfaction within various domains of study. Additionally, they were able to be performed within the constraints of a large pen and paper test battery administered in a classroom setting.

2.4.2.3.1 Fluid Reasoning (Gf)

Letter Sets (part 1): This test measures Induction (I) with 15 reasoning problems. Five sets of letter strings are presented, and respondents must find the rule which makes four of the sets alike in order to determine which one letter set is different. Test scores are the number of correct responses minus 1/5 of incorrect responses. A maximum score of 15 can be obtained, and seven minutes were assigned for completion.

Nonsense Syllogisms (part 1): This test measures General Sequential Reasoning (RG) with 15 formal syllogisms formed with false content. Participants must determine which syllogisms contain conclusions that logically follow from the premises. Test scores are the number of correct responses minus the number of incorrect responses. A maximum score of 15 can be obtained, and 4 minutes were assigned for completion.

2.4.2.3.2 Long-Term Storage & Retrieval (Glr)

Word Beginnings (part 1): This test measures Word Fluency (FW). Respondents are requested to write as many words as possible that begin with the letters “PRO” (for example, “professional”). Test scores are the number of correct responses, with no maximum score; three minutes were assigned for completion.

Elaboration (part 1): This test measures Figural Fluency (FF). Respondents are requested to draw as many different decorative patterns as possible on 20 blank images (for example, “Here are some

cups. Add something to the decoration on as many as you can"). Test scores are the number of responses, and two minutes were assigned for completion.

2.4.2.3.3 Processing Speed (Gs)

Number Comparison (part 1): This test measures Perceptual Speed (P) with 48 item pairs. Respondents must visually compare two numbers strings and determine whether they are identical. Test scores are the number of correct responses minus incorrect responses. A maximum score of 48 can be obtained, and 1 minute 30 seconds was assigned for completion.

Subtraction and Multiplication (part 1): This test measures Number Facility (N) with 60 numerical problems. Test scores are the number of correct responses. A maximum score of 60 can be obtained, and two minutes were assigned for completion.

2.4.2.3.4 Comprehension-Knowledge (Gc)

Advanced Vocabulary II (part 1): This test measures Lexical Knowledge (VL) with five possible choices of the correct synonym. Test scores are the number of correct responses minus 1/5 of incorrect responses. A maximum score of 18 can be obtained, and four minutes were assigned for completion.

2.4.2.3.5 Visual Processing (Gv)

Incomplete Words (part 1): This test measures Closure Speed (CS) with 18 incomplete words; respondents are requested to fill in the blank spaces to complete the words. Test scores are the number of correct responses. A maximum score of 18 can be obtained, and three minutes were assigned for completion. Verbal Closure (as it is called in the ETS Kit) does not align precisely with current Cattell-Horn-Carroll (CHC) theory (Schneider & McGrew, 2012), and although grouped under *Gv* also draws upon aspects of *Gc*.

Hidden Patterns (part 1): This test measures Flexibility of Closure (CF). Respondents are requested to assess whether a simple geometric image is contained within 200 detailed geometric images.

Only some of the detailed images contain the simple image. Test scores are the number of correct responses minus the number of incorrect responses, and three minutes were assigned for completion.

Vandenburg Mental Rotation Test (part 1): This is an independent measure of Speeded Rotation (SR) not contained within the ETS Kit (Vandenburg and Kuse, 1978). Part one of this test was used. An initial three-dimensional object is presented, with four possible choices of the same object viewed at a different rotation angle, of which the participant must choose two. A maximum score of 24 can be obtained, and three minutes were assigned for completion.

2.4.2.4 Values

The Schwartz Values Survey (SVS, Schwartz, 1992) was used to provide a measure of individual values. The SVS is a self-report measure of Schwartz's 1992 theory of basic human values. It uses 56 items to measure the importance that participants place on ten specific types of values on a nine point Likert scale ranging from -11 "Opposed to my values" to 7 "Of supreme importance". The ten basic values are Conformity, Tradition, Benevolence, Universalism, Self Direction, Stimulation, Hedonism, Achievement, Power, and Security. The SVS is widely used and inexpensive, and previous research has demonstrated that it has good construct validity and reliability in a wide array of cross-cultural settings (Schwartz et al., 2001).

2.4.2.5 Academic Satisfaction

The AcSat scale (Academic Satisfaction) was developed for the current research as a brief measure of academic satisfaction within specific academic disciplines (for full scale, see Appendix 1). This measure was intended to assess student satisfaction independent of major choice, due to the nature of Australian tertiary course structure (many courses do not require choosing a defined major). It was further intended to assess academic satisfaction separately from the specifics of coursework and teaching which may vary between departments and universities.

Academic satisfaction was measured with three items developed to summarise key elements of academic satisfaction within the existing literature pertaining to the content of academic disciplines ("Boring" to "Interesting", "Not Fun" to "Enjoyable", and "Worthless" to "Worth Learning"). These were rated on a five point Likert scale with the items themselves forming the scale anchors (for example, 1 = "Boring", 2 = "Somewhat boring", 3 = "Neither boring nor interesting", 4 = "Somewhat interesting", 5 = "Interesting") and the mean score of the three items was utilised as an overall score of academic satisfaction for a specific academic discipline.

Previous research has demonstrated that measures of academic satisfaction could be improved by including more than a single item to measure this concept, but also suggest that scale reliability does not improve with increasing the number of items and that Likert rating scales better encapsulate the nuances of satisfaction (Lounsbury et al., 2005a; Pozzebon et al., 2014). However, detailed measures of academic satisfaction have often focused on wider aspects of the course or university studies in general, or alternatively have measured satisfaction with an academic major and intention to persist in a chosen field of study. It was intended to create a simple scale of satisfaction with the content of any academic discipline currently undertaken by a student, regardless of whether it had been chosen as an academic major (Lounsbury et al., 2005a; Pozzebon et al., 2014). In the current research, the AcSat was shown to demonstrate moderate validity via correlations with the NEO-PI-R facets of C4 Achievement Striving (r=.17, p<.01) and N3 Depression (r=-.13, p<.05) and good reliability, with a Cronbach's α of .81. Furthermore, it is comparable to a three-item measure of academic satisfaction (with a Cronbach's α of .88) that has been used in other studies (Etzel & Nagy, 2016; Westermann, Elke, Spies, & Trautwein, 1996), but which was only accessible some time after the AcSat had been utilized in data collection.

2.4.2.6 Demographics

Participants were asked to report their age, gender, undergraduate year level, and all courses that they were currently enrolled in for the semester on a paper form at the commencement of the test battery.

2.4.3 Procedure

Test battery administration took approximately 2 hours and 30 minutes per participant to complete and was administered in a classroom testing situation during semester 1 of the academic year, with groups ranging from 2-30 participants. Approval was obtained from the university ethics committee. Participants were informed about the purpose of the study, that their participation was voluntary, that they could leave the study at any time, and that only group results would be reported.

2.5 Results

2.5.1 Preliminary analyses

Due to the exploratory nature of the AcSat measure preliminary statistics were performed. Cronbach's alpha for the AcSat measure was .81. Table 1 shows moderate inter-item correlations, demonstrating good internal consistency. Scores on the three item scale ranged from 3 to 15 with a mean of 11.96 (SD= 2.14) and a variance of 4.56.

Table 1: Inter-item correlations for the AcSat and its individual items

	AcSat	**B-I**	**NF-E**	**W-WL**
	r	***r***	***R***	***r***
AcSat Scale	-	.87***	.87***	.82***
Boring-Interesting		-	.68***	.54***
Not Fun-Enjoyable			-	.53***
Worthless-Worth Learning				-

Note: *N*=290. AcSat=Academic Satisfaction. B-I=Boring/Interesting item. NF-E=Not Fun/Enjoyable item. W-WL=Worthless/Worth Learning item.
*p <.05. **p <.01. ***p <.001.

Principal Components Analysis was performed to determine the unidimensionality of the AcSat scale. One component with an eigenvalue greater than 2.0 was extracted, explaining 72.2% of the total variance.

2.5.2 Main analyses

2.5.2.1 Correlations

Table 2 contains the means, standard deviations, correlations with academic satisfaction, and correlations with the individual academic satisfaction items, for all independent variables. Relatively low but significant relationships were found between all individual differences domains with overall academic satisfaction.

Descriptive statistics for each of the variables indicate that there were no marked ceiling or floor effects. Notably, the ability measure of Hidden Patterns had a wide standard deviation. This is due to the test itself; scores range from -200 to 200, and the ETS Kit manual reports an unpublished study which found standard deviations of 38.3 and 33.2 for males and females respectively (Ekstrom et al., 1976).

Table 2: Means, standard deviations and correlations between the test battery measures and the AcSat scale

			AcSat	B-I	NF-E	W-WL
	M	**SD**	***r***	***r***	***r***	***r***
NEO-PI-R Factors						
Neuroticism	100.50	24.38	-.12*	-.12*	-.12	-.08
Extraversion	114.90	20.62	.00	.02	-.04	.03
Openness to Experience	120.04	18.10	.06	.03	.03	.09
Agreeableness	115.13	19.00	.16**	.14*	.14*	.12
Conscientiousness	107.05	22.05	.21***	.17**	.25***	.12*
NEO-PI-R Facets						
N1 Anxiety	18.26	5.50	-.08	-.09	-.07	-.04
E1 Warmth	22.49	4.34	.05	.04	.02	.05
O1 Fantasy	20.40	5.21	-.12*	-.16**	-.13*	-.03
A1 Trust	17.77	5.31	.09	.10	.08	.05
C1 Competence	19.07	4.24	.16**	.13*	.14*	.14*
N2 Angry Hostility	14.91	5.17	-.11	-.14*	-.10	-.05
E2 Gregariousness	18.84	5.88	.01	.03	-.07	.07
O2 Aesthetics	19.17	5.68	.14*	.10	.12*	.14*
A2 Straightforwardness	18.77	5.05	.07	.02	.11	.05
C2 Order	16.76	4.71	.14*	.13*	.20***	.03
N3 Depression	17.53	6.60	-.12	-.09	-.11	-.10
E3 Assertiveness	15.83	5.27	-.01	-.02	-.03	.03
O3 Feelings	22.23	4.13	.10	.12*	.04	.09
A3 Altruism	22.75	3.56	.10	.10	.10	.05
C3 Dutifulness	20.56	4.03	.14*	.13*	.17**	.07
N4 Self Consciousness	17.39	5.06	-.12	-.12	-.09	-.09
E4 Activity	16.78	4.07	.01	-.03	.06	-.02
O4 Actions	16.31	3.96	-.02	-.02	-.05	.03

A4 Compliance	16.70	4.62	.12*	.10	.11	.08
C4 Achievement Striving	17.41	5.21	.16**	.10	.18**	.12*
N5 Impulsiveness	18.69	4.77	-.03	-.02	-.05	-.01
E5 Excitement Seeking	19.83	5.11	-.08	-.02	-.12*	-.07
O5 Ideas	20.42	5.74	.10	.10	.11	.04
A5 Modesty	19.10	5.04	.12*	.16**	.04	.12*
C5 Self Discipline	16.02	5.64	.22***	.15**	.27***	.13*
N6 Vulnerability	13.99	5.09	-.10	-.12	-.11	-.04
E6 Positive Emotions	21.27	5.01	.06	.08	.02	.05
O6 Values	21.40	4.04	-.01	-.05	-.03	.05
A6 Tender Mindedness	20.06	3.62	.16**	.12*	.15*	.14*
C6 Deliberation	16.87	4.65	.15*	.13*	.16**	.09
SDS-R interests						
Realistic	16.74	8.56	-.06	-.03	-.00	-.13*
Investigative	25.28	9.40	-.20***	-.16**	-.12*	-.23***
Artistic	25.05	9.81	.07	.02	.05	.10
Social	33.03	7.62	.26***	.21***	.18**	.27***
Enterprising	25.93	8.36	.10	.04	.08	.12*
Conventional	20.28	7.13	.05	.05	.03	.06
ETS Kit abilities						
Advanced Vocabulary	4.91	3.32	-.07	-.05	-.10	-.02
Incomplete Words	10.70	3.15	.02	.03	-.01	.04
Mental Rotation	8.16	4.84	-.12	-.06	-.15*	-.09
Hidden Patterns	97.66	32.61	-.10	-.05	-.10	-.10
Subtraction & Multiplication	18.34	10.10	-.03	-.04	.02	-.05
Number Comparison	13.67	3.13	-.15**	-.15*	-.11	-.15*
Letter Sets	10.06	2.85	-.09	-.05	-.10	-.09
Nonsense Syllogisms	2.46	4.07	-.06	-.04	-.07	-.04

Word Beginnings	15.08	5.94	-.08	-.02	-.12*	-.07
Elaboration	13.01	4.45	.03	.03	.07	-.03
SVS values						
Conformity	4.30	1.14	.08	.03	.11	.06
Tradition	3.01	1.32	.07	.02	.12*	.04
Benevolence	5.01	.90	.07	.03	.03	.12*
Universalism	4.48	1.01	.13*	.04	.14*	.15*
Self Direction	4.99	.89	.04	-.07	.09	.07
Stimulation	3.92	1.34	-.03	.01	-.06	-.03
Hedonism	4.66	1.23	-.00	-.03	.03	-.00
Achievement	4.57	1.06	-.04	-.08	.05	-.07
Power	2.47	1.50	-.05	-.09	.01	-.05
Security	4.21	1.07	.05	-.01	.11	.01

Note: *N*=290. AcSat=Academic Satisfaction. B-I=Boring/Interesting item. NF-E=Not Fun/Enjoyable item. W-WL=Worthless/Worth Learning item.
*p <.05. **p <.01. ***p <.001.

2.5.2.2 Regression

A series of hierarchical regressions were performed to predict academic satisfaction. Age and gender were entered into the first step to control for possible differences within the sample. Extended tables displaying prediction of the individual AcSat items are included within Appendix 2 for further details (see section 6.9). However, these should be considered cautiously, and emphasis placed upon the prediction of the overall AcSat scale, which appears to be unidimensional and has demonstrated good reliability (see section 2.5.1 for preliminary results).

The Big Five personality factors significantly predicted AcSat (6%), with Conscientiousness (2%) radioof unique variance to the prediction. Table 3 contains the hierarchical regression for the Big Five factors.

Table 3: Hierarchical regression for age, gender and personality factors predicting academic satisfaction

	AcSat				
Step and predictor variable	R^2	aR^2	ΔR^2	β	sr^2
Step 1 (Method: Enter)	.03**	.03	.03**		
Age				.11	.01
Gender				.09	.01
Step 2 (Method: Enter)	.08***	.06	.05**		
Neuroticism				-.11	.01
Extraversion				-.02	.00
Openness				.05	.00
Agreeableness				.07	.00
Conscientiousness				.15*	.02

Note: *N*=290. AcSat=Academic Satisfaction.
*p <.05. **p <.01. ***p <.001.

The Big Five facets accounted for more of the variance than the Big Five factors, significantly predicting AcSat (10%). The Big Five facets additionally demonstrated greater utility, with AcSat predicted by the Neuroticism facet of N3 Depression (2%), the Openness facets of O1 Openness to Fantasy (1%) and O2 Openness to Aesthetics (1%), and the Conscientiousness facet of C5 Self Discipline (1%), in comparison with only Conscientiousness at the factor level. Unique variance was additionally contributed by N4 Self Consciousness (1%), N5 Impulsiveness (1%), Openness to Feelings (1%), A5 Modesty (1%), and A6 Tender Mindedness (1%). Table 4 contains the hierarchical regression for the Big Five facets.

Table 4: Hierarchical regression for age, gender and personality facets predicting academic satisfaction

	AcSat				
Step and predictor variable	R^2	aR^2	ΔR^2	β	sr^2
Step 1 (Method: Enter)	.03**	.03	.03**		
Age				.14*	.01
Gender				.07	.00
Step 2 (Method: Enter)	.20**	.10	.17**		
N1 Anxiety				-.06	.00
E1 Warmth				-.02	.00
O1 Fantasy				-.15*	.01
A1 Trust				-.06	.00
C1 Competence				.02	.00
N2 Angry Hostility				.02	.00
E2 Gregariousness				.00	.00
O2 Aesthetics				.16*	.01
A2 Straightforwardness				-.09	.00

C2 Order	.04	.00
N3 Depression	-.21*	.02
E3 Assertiveness	-.08	.00
O3 Feelings	.12	.01
A3 Altruism	.00	.00
C3 Dutifulness	-.05	.00
N4 Self Consciousness	-.14	.01
E4 Activity	-.08	.00
O4 Actions	-.05	.00
A4 Compliance	.03	.00
C4 Achievement Striving	-.03	.00
N5 Impulsiveness	.14	.01
E5 Excitement Seeking	-.01	.00
O5 Ideas	.04	.00
A5 Modesty	.14	.01
C5 Self Discipline	.21*	.01
N6 Vulnerability	.07	.00
E6 Positive Emotions	.04	.00
O6 Values	-.07	.00
A6 Tender Mindedness	.13	.01
C6 Deliberation	.07	.00

Note: *N*=290. AcSat=Academic Satisfaction.
*p <.05. **p <.01. ***p <.001.

Overall, vocational interests significantly predicted AcSat (10%). AcSat was predicted by Investigative (2%) and Social (5%) interests. Table 5 contains the hierarchical regression for Holland's vocational interest scale.

Table 5: Hierarchical regression for age, gender and vocational interests predicting academic satisfaction

	AcSat				
Step and predictor variable	R^2	aR^2	ΔR^2	β	sr^2
Step 1 (Method: Enter)	.03**	.03	.03**		
Age				.15**	.02
Gender				-.03	.00
Step 2 (Method: Enter)	.13***	.10	.10***		
Realistic				-.06	.00
Investigative				-.17**	.02
Artistic				.03	.00
Social				.28***	.05
Enterprising				.02	.00
Conventional				-.06	.00

Note: *N*=290. AcSat=Academic Satisfaction
*p <.05. **p <.01. ***p <.001

Overall, cognitive abilities did not significantly predict AcSat beyond age and gender. Number Comparison individually demonstrated a significant prediction and contributed 2% unique variance to the prediction. This result should be interpreted cautiously in the context of the wider *F* statistic but may indicate that the variable warrants further exploration. Table 6 contains the hierarchical regression for the ten ETS kit cognitive abilities.

Table 6: Hierarchical regression for age, gender, and cognitive abilities predicting academic satisfaction

	AcSat				
Step and predictor variable	R^2	aR^2	ΔR^2	β	sr^2
Step 1 (Method: Enter)	.04**	.03	.04**		
Age				.15*	.02
Gender				.09	.01
Step 2 (Method: Enter)	.09**	.05	.06		
Advanced Vocabulary				-.10	.01
Incomplete Words				.12	.01
Mental Rotation				-.03	.00
Hidden Patterns				-.06	.00
Subtraction & Multiplication				.04	.00
Number Comparison				-.16*	.02
Letter Sets				-.03	.00
Nonsense Syllogisms				-.02	.00
Word Beginnings				-.11	.01
Elaboration				.07	.00

Note: *N*=290. AcSat=Academic Satisfaction.
*p <.05. **p <.01. ***p <.001

Values did not significantly predict AcSat beyond age and gender. Table 7 contains the hierarchical regression for the ten values.

Table 7: Hierarchical regression for age, gender and values predicting academic satisfaction

Step and predictor variable	R^2	aR^2	ΔR^2	β	sr^2
Step 1 (Method: Enter)	.04**	.03	.04**		
Age				.14*	.02
Gender				.11	.01
Step 2 (Method: Enter)	.06	.02	.02		
Conformity				.09	.00
Tradition				.04	.00
Benevolence				-.03	.00
Universalism				.11	.01
Self Direction				-.01	.00
Stimulation				-.03	.00
Hedonism				.07	.00
Achievement				-.07	.00
Power				-.05	.00
Security				-.03	.00

Note: *N*=290. AcSat=Academic Satisfaction.
*p <.05. **p <.01. ***p <.001.

2.6 Discussion

The results of this study indicate that university students' personality traits and vocational interests are important to the prediction of their overall level of academic satisfaction, and of their interest, enjoyment, and perception of the worth of specific academic courses. Cognitive abilities and values did not predict academic satisfaction. However, Number Comparison – a measure of perceptual speed – may warrant further investigation. As hypothesised, personality facets provided greater and more statistically significant prediction than the broader Big Five personality factors.

In line with previous research using personality factors (Logue et al, 2007; Pozzebon et al., 2014) Conscientiousness was related to academic satisfaction with psychology, significantly predicting AcSat scores. Conscientiousness consistently predicts academic grades and GPA in the literature, and it is therefore not surprising that it predicts other measures of academic success (Pozzebon et al., 2014).

In contrast, Neuroticism and Extraversion were not significantly related to academic satisfaction with psychology. It must be noted, however, that Neuroticism did account for a very small amount of unique variance in the model. Differences between the findings in the literature and the current study may be due to the difference in academic discipline investigated; Logue et al (2007) used a sample of business students. It seems probable that more extraverted students would perhaps be better suited to studying business, and more satisfied within the discipline. Further, such differences found for Neuroticism and Extraversion between the studies may reflect the broad nature of the Big Five factors.

In line with this, personality facets were found to be significantly related to academic satisfaction with psychology. Previous research (Logue et al., 2007; Pozzebon et al., 2014), however, has focused on the factors. From the domain of Neuroticism, N3 Depression was negatively predictive of overall satisfaction with psychology, and additionally with student enjoyment, and whether students found psychology worth learning (see section 6.9.2.2 & section 6.9.2.3). Conversely, N5 Impulsiveness, which provided a very small amount of unique variance to the prediction of

academic satisfaction with psychology, was otherwise a significant predictor of student interest in psychology (see section 6.9.2.1). It seems probable that students who score high on Depression would likely experience low levels of satisfaction in general, in addition to lower satisfaction with the course content. Further, it is of interest that high levels of Impulsiveness predict interest; this finding suggests that the varied topics within psychology may satisfy a potential need for novelty of information.

Three facets of Openness to Experience were also found to be related to academic satisfaction with psychology; O1 Openness to Fantasy (negative relationship), O2 Openness to Aesthetics and O3 Openness to Feelings. As students' Openness to Fantasy increases, interest in psychology as a discipline decreases, suggesting that such individuals are perhaps better suited to more imaginative disciplines. Conversely, students with higher levels of appreciation for art and beauty experienced greater academic satisfaction with psychology overall, and increased enjoyment and value placed upon learning psychology. This finding somewhat aligns with the Holland Code for clinical psychology (Investigative Social Artistic) suggesting that psychology at least partially involves engaging creative skills (Holland, 1994). Additionally, higher Openness to Feelings predicted interest in psychology (see section 6.9.2.1); emotional students are perhaps more interested in the social aspects within psychology. For the domain of Agreeableness, A5 Modesty was a curious predictor of interest in, and higher valuation of psychology (see section 6.9.2.1 & section 6.9.2.3), and its unique variance within the prediction of academic satisfaction might suggest that students with less desire to have their achievements celebrated are drawn to a discipline that places more emphasis on helping others than competition amongst peers. However, it is also possible that this is a confounding factor; modest students may not feel comfortable providing low self-reports of psychology satisfaction to a study conducted within that discipline. Results for A6 Tender Mindedness lend credence to this theory; students with higher levels of sympathy report higher levels of enjoyment of psychology (see section 6.9.2.2). From the domain of Conscientiousness, only C5 Self Discipline was significantly related to academic satisfaction with psychology. Students with higher capacity to follow through on tasks and restrain impulses reported higher overall academic

satisfaction with psychology as well as higher levels of enjoyment. This finding supports previous research on students from varied disciplines, suggesting that the ability to complete academic tasks without succumbing to distraction predicts academic satisfaction in general.

The second major finding of this study was that vocational interests predicted academic satisfaction with psychology. Realistic interests were negatively predictive for whether students found psychology worth learning (see section 6.9.4.3). This aligns with research by Logue et al. (2007), and further with Holland's Hexagonal theory; Holland Codes for psychology utilise Social interests, which are in opposition to Realistic interests in the hexagonal structure. Investigative interests, in alignment with previous research by Logue et al. (2007) but contrary to Holland's theory and Holland Codes for the area, negatively predicted academic satisfaction for psychology students. However, the current study was sampled from a psychology population of which a large number were additionally studying biology; such results may be indicative of those with higher levels of scientific interest feeling less satisfied with psychology in comparison to their other academic courses. Finally, Social interests, in line with Holland's theory, were predictive of both overall and item-specific academic satisfaction within psychology.

Pozzebon et al. (2014) found that verbal and math ability did not predict academic satisfaction, whereas this study found that cognitive abilities were weakly predictive of whether students enjoyed taking psychology courses, but not of academic satisfaction with psychology overall. The Verbal Fluency measure predicted enjoyment of psychology (see section 6.9.3.2), and despite a lack of overall model significance, the Perceptual Speed measure itself was a significant predictor of academic satisfaction with psychology and accounted for unique variance, in addition to its significant correlations with the AcSat measure. While these results do not demonstrate the utility of cognitive abilities, they suggest that some specific, narrow ability measures may potentially predict academic satisfaction.

Results showed that the Schwartz values did not predict academic satisfaction with psychology or the individual AcSat items. Despite personal values being widely used for research into life

satisfaction, there is a lack of research utilizing values for academic satisfaction, and the results of this study imply that values held by students do not influence their satisfaction with psychology.

Possible limitations with the current research that need to be considered are that administration was lengthy and the measures required considerable concentration, which may have affected the participant group through self-selection. Although course credit was provided, and prizes were offered, it was difficult to recruit participants, and it is possible that students who chose to participate differed in some way from those who decided against participation. Additionally, cognitive abilities measures were condensed in order to reduce the lengthy administration time. Future research should combine all variables for prediction and investigate whether the predictors of academic satisfaction are different for academic disciplines other than psychology.

2.6.1 Conclusion

The current research has demonstrated that personality and vocational interests can successfully predict whether an individual will experience academic satisfaction within undergraduate psychology. Further, this suggests that personality and vocational interests measures may be useful to academic career counsellors for helping to determine which students would be best suited for particular courses, and that specific, narrow personality measures may be better for career counselling than brief or broad measures. The study has identified that values and cognitive abilities are largely unnecessary for determining whether a student will experience academic satisfaction specifically with psychology courses, although narrow cognitive ability measures may provide advice on whether a student will enjoy psychology.

This study provides a framework for a closer inspection of academic satisfaction. It has investigated a new measure of academic satisfaction and has extended knowledge on predictive variables and on the use of facets for prediction. Personality facets and vocational interests were shown to be important for prediction of student satisfaction with psychology. If further research involving additional academic disciplines was conducted, such research may provide insight that improves both career counselling methods and successful outcomes for students of a wide range of academic

disciplines. As such, the incorporation of measures of personality facets, vocational interests, and narrow cognitive abilities into current career counselling activities may both streamline the efficiency and improve the successfulness of a match between indecisive students and career paths that will satisfy their behavioural traits, interests, and skills, and provide them with increased satisfaction regarding their career trajectory, as well as increased life satisfaction.

2.7 References

Ackerman, P. L. (1997). Personality, Self-Concept, Interests, and Intelligence: Which Construct Doesn't Fit? *J Pers, 65*(2), 171-205.

Edwards, J. E., & Waters, L. (1982). Involvement, ability, performance, and satisfaction as predictors of college attrition. *Educational and Psychological Measurement, 42*(4), 1149-1152.

Ekstrom, R. B., French, J. W., Harman, H. H., & Dermen, D. (1976). Manual for kit of factor referenced cognitive tests. *Princeton, NJ: Educational testing service*.

Harvey, A. & Luckman, M. (2014). Beyond demographics: Predicting student attrition within the Bachelor of Arts degree. *The International Journal of the First Year in Higher Education, 5*(1), 19-29.

Holland, J.L., Powell, A. & Fritzsche, B. (1994). *SDS professional user's guide.* Odessa, FL: Psychologial Assessment Resources, Inc.

Judge, T.A., Heller, D. & Mount, M.K. (2002). Five-factor model of personality and job satisfaction: a meta-analysis. *Journal of Applied Psychology, 87*(3), 530-541.

Judge, T.A., Higgins, C.A., Thoresen, C.J. & Barrick, M.R. (2006). The Big Five personality traits, general mental ability, and career success across the life span. *Personnel Psychology, 52*(3), 621-652.

Kotov, R., Gamez, W., Schmidt, F., Watson, D. (2010). Linking "big" personality traits to anxiety, depressive, and substance use disorders: A meta-analysis. *Psychological Bulletin, 136*(5), 768-821.

Logue, C. T., Lounsbury, J. W., Gupta, A., & Leong, F. T. L. (2007). Vocational interest themes and personality traits in relation to college major satisfaction of business students. *Journal of Career Development, 33*(3), 269-295. doi: Doi 10.1177/0894845306297348

Lounsbury, J. W., Saudargas, R. A., Gibson, L. W., & Leong, F.T. (2005). An investigation of broad and narrow personality traits in relation to general and domain-specific life satisfaction of college students. *Research in Higher Education, 46*(6), 707-729. doi: Doi 10.1007/11162-004-4140-6

McMillan, J. (2005). *LSAY Research Reports.* Longitudinal studies of Australian youth research report (Reasearch Report No. 39). Retrieved from Australian Council for Educational Research website: http://research.acer.edu.au/lsay_research/43

O'Keefe, P. (2013). A sense of belonging: Improving student retention. *College Student Journal, 47*(4), 605-613.

Pozzebon, J. A., Ashton, M. C., & Visser, B. A. (2014). Major Changes Personality, Ability, and Congruence in the Prediction of Academic Outcomes. *Journal of Career Assessment, 22*(1), 75-88.

Schneider, W. J., & McGrew, K. S. (2012). The Cattell-Horn-Carroll model of intelligence. *Contemporary intellectual assessment: Theories, tests, and*, (3rd), 99-144.

Schwartz, S.H. (1992). Universals in the content and structure of values: Theoretical advances and empirical tests in 20 countries. In M.P. Zanna (Ed.), *Advances in Experimental Social Psychology,* (Vol. 25*,* pp.1-65). Orlando, FL: Academic.

Toker, Y., & Ackerman, P. L. (2012). Utilizing occupational complexity levels in vocational interest assessments: Assessing interests for STEM areas. *Journal of Vocational Behavior, 80*(2), 524-544. doi: http://dx.doi.org/10.1016/j.jvb.2011.09.001

Wolniak, G. C., & Pascarella, E. T. (2005). The effects of college major and job field congruence on job satisfaction. *Journal of Vocational Behavior, 67*(2), 233-251. doi: DOI 10.1016/j.jvb.2004.08.010

2.8 Contextual Statement: Study 1 to Study 2

Tertiary education needs effective career counselling for students that are indecisive or at risk of dropping out of their academic courses, and as such, the first study aimed to examine variables of relevance for predicting academic satisfaction. This involved using personality factors and facets in addition to vocational interests, cognitive abilities and values for the prediction of academic satisfaction with psychology. Having established that these independent variables were predictive of academic satisfaction to varying degrees, the second study's aim was to examine variables of relevance to predicting academic performance, which involved utilizing personality factors and facets, vocational interests, cognitive abilities and values to predict the related academic outcome of academic performance. Academic performance was examined for both the broader GPA, and the narrower psychology course grades.

Chapter 3: Personality, Vocational Interests, Cognitive Abilities and Values as predictors of Academic Performance

3.1 Statement of Authorship

Statement of Authorship

Title of Paper	Personality, vocational interests, cognitive abilities and values as predictors of academic performance.
Publication Status	☐ Published ☐ Accepted for Publication ☐ Submitted for Publication ☑ Unpublished and Unsubmitted work written in manuscript style
Publication Details	

Principal Author

Name of Principal Author (Candidate)	Annamaria R. Quaresima		
Contribution to the Paper	Designed the study, compiled the test battery, collected the data, analysed and interpreted data, and wrote the manuscript.		
Overall percentage (%)	80%		
Certification:	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.		
Signature		Date	11/08/2020

Co-Author Contributions

By signing the Statement of Authorship, each author certifies that:

i. the candidate's stated contribution to the publication is accurate (as detailed above);

ii. permission is granted for the candidate in include the publication in the thesis; and

iii. the sum of all co-author contributions is equal to 100% less the candidate's stated contribution.

Name of Co-Author	Dr. Neil Kirby		
Contribution to the Paper	Supervised work, assisted in study design, reviewed and edited manuscript.		
Signature		Date	31/08/2020

Name of Co-Author	Dr. Aspa Sarris		
Contribution to the Paper	Supervised work, assisted in study design, reviewed and edited manuscript.		
Signature		Date	27/08/2020

Please cut and paste additional co-author panels here as required.

3.2 Abstract

The prediction of academic performance has long been considered important, but it is only recently that a detailed approach integrating multiple individual differences measures and examining personality at the facet level has been utilised. The current study predicted GPA and course grade using measures of personality, vocational interests, cognitive abilities and personal values. A sample of 358 undergraduate psychology students completed an individual differences test battery involving self-report and timed measures, and course grades were collected at the end of semester. Personality facets, vocational interests and cognitive abilities were predictive of both GPA and psychology course grade. Personality factors only predicted GPA and personal values only predicted psychology course grade. The results demonstrate the utility of personality facets for prediction, and the potential for integrated individual differences to provide greater detail. They further suggest that specific individual differences measures may be useful for predicting grades in specific academic courses.

Keywords: Academic performance; Grades; Big Five; personality facets; Vocational interests; Cognitive abilities; Values;

3.3 Introduction

The prediction of academic performance has long been considered an important area of research. At the societal level, identifying predictors of academic success allows a closer understanding of what sort of person will be most suitable for any given job, increasing productivity and decreasing wasted resources. At an individual level, identifying predictors of academic success can provide better life outcomes for students, assisting them in choosing careers that they will thrive in and find fulfilling, and identifying students at risk of low academic performance in order to provide them with additional support. Poor tertiary academic performance has been shown to predict dropout from academic courses (Allen, Robbins, Casillas & Oh, 2008) and intention to persist within an academic course has shown moderate to strong correlations with academic satisfaction (Strahan & Crede, 2015).

Strong and well-established relationships exist between cognitive ability and academic performance, and between personality and academic performance (Chamorro-Premuzic & Furnham, 2008; Deary, Strand, Smith & Fernandes, 2007; Fonteyne, Duyck & De Fruyt, 2017; Lounsbury, Huffstetler, Leong & Gibson, 2005; Noftle & Robins, 2007; O'Connor & Paunonen, 2007; Vedel, 2014; Vedel, Thomsen & Larsen, 2015). Additionally, studies have increasingly used non-ability measures such as vocational interests to successfully predict academic outcomes (De Fruyt & Mervielde, 1996; Lounsbury, Sundstrom, Loveland & Gibson, 2003; Nye, Su, Rounds & Drasgow, 2017), which have greater utility in a range-restricted tertiary population, and can support prediction in instances where cognitive abilities might be less indicative of academic performance, such as test taking anxiety, or increased effort (Fonteyne, Duyck & De Fruyt, 2017).

However, few studies have investigated the use of personal values for the prediction of academic performance. Recent research using a secondary school sample has found that Universalism and Stimulation positively predict mathematics-specific achievement, whereas Tradition and Power were negative predictors (Pipere & Mierina, 2017). In terms of tertiary performance, Parks & Guay (2012) found that personal values were predictive of course grades beyond personality and

demonstrated that Achievement values had a relationship with academic performance, mediated by goal content and goal striving.

Additionally, few studies take a fine-grained approach to individual differences when predicting academic performance, and this may overlook important aspects. Brunswik symmetry (Wittmann & Süß, 1999) posits that there must be symmetrical scope of measurement between criterion and predictor variables, otherwise correlations between the two will be diminished. Recently, Vedel, Thomsen & Larsen (2015) suggested that taking this approach when utilising fine-grained criterion variables of academic performance could increase predictive validity, which was supported by their finding that personality facets were good predictors of academic performance, demonstrating both prediction of GPA – and more importantly in terms of Brunswik symmetry – significantly stronger prediction of GPA for specific academic majors. Notably, some facets that did not predict overall GPA were nevertheless significant predictors of academic major GPA, which highlights that the using a fine-grained approach can result in discovering otherwise hidden findings, and the utility of specific facets for specific academic areas of study; for example, N2 Angry Hostility was not predictive of overall GPA, or of any other area of study other than Psychology. However, for psychology students, a significant negative prediction existed. As levels of Angry Hostility increased, students were less likely to receive high GPAs in Psychology.

Studies which have examined individual differences variables within a narrower scope have demonstrated that personality facets and narrow stratum cognitive abilities can provide additional context-dependent information beyond that provided by personality factors and broader abilities. Facets within the same personality factor can differ in the strength and direction of their relationships with academic performance (Paunonen and Ashton, 2001a; Rikoon et al., 2016; Vedel, Thomsen & Larsen, 2015) and have been shown to provide better prediction of academic performance than broader personality factors (Armstrong & Anthoney, 2009; McAbee, Oswald & Connelly, 2014; O'Connor & Paunonen, 2007).

Fewer studies have focused on a variety of narrow cognitive ability measures (Colom, Escorial, Shih & Privado, 2007). However, Rohde & Thompson (2007) compared verbal and fluid measures of general cognitive ability with measures of specific cognitive abilities and found that specific cognitive abilities did not account for additional variance beyond the general measures, yet when specifically predicting academic performance in the mathematics section of the SAT, processing speed and spatial ability accounted for significant additional variance. Whilst general academic performance is currently well-predicted by general measures of ability, specific cognitive abilities may be useful predictors of performance in specific academic courses.

Furthermore, relatively few studies have investigated various combinations of personality, cognitive abilities, vocational interests and values for prediction of academic performance, particularly studies including more than two of these domains, and no studies to date have included all four domains. Pozzebon, Ashton & Visser's (2014) research investigated personality, cognitive abilities and vocational interest congruence within different academic majors for the prediction of overall GPA and academic major-specific GPA. They found that Conscientiousness, Verbal ability and Mathematical ability were predictive of both overall and major-specific GPA, but that congruence was not predictive of either. Recent research using an elementary school sample has also investigated these three domains in combination. Krapić and Kuljanić (2017) found that 44% of the variance in general achievement could be explained by cognitive abilities, personality factors and vocational interests. Measures of verbal ability, numeric ability, Conscientiousness, Neuroticism, and Investigative interests were all significant predictors of general achievement.

Despite a dearth of research involving relationships between values and cognitive abilities, Stankov (2009) found that a Conservatism factor, partly comprising Schwartz' 1992 basic human values of Conformity and Tradition, had significant negative relationships with verbal ability and logical reasoning. Berings, De Fruyt & Bouwen (2004) demonstrated that personality factors, and a measure of work values found to be comparable to the Schwartz' Values Survey (Schwartz, 1992), had a moderate relationship and were predictive of vocational interests. Further, Parks & Guay's (2012) path analysis model suggests that personal values are related to personality and fit into a

hierarchical structure with goals and personality factors for the prediction of GPA. When viewed in combination with Ackerman & Heggestad's (1997) research involving the relationships between personality, vocational interests and cognitive abilities and their later use of the subsequent trait complexes that arise to significantly predict GPA (Ackerman, Kanfer & Beier, 2013), a potential overarching structure for combining personality, vocational interests, cognitive abilities and values to predict academic performance begins to emerge.

The current study aims to explore a variety of individual differences, whilst including narrower measurement of personality facets and cognitive abilities. It is hypothesised that a) personality factors and facets, vocational interests, cognitive abilities and values will each independently and significantly predict academic course grades in Psychology and GPA. Further, it is hypothesised that b) personality facets will provide improved prediction of Psychology course grades and GPA in comparison to the larger personality factors.

3.4 Methods

3.4.1 Participants

A sample of 358 undergraduate psychology students were recruited from an Australian university; 255 were female, the mean age was 20.5 years (SD = 5.56, range 16-53), and most (321) were first year undergraduates. All participants were enrolled in one or more psychology courses and recruited via the university website for psychology research participation.

3.4.2 Measures

3.4.2.1 Personality

The NEO Personality Inventory Revised (NEO-PI-R, Costa & McCrae, 1992) measures the Five Factor Model of personality. It contains 240 self-report items that measure five broad personality factors (Neuroticism, Extraversion, Openness, Agreeableness, Conscientiousness), and 30 specific personality facets (six per personality factor), rated on a five point Likert scale. The NEO-PI-R

professional manual has reported good construct validity, and reliabilities ranging from .86 to .92 for each of the factors (Costa and McCrae, 1992).

3.4.2.2 Vocational Interests

The Self Directed Search Second Australian Edition (SDS-R; Holland, Shears & Harvey-Beavis, 2001) measures Holland's theory of vocational interests (Holland, 1997). It contains 228 self-report items that measure six vocational interest scales (Realistic, Investigative, Artistic, Social, Enterprising, Conventional). Each scale contains four response subscales. The Self Estimates subscale is rated on a seven-point Likert scale, whilst Activities, Competencies and Occupations utilize a forced choice response. Reliabilities in an Australian university sample ranged from .87 to .91 and research by Holland et al. (2001) provides support for the validity of the SDS-R.

3.4.2.3 Cognitive Abilities

The ETS Kit of Factor Referenced Cognitive Tests (Ekstrom et al., 1976) is a test battery which measures cognitive abilities under timed conditions and has been shown to have decent reliability and validity (Ekstrom et al., 1979). It contains 72 ability tests arranged into Stratum I type cognitive abilities. Of these, nine tests were selected that encompass five broad Stratum II groups of ability (Fluid Reasoning (*Gf*), Long Term Storage & Retrieval (*Glr*), Comprehension-Knowledge (*Gc*), Visual Processing (*Gv*), and Processing Speed (*Gs*)) and were chosen to sample a range of cognitive abilities of relevance to academic performance within various academic domains of study. Participants completed Part 1 for each test, under halved time conditions.

Fluid Reasoning *(Gf)* was measured via Letter Sets (Induction) and Nonsense Syllogisms (Logical Reasoning). Long-Term Storage & Retrieval *(Glr)* was measured through Word Beginnings (Word Fluency) and Elaboration (Figural Fluency). Processing Speed *(Gs)* was measured via Number Comparison (Perceptual Speed) and Subtraction & Multiplication (Number). Comprehension-Knowledge *(Gc)* was measured through Advanced Vocabulary II (Verbal Comprehension). Visual Processing *(Gv)* was measured via Incomplete Words (Verbal Closure) and Hidden Patterns

(Flexibility of Closure). Speeded Rotation *(SR)* was measured through the Vandenburg Mental Rotation Test, an independent measure of spatial rotation shown to have good validity and reliability (Vandenburg and Kuse, 1978).

3.4.2.4 Values

The Schwartz Values Survey (SVS, Schwartz, 1992) measures Schwartz's theory of basic human values. It contains 56 self-report items grouped into ten personal values (Conformity, Tradition, Benevolence, Universalism, Self Direction, Stimulation, Hedonism, Achievement, Power, Security), measured on a nine-point Likert scale. The SVS is shown to have good construct validity in a wide array of cultures (Schwartz et al., 2001).

3.4.2.5 Academic Performance

Academic performance was measured through participants' grades for courses undertaken in the semester. The tertiary grading system most commonly used in Australia at the time of testing consisted of course marks between 0-100, and five categories of grades. These were Fail (1-49), Pass (50-64), Credit (65-74), Distinction (75-84) and High Distinction (85-100).

Psychology course grades and GPA were gathered through student self-reports. Psychology grades were defined as the raw scores for the psychology course undertaken, whilst overall GPA was defined for the current study as the average of the raw scores for all courses undertaken in the semester, without any course weighting.

3.4.2.6 Demographics

Participants reported gender, age, year level of their undergraduate degree, and all courses that they were enrolled in for the semester.

3.4.3 Procedure

Participants booked a testing session time via the university research participation website, were compensated with partial course credit and further entered into a cash prize lottery as an incentive to combat the testing length, which was approved by the university's research ethics committee. Participants were informed about the purpose of the study, that their participation was voluntary, that they could leave the study at any time, and that only group results would be reported. Administration of the test battery took approximately 2 hours and 30 minutes per session. Each session included 2-30 participants in a classroom testing situation. The instructor read out the instructions for each measure and timed the cognitive measures. Grades were collected at the end of the semester.

3.5 Results

3.5.1 Correlations

Correlations between the individual differences domains with GPA and Psychology course grade were weak but significant, and relationships were found between all individual differences domains with GPA and Psychology course grade. Table 8 contains the means, standard deviations, correlations with GPA, and correlations with Psychology course grade for all independent variables.

Table 8: Means, standard deviations and correlations between test battery measures and academic performance

			GPA	Psych Grade
	M	**SD**	***r***	***R***
Neuroticism	100.50	24.38	-.10	.00
Extraversion	114.90	20.62	-.02	-.04
Openness to Experience	120.04	18.10	.01	.09
Agreeableness	115.13	19.00	.14*	.10
Conscientiousness	107.05	22.05	.19**	.10
N1 Anxiety	18.26	5.50	-.05	.01
E1 Warmth	22.49	4.34	.01	-.04
O1 Fantasy	20.40	5.21	-.09	-.06
A1 Trust	17.77	5.31	.14*	.09
C1 Competence	19.07	4.24	.23***	.14*
N2 Angry Hostility	14.91	5.17	-.10	-.03
E2 Gregariousness	18.84	5.88	-.04	-.04
O2 Aesthetics	19.17	5.68	-.07	-.03
A2 Straightforwardness	18.77	5.05	.13*	.16*
C2 Order	16.76	4.71	.07	.01
N3 Depression	17.53	6.60	-.12	-.01
E3 Assertiveness	15.83	5.27	.04	.01
O3 Feelings	22.23	4.13	-.00	.06
A3 Altruism	22.75	3.56	.02	-.02
C3 Dutifulness	20.56	4.03	.13*	.09
N4 Self Consciousness	17.39	5.06	-.00	.06
E4 Activity	16.78	4.07	.07	.03
O4 Actions	16.31	3.96	.10	.12
A4 Compliance	16.70	4.62	.15*	.09

C4 Achievement Striving	17.41	5.21	.12*	.07
N5 Impulsiveness	18.69	4.77	-.11	.01
E5 Excitement Seeking	19.83	5.11	-.17**	-.11
O5 Ideas	20.42	5.74	.08	.14*
A5 Modesty	19.10	5.04	-.01	.01
C5 Self Discipline	16.02	5.64	.17**	.06
N6 Vulnerability	13.99	5.09	-.05	.04
E6 Positive Emotions	21.27	5.01	.04	.00
O6 Values	21.40	4.04	.10	.15*
A6 Tender Mindedness	20.06	3.62	.13*	.05
C6 Deliberation	16.87	4.65	.12	.08
Realistic	16.74	8.56	-.21***	-.22***
Investigative	25.28	9.40	.14*	.19**
Artistic	25.05	9.81	-.03	-.07
Social	33.03	7.62	.05	.02
Enterprising	25.93	8.36	-.05	-.05
Conventional	20.28	7.13	-.02	.01
Advanced Vocabulary	4.91	3.32	.26***	.29***
Incomplete Words	10.70	3.15	.09	.12*
Mental Rotation	8.16	4.84	.04	-.01
Hidden Patterns	97.66	32.61	.05	.00
Subtraction & Multiplication	18.34	10.10	.09	.05
Number Comparison	13.67	3.13	.08	.04
Letter Sets	10.06	2.85	.29***	.28***
Nonsense Syllogisms	2.46	4.07	.26***	.27***
Word Beginnings	15.08	5.94	.24***	.28***
Elaboration	13.01	4.45	.21***	.16*
Conformity	4.30	1.14	-.09	-.16*

Tradition	3.01	1.32	-.15*	-.20***
Benevolence	5.01	.90	-.06	-.07
Universalism	4.48	1.01	-.11	-.09
Self Direction	4.99	.89	-.11	-.13*
Stimulation	3.92	1.34	-.03	.01
Hedonism	4.66	1.23	-.08	-.05
Achievement	4.57	1.06	.03	.06
Power	2.47	1.50	-.10	-.13*
Security	4.21	1.07	-.13**	-.18**

Note: *N*=259. *p<.05, **p<.01, ***p<.001.

3.5.2 Regression

Hierarchical multiple regression was performed to predict GPA and psychology course grade separately for all individual differences domains. The first step of all regressions included age and gender to control for intra-sample differences.

The Big Five factors significantly predicted 4% of the variance in GPA. Conscientiousness was the only significant factor. The factors were not predictive of psychology course grades beyond age and gender. However, gender was a significant predictor, suggesting that female students received higher grades in psychology. Table 9 contains the hierarchical regression for the Big Five personality factors.

Table 9: Hierarchical regression for age, gender and personality factors predicting academic performance

	GPA					Psych Grade				
Step and predictor variable	R^2	aR^2	ΔR^2	β	sr^2	R^2	aR^2	ΔR^2	β	sr^2
Step 1 (Method: Enter)	.02	.01	.02			.04**	.03	.04**		
Age				-.05	.00				-.06	.00
Gender				.12	.01				.20**	.03
Step 2 (Method: Enter)	.07*	.04	.05*			.07*	.04	.03		
Neuroticism				-.09	.01				-.03	.00
Extraversion				-.11	.01				-.12	.01
Openness				.05	.00				.11	.01
Agreeableness				.09	.01				.03	.00
Conscientiousness				.15*	.02				.10	.01

Note: *N*=253. *p<.05, **p<.01, ***p<.001.

Comparatively, the Big Five facets explained 10% of the variance in overall GPA. When compared to Conscientiousness as the sole significant predictor from the personality factors, facets drawn from Neuroticism, Extraversion, Agreeableness and Conscientiousness provided a wider range of information about the prediction. Age remained a negative predictor of GPA in step 2. The facets that significantly predicted GPA were N4 Self Consciousness (2%), E5 Excitement Seeking (negative predictor, 2%), A3 Altruism (negative predictor, 2%) and C1 Competence (3%). This suggests that higher social anxiety, increased self confidence in ones' abilities, and decreased needs for stimulation and lower levels of concern for others predict overall GPA for the semester.

The Big Five facets explained 10% of the variance in Psychology grades. Significantly predictive facets were drawn from Openness to Experience and Agreeableness. Both age and gender were found to be initially significant; indicating that Psychology grades decrease with age, and that

female students obtain higher grades in the discipline. O5 Openness to Ideas accounted for 2% of the variance, and O6 Openness to Values accounted for a further 1%. These results suggest that open-mindedness towards different ideas and values increase Psychology grades. From the Agreeableness factor, A2 Straightforwardness accounted for 1% of the variance in Psychology grades, whilst A3 Altruism was again a negative predictor, accounting for 2% of the variance. These findings indicate that being frank with others and prioritising one's own welfare leads to increased grades within Psychology. Table 10 contains the Big Five facet-level hierarchical regressions for overall GPA and Psychology course grade.

Table 10: Hierarchical regression for age, gender and personality facets predicting academic performance

	GPA					**Psych Grade**				
Step and predictor variable	R^2	aR^2	ΔR^2	B	sr^2	R^2	aR^2	ΔR^2	β	sr^2
Step 1 (Method: Enter)	.02	.01	.02			.04**	.03	.04**		
Age				-.14*	.01				-.14*	.01
Gender				.10	.01				.19**	.02
Step 2 (Method: Enter)	.21**	.10	.20**			.21**	.10	.17*		
N1 Anxiety				-.13	.01				-.13	.01
E1 Warmth				.04	.00				-.03	.00
O1 Fantasy				-.13	.01				-.13	.01
A1 Trust				.05	.00				.05	.00
C1 Competence				.26**	.03				.17	.01
N2 Angry Hostility				.09	.00				.09	.00
E2 Gregariousness				-.03	.00				.02	.00

O2 Aesthetics	-.12	.01	-.14	.01
A2 Straightforwardness	.11	.00	.18*	.01
C2 Order	.02	.00	.03	.00
N3 Depression	-.12	.01	-.11	.00
E3 Assertiveness	.03	.00	.02	.00
O3 Feelings	.04	.00	.08	.00
A3 Altruism	-.20*	.02	-.20*	.02
C3 Dutifulness	.02	.00	.01	.00
N4 Self Consciousness	.20*	.02	.17	.01
E4 Activity	.10	.01	.08	.00
O4 Actions	.08	.00	.10	.01
A4 Compliance	.16	.01	.14	.01
C4 Achievement Striving	-.11	.00	-.08	.00
N5 Impulsiveness	-.07	.00	-.01	.00
E5 Excitement Seeking	-.21**	.02	-.13	.01
O5 Ideas	.10	.01	.20*	.02
A5 Modesty	-.07	.00	-.07	.00
C5 Self Discipline	.06	.00	-.02	.00
N6 Vulnerability	.17	.01	.20	.01
E6 Positive Emotions	.07	.00	.05	.00
O6 Values	.13	.01	.15*	.01
A6 Tender Mindedness	.08	.00	-.03	.00
C6 Deliberation	-.12	.01	-.05	.00

Note: *N*=253. *p<.05, **p<.01, ***p<.001

Holland's vocational interests significantly predicted 8% of the variance in GPA. Realistic interests and Investigative interests accounted for 6% of the unique variance each, suggesting that overall grades decrease with higher levels of practical interests, and increase with higher levels of scientific, information-based interests.

For Psychology grades, vocational interests predicted 13% of the variance, and gender was initially significant, with an increase in grades for female students. The same variables were found to be significant; Realistic interests accounted for 5% of the unique variance, and Investigative interests accounted for 9%. The increase in prediction for Investigative interests demonstrates the relationship between this variable and the discipline of Psychology. Table 11 contains the vocational interests hierarchical regressions for overall GPA and Psychology course grade.

Table 11: Hierarchical regression for age, gender and vocational interests predicting academic performance

	GPA					**Psych Grade**				
Step and predictor variable	R^2	aR^2	ΔR^2	B	sr^2	R^2	aR^2	ΔR^2	β	sr^2
Step 1 (Method: Enter)	.02	.01	.02			.04**	.04	.04**		
Age				.06	.00				.04	.00
Gender				.05	.00				.17*	.02
Step 2 (Method: Enter)	.11***	.08	.09***			.16***	.13	.11***		
Realistic				-.29***	.06				-.27***	.05
Investigative				.27***	.06				.32***	.09
Artistic				-.04	.00				-.08	.01
Social				.09	.00				.01	.00
Enterprising				-.01	.00				.00	.00
Conventional				-.04	.00				-.01	.00

Note: *N*=253. *p<.05, **p<.01, ***p<.001.

Specific cognitive abilities drawn from the ETS test kit were found to predict 17% of the variance in GPA beyond age and gender. Gender contributed 2% unique variance to the prediction, and similar to previous results, female students received higher overall grades. Letter Sets, a test of inductive reasoning, contributed 4% unique variance to the prediction of GPA. Advanced Vocabulary, Nonsense Syllogisms and Elaboration each contributed 2% to the prediction of GPA. These results suggest that higher levels of inductive reasoning and to a lesser extent, verbal ability, logical reasoning, and figural fluency, predict higher overall GPA.

Cognitive abilities were also shown to predict 22% of the variance in Psychology grade. Again, gender contributed 4% unique variance to the prediction, and similarly significant variables were found; Letter Sets contributed 3% unique variance to the prediction of Psychology grade, whereas Advanced Vocabulary and Nonsense Syllogisms each contributed 2% unique variance. However, Word Beginnings, a measure of verbal fluency, contributed 2% additional variance. These findings suggest that the same cognitive ability measures that predict overall grades also heavily contribute to predicting specific subject grades. Higher grades in Psychology are predicted by higher levels of inductive and logical reasoning, verbal comprehension and verbal fluency. Table 12 contains the cognitive abilities hierarchical regressions for overall GPA and Psychology course grade.

Table 12: Hierarchical regressions for age, gender and cognitive abilities predicting academic performance

	GPA					Psych Grade				
Step and predictor variable	R^2	aR^2	ΔR^2	B	sr^2	R^2	aR^2	ΔR^2	β	sr^2
Step 1 (Method: Enter)	.02	.01	.02			.05**	.04	.05**		
Age				-.04	.00				-.08	.01
Gender				.15*	.02				.22***	.04
Step 2 (Method: Enter)	.21***	.17	.19***			.26***	.22	.21***		
Advanced Vocabulary				.16*	.02				.17*	.02
Incomplete Words				-.11	.01				-.10	.01
Mental Rotation				.02	.00				-.01	.00
Hidden Patterns				-.07	.00				-.12	.01
Subtraction & Multiplication				.01	.00				.00	.00
Number Comparison				-.01	.00				-.03	.00
Letter Sets				.22***	.04				.21***	.03
Nonsense Syllogisms				.14*	.02				.17**	.02
Word Beginnings				.13	.01				.18**	.02
Elaboration				.16**	.02				.10	.01

Note: *N*=253. *p<.05, **p<.01, ***p<.001.

Personal values from the Schwartz Values Survey were not predictive of overall GPA beyond age and gender. Further, the only significant variable of note was Achievement, which contributed 2%

unique variance. This indicates that placing higher value on personal success predicted higher grades overall but would not necessarily be an important factor for future inclusion in career counselling.

However, personal values predicted 10% of the variance in Psychology grades. Gender was again shown to be significant, and Achievement contributed 3% unique variance. Unique to the prediction of Psychology grade, Self Direction was found to be a negative predictor, contributing 2% to the variance. This suggests that valuing the ability to determine one's own choices predicted lower grades within Psychology. Table 13 contains the personal values hierarchical regressions for overall GPA and Psychology course grades, and Figure 3 displays the significant predictive individual differences domains for GPA and Psychology course grades.

Table 13: Hierarchical regressions for age, gender and values predicting academic performance

	GPA					**Psych Grade**				
Step and predictor variable	R^2	aR^2	ΔR^2	B	sr^2	R^2	aR^2	ΔR^2	β	sr^2
Step 1 (Method: Enter)	.02	.01	.02			.05**	.04	.05**		
Age				.03	.00				.02	.00
Gender				.10	.01				.17**	.03
Step 2 (Method: Enter)	.08	.04	.06			.14***	.10	.10**		
Conformity				.05	.00				-.03	.00
Tradition				-.16	.01				-.17	.01
Benevolence				-.01	.00				-.02	.00
Universalism				-.01	.00				.05	.00
Self Direction				-.10	.01				-.18*	.02
Stimulation				-.01	.00				.02	.00
Hedonism				-.03	.00				.02	.00
Achievement				.16*	.02				.22**	.03
Power				-.08	.00				-.13	.01
Security				-.09	.00				-.08	.00

Note: *N*=253. *p<.05, **p<.01, ***p<.001.

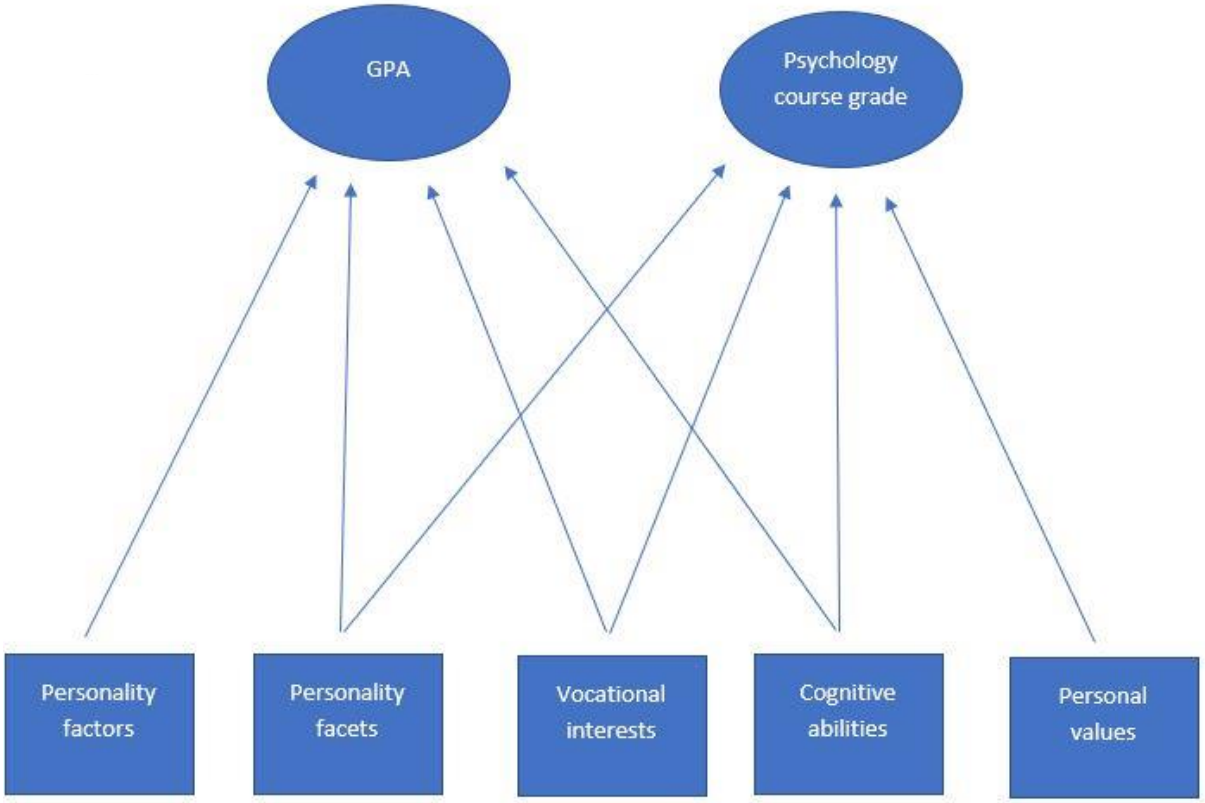


Figure 3: Significant individual differences domains for the prediction of academic performance

3.6 Discussion

The results of this study indicate that in addition to personality factors, personality facets, vocational interests, narrow cognitive abilities and, to a lesser extent, personal values, are important for the prediction of tertiary students' GPA and course grades. Contrary to the first hypothesis, values did not significantly predict GPA, and personality factors did not significantly predict course grades, although personality facets, vocational interests and cognitive abilities were all predictive of both GPA and Psychology course grade. However, as was hypothesised, personality facets provided a wider range of information and improved prediction of academic performance than personality factors - largely due to the range and specificity of facets.

It was found that the individual differences examined within this study were significantly related to different aspects of academic performance. Personality factors were only predictive of GPA and values were only significantly predictive of Psychology course grade, while vocational interests and cognitive abilities were predictive of both criterion variables. Personality facets were also predictive of both, although individual facets were specifically predictive of either GPA or Psychology course grades; only A3 Altruism was a shared significant negative predictor. This suggests that individual differences relate to academic performance differently; some may be more closely linked with overall achievement in university, and other variables with highly subject-dependent achievement, and that this relationship can occur at a narrower level of measurement than broad individual differences domains (Rikoon et al., 2016). These results support and extend upon previous research which found that relationships between individual differences and academic performance differ depending on type of academic performance measured and upon academic major (De Fruyt & Mervielde, 1996; Fonteyne, Duyck & De Fruyt, 2017; Vedel, 2014; Vedel, Thomsen & Larsen, 2015).

The second finding, that the Big Five personality factors were predictive of GPA, was consistent with previous research (Chamorro-Premuzic & Furnham 2008; De Fruyt & Mervielde, 1996; Fonteyne, Duyck & De Fruyt, 2017; Komarraju, 2011; Krapić and Kuljanić, 2017; O'Connor & Paunonen 2007a; Pozzebon, Ashton & Visser, 2014; Noftle & Robins 2007; Vedel, 2014; Vedel, Thomsen & Larsen,

2015). Conscientiousness, the single strongest predictor of GPA in the literature, was the only personality factor which significantly predicted GPA, albeit weakly. No factors were predictive of Psychology course grade. Potentially, using broad personality factors to predict specific subject grades may be problematic in terms of weakening predictions or changing the direction of predictions via aggregation (Paunonen & Ashton, 2001b; Vedel, Thomsen & Larsen, 2015).

The third finding was that the Big Five personality facets, in line with previous research, were much better predictors of both overall GPA and specific Psychology course grades (Armstrong & Anthoney, 2009; McAbee, Oswald & Connelly, 2014; O'Connor & Paunonen, 2007; Paunonen & Ashton, 2001a; Paunonen & Ashton, 2001b; Vedel, Thomsen & Larsen, 2015). Although limited by sample size, the results were similar to Vedel, Thomsen and Larsen (2015) in some instances. All replicated findings were with results for their total GPA rather than their Psychology major-derived GPA, and it is not surprising that there was a lack of correspondence, considering the disparity between Psychology major-specific GPA and the Psychology course grades used in the current study. Results replicated the findings for C1 Competence and N4 Self Consciousness with overall GPA, and similar though not identical results were found for A2 Straightforwardness, O5 Openness to Ideas, and O6 Openness to Values, which were significant predictors of Psychology course grade. Two new findings of note, however, were for A3 Altruism as a negative predictor of both GPA and Psychology course grade, and for E5 Excitement Seeking as a negative predictor of GPA; these add to the knowledge on predicting academic performance, and specifically, what predicts poor academic performance. In addition to providing a range of specific, significant predictors, differences between which facets predicted GPA and Psychology course grade were informative; C1 Competence, N4 Self Consciousness and E5 Excitement Seeking were uniquely predictive of GPA, whereas A2 Straightforwardness, O5 Openness to Ideas, and O6 Openness to Values were uniquely predictive of Psychology course grade. For GPA, this indicates that believing in one's abilities, having feelings of social shyness or anxiety, and needing a low stimulation environment may predict higher overall academic performance, perhaps due to feeling more confident and comfortable within an academic environment than a social one. Conversely, for Psychology grades, this indicates that

being frank and honest, having intellectual curiosity, and being willing to re-evaluate one's own values may predict higher Psychology course grade performance. The only facet that predicted both GPA and Psychology grade was A3 Altruism, and this negative predictor indicated that being overly concerned for others' welfare may be detrimental to one's own academic performance at both a general and a specific level. It is possible that students with increased levels of selflessness may prioritise helping others understand course content to the detriment of their own coursework. The implications of the results involving facets for prediction are that GPA and specific course grades may require different predictors, particularly in terms of informing career counselling, and that using facets shown to significantly predict GPA may be less helpful when determining a student's career path rather than generalized academic potential. There is much to be gained by the further exploration of facets for prediction. Facets are shown to be increasingly promising predictors of behaviour, and in terms of practical application, they may prove to be simpler and more cost effective to assess if further research reliably unearths specific facets, or combinations of facets, tied to success in specific academic majors.

In line with previous research (De Fruyt & Mervielde, 1996; Krapić and Kuljanić, 2017; Lounsbury et al., 2003; Nye et al., 2017; Paunonen & Ashton, 2001a) the findings illustrate that individual differences beyond the Big Five can add significantly to the prediction of academic performance. Vocational interests were found to be predictive for both GPA and Psychology course grade. This is unsurprising because of vocational interests' direct impact upon goal directed behaviours, and subsequently, upon achievement (Holland, 1997; Nye et al., 2017). The significant variables were Realistic and Investigative interests; having less interest in practical, physical activities and more interest in scientific, theory-driven activities predicted higher GPA, and higher course grades in Psychology. Psychology is defined by its higher levels of Investigative, Social and Enterprising interests, which reflect its tripartite emphasis on analysis and research, helping people and social interaction, and social influence and motivation (Holland, 1997). Conversely, Psychology places less emphasis on the physical environment, and thus, upon Realistic interests. The findings for GPA additionally make sense in terms of the university environment as a whole; regardless of course;

attending an institution of tertiary education largely involves the preference for theoretical activities over practical ones.

The fifth finding was that comprehension and reasoning-based abilities predicted both academic performance variables, but that the fluency measures linked to GPA and Psychology course grade varied. Figural fluency predicted GPA, while verbal fluency predicted Psychology course grade. Shared predictors were Advanced Vocabulary, Letter Sets, and Nonsense Syllogisms; this indicates that higher verbal ability, inductive reasoning and logical reasoning - all of which are important abilities for achievement in general - predict higher overall GPA and higher Psychology grades, and suggests that non-verbal flexibility of thinking may be important overall in terms of academic performance, but that verbal flexibility is much more important to performance within Psychology. Rohde & Thompson (2007) found that although specific abilities did not predict academic performance beyond general cognitive ability, they were predictive of math-specific academic performance. Taken with the current findings, this suggests that narrow abilities may be predictive beyond *g* for specific course grades.

The sixth finding was that personal values were weakly predictive of Psychology course grade, and not predictive of overall GPA, indicating that the usefulness of these variables as predictors may depend on the specificity and measurement of academic performance utilized. Achievement was a shared predictor for both GPA and Psychology grade, suggesting that higher prioritisation of success and intention to demonstrate personal competence predict actual academic performance. Further, this finding supports previous research by Parks & Guay (2012). Self Direction was the only unique predictor found for Psychology course grade; placing higher priority upon freedom of thought and action predicted lower course grades, perhaps due to a conflict between desiring independence and the need to fulfil course requirements.

When comparing the predictive validity of the variables for overall GPA and Psychology grade, it can be seen that personality factors predicted 4% of the variance for GPA but were not significant predictors of Psychology grade. Personality facets predicted 10% of the variance for GPA and

Psychology grade, respectively. Vocational interests predicted 8% of the variance for GPA and 13% for Psychology grade. Cognitive abilities predicted 17% and 22%, respectively. Finally, values were not predictive of GPA, but contributed 10% of the variance for Psychology grade. These results demonstrate that variability is occurring between general academic performance, and academic performance within specific subjects, and between the different individual differences domains.

In summary for GPA, it was found that higher GPA can be predicted by increased levels of Conscientiousness, C1 Competence, N4 Self Consciousness, Investigative interests, Advanced Vocabulary, Letter Sets, Nonsense Syllogisms, Elaboration, and Achievement. It was also found that lower GPA can be predicted by increased levels of A3 Altruism, E5 Excitement Seeking, and Realistic interests.

In summary for Psychology course grade, it was found that higher Psychology grades can be predicted by increased levels of A2 Straightforwardness, O5 Openness to Ideas, O6 Openness to Values, Investigative interests, Advanced Vocabulary, Letter Sets, Nonsense Syllogisms, Word Beginnings, and Achievement. It was also found that lower Psychology grades can be predicted by increased levels of A3 Altruism, Realistic interests and Self Direction.

The current research has implications for improving career counselling advice within tertiary education. It compares four domains of individual differences which have previously not been utilized together and suggests methods of refining measures for career counselling. Firstly, the current research suggests that the inclusion of a range of narrow measures can provide greater specificity of advice for success in different academic majors. Secondly, the current research suggests that predicting whether a student will generally succeed in university is indicated by different variables than those that predict whether a student will succeed within a specific academic discipline, and therefore relevant measures should be selected with caution. It demonstrates that specific aspects of a wide selection of measures can be refined, and thus streamline and personalize career counselling assessment, while reducing costs and time. Further, it illustrates that the inclusion of personality facets is important for the prediction of academic

performance and suggests that values may be of importance for some academic disciplines. In general, this research suggests methods for improving current counselling assessment which may increase successful outcomes and well-being for students in need of career advice.

Limitations with the current research that need to be addressed are largely issues of practicality in terms of recruitment, test administration and data collection. Recruiting students to participate in a two and a half hour study is not without difficulty, and may influence the results with participant self-selection. Once recruited, test administration was lengthy and participant concentration may have waned. Future research could improve participant numbers, reduce selection bias and test fatigue with online administration. Further, a larger sample would allow for prediction of course grades for a wider range of majors than just Psychology, which would contribute significantly to this area of research. Data collection could also be improved; students were asked to self-report grades at the end of the semester, but the response rate was considerably lower than the number of initial participants. Future research should endeavour to work with universities in the collection of course grades.

3.6.1 Conclusions

These results support the findings that personality facets have better predictive validity than personality factors, suggesting that future studies should utilize facets, and potentially other narrow measures of individual differences. They further support Vedel, Thomsen & Larsen's (2015) findings that different variables were important for the prediction of GPA and Psychology grades and they show that different mechanisms appear to underpin the prediction of high and low academic achievement, as well as overall GPA and specific academic courses. The current research extends knowledge by including personality, vocational interests, cognitive abilities and personal values in the prediction of academic performance, and the results illustrate that individual differences domains are differential predictors of academic performance. Further, it suggests that values have some utility for the prediction of academic performance despite limitations. These results provide an exploration of the interactions between individual differences domains, academic performance,

and the level of measurement chosen. The implications of such findings are that the incorporation of measures of personality facets, vocational interests, cognitive abilities and personal values into current career counselling activities may both streamline the efficiency and improve the successfulness of a match between academically underperforming students and career paths that will satisfy their behavioural traits, interests, skills and principles and assist them with attaining increased academic grades, increased GPA, and successfully completing their degree, leading to increases in life satisfaction and QOL (Quality Of Life).

As such, the incorporation of measures of personality facets, vocational interests, and narrow cognitive abilities into current career counselling activities may both streamline the efficiency and improve the successfulness of a match between indecisive students and career paths that will satisfy their behavioural traits, interests, and skills and provide indecisive students with increased satisfaction regarding their career trajectory, as well as increased life satisfaction.

3.7 References

Ackerman, P. L., & Heggestad, E. D. (1997). Intelligence, personality, and interests: evidence for overlapping traits. *Psychological bulletin*, *121*(2), 219.

Ackerman, P. L., Kanfer, R., & Beier, M. E. (2013). Trait complex, cognitive ability, and domain knowledge predictors of baccalaureate success, STEM persistence, and gender differences. *Journal of Educational Psychology*, *105*(3), 911.

Allen, J., Robbins, S. B., Casillas, A., & Oh, I. S. (2008). Third-year college retention and transfer: Effects of academic performance, motivation, and social connectedness. *Research in Higher Education*, *49*(7), 647-664.

Armstrong, P. I., & Anthoney, S. F. (2009). Personality facets and RIASEC interests: An integrated model. *Journal of Vocational Behavior*, *75*(3), 346-359.

Berings, D., De Fruyt, F., & Bouwen, R. (2004). Work values and personality traits as predictors of enterprising and social vocational interests. *Personality and Individual Differences, 36*(2), 349-364.

Chamorro-Premuzic, T., & Furnham, A. (2008). Personality, intelligence and approaches to learning as predictors of academic performance. *Personality and individual differences*, *44*(7), 1596-1603.

Colom, R., Escorial, S., Shih, P. C., & Privado, J. (2007). Fluid intelligence, memory span, and temperament difficulties predict academic performance of young adolescents. *Personality and Individual differences, 42*(8), 1503-1514.

Costa, P. T. J., & McCrae, R. (1992). *Revised NEO Personality Inventory.* Odessa, Fl.: Psychological Assessment Resources Inc.

Deary, I. J., Strand, S., Smith, P., & Fernandes, C. (2007). Intelligence and educational achievement. *Intelligence*, *35*(1), 13-21.

De Fruyt, F., & Mervielde, I. (1996). Personality and interests as predictors of educational streaming and achievement. *European Journal of Personality*, *10*(5), 405-425.

Ekstrom, R. B., French, J. W., Harman, H. H., & Dermen, D. (1976). Manual for kit of factor-referenced cognitive tests. *Princeton, NJ: Educational testing service*.

Ekstrom, R. B., French, J. W., & Harman, H. H. (1979). Cognitive factors: Their identification and replication. *Multivariate Behavioral Research Monographs*

Fonteyne, L., Duyck, W., & De Fruyt, F. (2017). Program-specific prediction of academic achievement on the basis of cognitive and non-cognitive factors. *Learning and Individual Differences*, *56*, 34-48.

Holland, J. L. (1997). *Making vocational choices: A theory of vocational personalities and work environments.* Psychological Assessment Resources.

Holland, J. L., Shears, M., & Harvey-Beavis, A. (2001). *Self Directed Search Australian Manual* (Second Australian Edition ed.). Melbourne: ACER Press.

Komarraju, M., Karau, S. J., Schmeck, R. R., & Avdic, A. (2011). The Big Five personality traits, learning styles, and academic achievement. *Personality and individual differences*, *51*(4), 472-477.

Krapić, N., & Kuljanić, P. (2017). Intelligence, Personality Traits and Vocational Interests as Predictors of School Achievement. *Psihologijske teme*, *26*(2), 431-450.

Lounsbury, J. W., Huffstetler, B. C., Leong, F. T., & Gibson, L. W. (2005). Sense of identity and collegiate academic achievement. *Journal of College Student Development, 46*(5), 501-514.

Lounsbury, J. W., Sundstrom, E., Loveland, J. M., & Gibson, L. W. (2003). Intelligence, "Big Five" personality traits, and work drive as predictors of course grade. *Personality and Individual Differences*, *35*(6), 1231-1239.

McAbee, S. T., Oswald, F. L., & Connelly, B. S. (2014). Bifactor models of personality and college student performance: A broad versus narrow view. *European Journal of Personality*, *28*(6), 604-619.

Noftle, E. E., & Robins, R. W. (2007). Personality predictors of academic outcomes: big five correlates of GPA and SAT scores. *Journal of personality and social psychology*, *93*(1), 116.

Nye, C. D., Su, R., Rounds, J., & Drasgow, F. (2017). Interest congruence and performance: Revisiting recent meta-analytic findings. *Journal of Vocational Behavior*, *98*, 138-151.

O'Connor, M. C., & Paunonen, S. V. (2007). Big Five personality predictors of post-secondary academic performance. *Personality and Individual differences*, *43*(5), 971-990.

Parks, L., & Guay, R. P. (2012). Can personal values predict performance? Evidence in an academic setting. *Applied psychology*, *61*(1), 149-173.

Paunonen, S. V., & Ashton, M. C. (2001a). Big Five predictors of academic achievement. *Journal of Research in Personality, 35*(1), 78-90.

Paunonen, S. V., & Ashton, M. C. (2001b). Big five factors and facets and the prediction of behavior. *Journal of personality and social psychology*, *81*(3), 524.

Pipere, A., & Mieriņa, I. (2017). Exploring non-cognitive predictors of mathematics achievement among 9th grade students. *Learning and Individual Differences*, *59*, 65-77.

Pozzebon, J. A., Ashton, M. C., & Visser, B. A. (2014). Major changes: Personality, ability, and congruence in the prediction of academic outcomes. *Journal of Career Assessment*, *22*(1), 75-88.

Rikoon, S. H., Brenneman, M., Kim, L. E., Khorramdel, L., MacCann, C., Burrus, J., & Roberts, R. D. (2016). Facets of conscientiousness and their differential relationships with cognitive ability factors. *Journal of Research in Personality*, *61*, 22-34.

Rohde, T. E., & Thompson, L. A. (2007). Predicting academic achievement with cognitive ability. *Intelligence, 35*(1), 83-92.

Schwartz, S. H. (1992). Universals in the content and structure of values: Theoretical advances and empirical tests in 20 countries. *Advances in experimental social psychology*, *25*, 1-65.

Schwartz, S. H., Melech, G., Lehmann, A., Burgess, S., Harris, M., & Owens, V. (2001). Extending the

cross-cultural validity of the theory of basic human values with a different method of measurement. *Journal of cross-cultural psychology*, *32*(5), 519-542.

Strahan, S., & Credé, M. (2015). Satisfaction With College Re-Examining Its Structure and Its Relationships with The Intent to Remain in College and Academic Performance. *Journal of College Student Retention: Research, Theory & Practice*, *16*(4), 537-561.

Stankov, L. (2009). Conservatism and cognitive ability. *Intelligence*, *37*(3), 294-304.

Vandenberg, S. G., & Kuse, A. R. (1978). Mental rotations, a group test of three-dimensional spatial visualization. *Perceptual and motor skills*, *47*(2), 599-604.

Vedel, A. (2014). The Big Five and tertiary academic performance: A systematic review and meta-analysis. *Personality and Individual Differences*, *71*, 66-76.

Vedel, A., Thomsen, D. K., & Larsen, L. (2015). Personality, academic majors and performance: Revealing complex patterns. *Personality and Individual Differences*, *85*, 69-76.

Wittmann, W. W., & Süß, H. M. (1999). Investigating the paths between working intelligence, knowledge, and complex problem-solving performances via Brunswik symmetry.

3.8 Contextual Statement: Study 2 to Study 3

The second study aimed to examine variables of relevance for predicting academic performance. This involved the usage of personality factors and facets in addition to vocational interests, cognitive abilities and values for the prediction of overall GPA and psychology course grades. Having established that these independent variables were predictive yet diverse, with some variables only predictive of GPA or psychology course grade, and some predictive of both, the third study's aim was to further examine the breadth and interactions of these individual differences variables in greater combination than has previously been utilised. Namely, the next step in the project was to examine the factor structure of personality factors, vocational interests, cognitive abilities and values in combination, and in an exploratory way use any emergent factor scores as predictors of academic satisfaction and academic performance.

Chapter 4: Dimensions of Individual Differences and the prediction of Academic Performance and Academic Satisfaction

4.1 Statement of Authorship

Statement of Authorship

Title of Paper	Dimensions of individual differences and the prediction of academic performance and academic satisfaction.
Publication Status	☐ Published ☐ Accepted for Publication ☐ Submitted for Publication ☑ Unpublished and Unsubmitted work written in manuscript style
Publication Details	

Principal Author

Name of Principal Author (Candidate)	Annamaria R. Quaresima		
Contribution to the Paper	Designed the study, compiled the test battery, designed the satisfaction survey, collected the data, analysed and interpreted data, and wrote the manuscript.		
Overall percentage (%)	80%		
Certification:	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.		
Signature		Date	11/08/2020

Co-Author Contributions

By signing the Statement of Authorship, each author certifies that:

i. the candidate's stated contribution to the publication is accurate (as detailed above);
ii. permission is granted for the candidate in include the publication in the thesis; and
iii. the sum of all co-author contributions is equal to 100% less the candidate's stated contribution.

Name of Co-Author	Dr. Neil Kirby		
Contribution to the Paper	Supervised work, assisted in study design, reviewed and edited manuscript.		
Signature		Date	31/08/2020

Name of Co-Author	Dr. Aspa Sarris		
Contribution to the Paper	Supervised work, assisted in study design, reviewed and edited manuscript.		
Signature		Date	27/08/2020

Please cut and paste additional co-author panels here as required.

4.2 Abstract

The prediction of academic performance and academic satisfaction have long been considered important – however, the extent to which multiple individual differences domains may be predictive of academic performance has not been fully explored, whilst academic satisfaction is still an under-researched field. In the current study, 358 undergraduate psychology students completed a test battery of personality, vocational interests, cognitive abilities and values along with academic satisfaction. Course grades and grade point average (GPA) were collected at the end of the semester. Ten oblique factors were extracted from an exploratory factor analysis (EFA), and the factor scores were used to predict 18.4% of the variance in psychology course grade, 14.6% of the variance in overall GPA and 10% of the variance in academic satisfaction. The results demonstrate the utility of integrating multiple individual differences domains. Future research should examine whether personality facets might further improve the prediction of academic performance and satisfaction, and consequent counselling advice provided to university students.

Keywords

Academic performance; Academic satisfaction; Big Five; Vocational interests; Cognitive abilities; Values;

4.3 Introduction

The prediction of academic performance and academic satisfaction in tertiary education are two related areas of research that have important implications for student counselling, wellbeing and positive life outcomes (Lounsbury, Saudargas, Gibson & Leong, 2005; Strahan & Crede, 2015). Further, when academic performance is poor or academic dissatisfaction is high, students are likely to change majors, or simply drop out from the academic course (Allen, Robbins, Casillas & Oh, 2008; Pozzebon, Ashton & Visser, 2014; Wolniak & Pascarella, 2005). The implications of discarding a course or enrolling in a new course are wasted time and resources for both the individual and the educational institution.

Academic performance and academic satisfaction are both related to student wellbeing and positive life outcomes, but only weakly related to each other (Logue, Lounsbury, Gupta, & Leong, 2007). Many studies have examined the prediction of academic performance (Chamorro-Premuzic & Furnham, 2008; O'Connor & Paunonen, 2007) but few have examined narrow stratum cognitive abilities, and it is only recently that research has examined multiple individual differences domain predictors of academic performance with a focus on areas other than ability (Lounsbury, Sundstrom, Loveland & Gibson, 2003; Vedel, 2014; Vedel, Thomsen & Larsen, 2015). Further, academic satisfaction has had comparatively little research compared to academic performance, yet it would appear to be an important factor in determining whether students remain in an academic course (Logue et al., 2007).

It has generally been acknowledged that multiple individual differences domains are required for increasing prediction and constructing informative models for vocational guidance, yet there is still much room for improvement (Logue et al., 2007). Personality, vocational interests, cognitive abilities and values in combination may potentially predict academic outcomes. Currently, however, personality, vocational interests and cognitive abilities research focuses on different approaches to individual differences; personality research emphasises behaviour across all environments, vocational interests research emphasises the interaction of interests and environment, and

cognitive abilities research is split between the two (Volodina, Nagy & Köller, 2015). Additionally, personal values research takes a similar approach to personality, emphasising value priorities across all environments. Although much research focuses on single domain prediction, the literature suggests there are persistent interrelationships. As such, single domain prediction might have limited validity in the context of further relevant domains that are left unexplored (Volodina et al., 2015).

Personality appears to be a unifying domain of individual differences; research shows that it has relationships with vocational interests (De Fruyt & Mervielde, 1997; Harris, Vernon, Johnson & Jang, 2006; Larson, Rottinghaus & Borgen, 2002), cognitive abilities (DeYoung, Quilty, Peterson, & Gray, 2014; Lechner, Danner & Rammstedt, 2017; Rammstedt, Danner & Martin, 2016), and personal values (Douglas, Bore & Munro, 2016; Parks & Guay, 2009; Parks-Leduc, Feldman & Bardi, 2015; Roccas, Sagiv, Schwartz & Knafo, 2002). Further, smaller relationships have been found between vocational interests and cognitive abilities (Robertson, Smeets, Lubinski & Benbow, 2010; Ackerman & Heggestad, 1997), and between vocational interests and personal values (Sagiv, 2002), while there has been limited correlational research using cognitive abilities and personal values. One of the few studies to include both domains found that personality and general cognitive ability were independently correlated with the behaviour of career counselling clients, and values were able to explain unique variance in the prediction of behaviour – over the inclusion of ability (Sagiv & Schwartz, 2004). The significant yet often modest relationships found between these four individual differences domains suggests that a structure of latent factors may exist, and that these individual differences domains are dispersed between the latent variables, with various levels of relationship.

In terms of predicting academic performance, numerous studies have utilised cognitive abilities (for example, Deary, Strand, Smith & Fernandes, 2007), and many studies have used multiple individual differences domains, but no studies have examined the extent to which cognitive abilities, personality, vocational interests, and values in combination predict academic performance. O'Connor and Paunonen's (2007) meta-analysis established that Conscientiousness, Extraversion and Openness to Experience are most commonly predictive of academic performance, whilst

Chamorro-Premuzic & Furnham (2008) explained 40% of the variance when using personality factors, learning approach styles and cognitive abilities. Rothstein, Paunonen, Rush and King (1994) found that personality and cognitive abilities were predictive of different criterion measures of academic performance. Vedel et al.'s (2015) prediction of academic performance from personality in various subject disciplines found that personality factors were able to predict 5-15% of the variance in GPA. Brunswik's theory posits that using narrow variables that correspond more closely to the level of measurement of the dependent variables might improve predictive validity (Wittmann, & Süß, 1999), and other researchers (Ackerman, Kanfer, & Beier, 2013; Vedel et al., 2015) further suggested that this might be usefully applied to the prediction of academic outcomes. A meta-analysis by Nye, Su, Rounds and Drasgow (2012) demonstrated persistent relationships between vocational interests and academic performance in general, in addition to academic persistence within a degree. Parks and Guay (2012) found that values could predict academic performance beyond the contribution of the Big Five personality factors. In line with established findings, the three domain study by Pozzebon et al. (2014) found that GPA was predicted by Conscientiousness and cognitive abilities, but not by vocational interests. Additionally, Schmidt (2014) proposed a theoretical model based on the findings of four previous studies. They suggested that academic performance in any given area was directly influenced by Conscientiousness, relevant vocational interests and crystallized cognitive abilities.

In terms of academic satisfaction, few studies have examined the predictors of academic satisfaction whilst utilising more than two individual differences domains, and no studies have examined values as a potential predictor. Volodina et al. (2015) found that personality and vocational interests were predictive of academic satisfaction, but that cognitive abilities were not predictive. Pozzebon et al. (2014) additionally examined personality, cognitive abilities and vocational interests as predictors of academic satisfaction and found that personality and abilities explained 6% of the variance, but that vocational interests did not explain any additional variance. Previously, Logue et al. (2007) had examined personality and vocational interests as predictors of

academic satisfaction. They found that 49% of the variance could be explained with Realistic interests, Neuroticism, Extraversion and Conscientiousness as significant predictors.

Studies such as Vedel et al. (2015) and De Fruyt and Mervielde (1997) demonstrate that participants within specific majors or disciplines can differ greatly in their individual differences, and that the predictive validity for academic outcomes using individual differences can subsequently differ. To date, no study has examined personality, vocational interests, cognitive abilities and values in combination as predictors of academic satisfaction. Nor has any study attempted to use factor analysis to determine whether particular combinations of all four of these variables might improve prediction.

Ackerman & Heggestad (1997) performed a meta-analysis of the literature for personality, vocational interests and cognitive abilities, and suggested the existence of four latent trait complexes (Social, Clerical/Conventional, Science/Math, Intellectual/Cultural) within a hierarchical structure. Using all possible variables for prediction can lead to an overfitted model with redundant predictors. Further, factor scores are ideal for condensing a large number of related variables for streamlined prediction. Within the constraints of a sample drawn entirely from the discipline of psychology, the current study aimed to address this gap by investigating the extent to which exploratory factor analysis could be used with the Big Five personality factors of the NEO-PI-R (Costa & McCrae, 1992), Holland's vocational interests (Holland, 1997), cognitive abilities drawn from the Educational Testing Service Kit of Factor Referenced Cognitive Tests (Ekstrom, French, Harman & Dermen, 1976), and Schwartz's basic human values (Schwartz & Bardi, 2001) to identify factors as improved predictors of academic performance and academic satisfaction.

Based on the modest but significant correlations between all the individual differences domains, it was hypothesized that (a) a latent structure of individual differences will arise, in which the individual differences groups are somewhat equally divided between the factors, rather than clustered within specific factor dimensions. It was also hypothesized that factor scores arising from

these factor dimensions will be predictive of (b) academic performance and (c) academic satisfaction within psychology.

4.4 Methods

4.4.1 Participants

Participants were 358 undergraduate psychology students at an Australian university. The mean age was 20.5 years (SD=5.56, range 16-53), 255 were female. Most participants (321) were first year undergraduates, who received partial course credit for participation (22 were second year undergraduates, 15 were third year).

4.4.2 Measures

4.4.2.1 Personality

The NEO Personality Inventory Revised (NEO-PI-R, Costa & McCrae, 1992) measures "Big Five" domains of personality on five separate factors, each containing six facets. These factors are Neuroticism, Extraversion, Openness, Agreeableness and Conscientiousness. The NEO-PI-R uses 240 self-report items to measure the factors on a five point Likert scale. Good construct validity and reliability for each of the factors has been documented (Costa and McCrae, 1992).

4.4.2.2 Vocational Interests

The Self Directed Search Second Australian Edition (SDS-R; Holland, Shears & Harvey-Beavis, 2001) measures Holland's hexagonal theory of vocational interests for an Australian population. The SDS uses 228 self-report items, each with four subscales, to measure six vocational interest scales comprising Realistic, Investigative, Artistic, Social, Enterprising, and Conventional interests using a 7 point Likert scale and forced choice response. The manual provides good reliabilities for an Australian sample ranging from .87 to .91 and research by Holland et al. (2001) supports the validity of the SDS-R.

4.4.2.3 Cognitive Abilities

4.4.2.3.1 ETS Kit of Factor Referenced Cognitive Tests

The ETS Kit of Factor Referenced Cognitive Tests (Ekstrom et al., 1976) measures cognitive ability through a test battery of 72 individual measures. These largely correspond to the Cattell-Horn-Carroll theory's (McGrew, 2009) Stratum I narrow abilities. Tests range from timed conditions to free response, and the battery has moderate reliability and validity when used in research settings (Ekstrom, French & Harman, 1979). Nine tests were chosen to encompass the broader Stratum II groupings of Fluid Reasoning (*Gf*), Long Term Storage & Retrieval (*Glr*), Comprehension-Knowledge (*Gc*), Visual Processing (*Gv*), and Processing Speed (*Gs*). These were: Letter Sets (Induction) and Nonsense Syllogisms (Logical reasoning) to measure Fluid Reasoning (*Gf*), Word Beginnings (Word Fluency) and Elaboration (Figural Fluency) to measure Long Term Storage & Retrieval (*Glr*), Number Comparison (Perceptual Speed) and Subtraction & Multiplication (Number) to measure Processing Speed (*Gs*), Incomplete Words (Verbal Closure) and Hidden Patterns (Flexibility of Closure) to measure Visual Processing (*Gv*), and Advanced Vocabulary II (Verbal Comprehension) to measure Comprehension-Knowledge (*Gc*).

4.4.2.3.2 The Vandenburg Mental Rotation Test

The Vandenburg Mental Rotation Test (Vandenburg & Kuse, 1978) is an independent measure of 3D mental rotation with good validity and reliability. It was chosen to align with the Stratum II grouping of Speeded Rotation (SR).

4.4.2.4 Values

The Schwartz Values Survey (SVS, Schwartz & Bardi, 2001) is a measure of Schwartz' Theory of Basic Human Values with moderate reliability and good validity in a range of countries (Kusurkar & Croiset, 2015). It uses 56 self-report items rated on a nine-point Likert scale to measure ten personal value priorities, grouped into four broad motivational orientations on a circumplex

structure. These are: Conformity, Tradition and Security (Conservation), Benevolence and Universalism (Self-Transcendence), Self Direction and Stimulation (Openness to Change), Hedonism, Performance, and Power (Self-Enhancement).

4.4.2.5 Academic Performance

Academic Performance was measured through undergraduate psychology course grades, and through an unweighted GPA based on all undergraduate courses undertaken at the time of testing. Australia's tertiary grading system consists of course marks between 0-100. Category distinctions in the grading system are made between Fail (1-49), Pass (50-64), Credit (65-74), Distinction (75-84) and High Distinction (85-100).

Psychology course grades and GPA were gathered through student self-reports. Psychology grades comprised the numeric grades for undergraduate psychology, whilst overall GPA comprised the unweighted average of the numeric grades for all courses undertaken in the semester.

4.4.2.6 Academic Satisfaction

A three item measure of Academic Satisfaction (AcSat) was utilised to capture abstract academic satisfaction in a tertiary setting via student interest, enjoyment and valuation of an academic course. The three items were rated on a five-point Likert scale ("strongly disagree", "disagree", neither agree nor disagree", "agree", and "strongly agree"), and the mean score was used as the total AcSat score. The scale reliability (Cronbach's α) was .81. Item anchors were "Boring - Interesting", "Not Fun - Enjoyable" and "Worthless - Worth Learning".

4.4.2.7 Demographics

Participants reported gender, age, year level of their undergraduate degree, and all courses that they were enrolled in for the semester.

4.4.3 Procedure

Participants booked a testing session on the university's research participation website from a range of timeslots. Each testing session had a minimum of 1 participant in order to be run, and a maximum booking potential of 30 participants per session. Participants were informed of the purpose of the study, that their participation was voluntary, that they could withdraw from the study at any time, and that only group results would be reported. The test battery took 2 hours and 30 mins for a participant to complete. Administration took place in a classroom testing situation; an instructor was present to provide information sheets, collect consent forms for participation, read out instructions for the self-report measures, time the cognitive ability measures and inform participants of time limits, and further answer any queries. First year participants were given partial course credit immediately after the session, and participants were entered into a draw with the chance to receive one of 5 $100 prizes, approved by the Research Ethics Committee. Grades were collected at the end of semester.

4.5 Results

4.5.1 Factor Analysis

An exploratory factor analysis with oblique rotation was performed on the individual differences data from 328 participants (Initial data= 358, missing data=30). The KMO coefficient was .73. Principal Axis Factoring extraction was used with Promax rotation, and the Kaiser criterion and scree plot, along with general interpretability of the data, were used to decide upon a ten-factor solution that explained 50.20% of the variance. Rather than a simple structure, large cross-loadings were retained due to the clear interpretability and relevance within individual factors. The EFA and resulting ten factor structure are presented in Table 14. For descriptive statistics, see Table 2.

Table 14: Pattern matrix for 10 factor EFA using PAF extraction and Promax rotation

	Factors									
	1	2	3	4	5	6	7	8	9	10
Conformity	**.962**	.080	-.104	-.022	.055	-.059	-.009	-.034	.105	.097
Tradition	**.910**	-.066	.045	-.026	.109	-.199	.014	-.085	-.038	.089
Security	**.615**	-.018	.099	-.033	-.216	.101	.053	-.004	.053	-.049
Nonsense Syllogisms	-.233	.103	.002	.084	.106	-.018	.147	-.042	.184	-.009
Incomplete Words	.144	**.704**	-.132	.016	.108	.058	.017	-.123	-.060	.049
Word Beginnings	.002	**.658**	.011	-.003	-.029	-.058	.042	.042	-.072	-.013
Advanced Vocabulary II	-.128	**.605**	.105	-.090	-.070	-.079	-.197	.035	-.009	-.057
Self Direction	-.062	-.061	**.829**	-.031	-.073	.225	.004	.173	-.102	.064
Universalism	.241	-.061	**.666**	-.019	.204	.058	.075	.006	.061	-.042
Openness to Experience	-.170	.261	**.550**	.117	.098	.059	-.107	-.041	.066	.182
Enterprising interests	.041	.051	-.053	**.771**	-.281	.022	-.063	.155	.036	-.104
Social interests	-.111	-.103	.112	**.698**	.297	-.081	.049	-.055	-.064	-.286
Artistic interests	.006	.006	**.384**	**.435**	-.136	-.142	-.040	-.219	-.004	.122
Agreeableness	.129	.022	.060	.010	**.731**	-.060	.007	.088	-.001	-.108
Power	.258	-.027	.064	.092	**-.616**	.118	.107	-.041	-.084	-.035
Benevolence	**.396**	-.040	.241	.035	**.449**	.122	.027	-.007	-.005	-.094

Stimulation	-.067	.043	.152	-.048	-.007	**.664**	-.055	-.138	.091	.059
Hedonism	-.153	-.174	.120	-.045	-.216	**.601**	.081	-.188	.066	-.148
Extraversion	.007	-.077	-.146	**.404**	.147	**.465**	-.027	.107	-.087	.295
Achievement	**.325**	.180	.097	-.016	-.090	**.415**	-.086	.139	-.027	-.134
Number Comparison	.035	-.022	-.080	.009	.003	.021	**.683**	-.010	-.031	.095
Subtraction & Multiplication	.008	-.056	.105	-.001	-.078	-.075	**.663**	.116	-.086	-.018
Letter Sets	-.082	.317	-.037	-.071	.071	.089	**.412**	-.040	.088	.115
Neuroticism	.130	.158	-.091	-.006	-.098	.130	-.028	**-.732**	-.142	-.168
Conscientiousness	.090	.122	-.006	.101	.141	-.110	-.018	**.618**	.003	-.153
Elaboration	-.081	.015	.119	-.007	-.079	-.108	.233	**.384**	-.118	.086
Investigative interests	-.053	.025	-.050	-.113	.141	.216	.027	.058	**.673**	-.033
Realistic interests	.176	-.148	-.021	.137	-.064	-.046	-.154	.029	**.661**	.121
Conventional interests	-.045	.082	-.072	**.513**	-.064	-.034	.121	.008	.174	**-.567**
Mental Rotation	.061	-.017	.094	-.186	-.195	-.053	.047	.096	.273	**.540**
Hidden Patterns	.066	.185	.014	.051	-.071	-.043	.286	.011	.045	**.438**

Loadings >.32 are bolded. 1 = *Conforming Values*, 2 = *Verbal Ability*, 3 = *Independent Values*, 4 = *Interaction Interests*, 5 = *Personable Behaviour*, 6 = *Sensation Seeking*, 7 = *Speeded Numeric Ability*, 8 = *Stable Competence*, 9 = *Conceptual Interests*, 10 = *Cognitive Flexibility*.

The first factor *Conforming Values* demonstrated high loadings on Schwartz values from the Conservation grouping, but also draws upon values from the Self-Enhancement and Self-

Transcendence groupings. This factor would appear to involve value priorities that conform to societal norms.

The second factor *Verbal Ability* comprised varied cognitive abilities that range from fluency and flexibility of closure to crystallized knowledge but are unified by their verbal measurement.

Independent Values as the third factor had loadings upon values, personality and vocational interests, and its highest loadings were values within the Openness to Change and Self-Transcendence groupings. It appears to be defined by variables that draw upon independent choice and openness to choices.

The fourth factor *Interaction Interests* was defined by loadings upon vocational interests and personality traits that involve a preference for social interaction.

The fifth factor, *Personable Behaviour*, involved loadings on personality and values that were unified by a preference for socially pleasant and non-assertive behaviour.

Sensation Seeking was defined as the sixth factor by values and personality traits that involve preferences for stimulation.

The seventh factor *Speeded Numeric Ability* involved loadings upon varied cognitive abilities that range from basic numeric ability and perceptual speed to fluid reasoning but were linked by their speeded, numeric measurement. The word "Numeric" was included in the label due to the higher loadings of the numeric abilities within the factor.

Stable Competence as the eighth factor had loadings on personality traits and cognitive ability and appeared to be a factor that unified emotional stability with subsequent accomplishment. It is believed that this factor's negative loading on Elaboration demonstrated an inhibitory effect on creativity for highly neurotic individuals and is present as a link between lack of Neuroticism and the competence involved in Conscientiousness.

Conceptual Interests was a factor defined by two high loadings on vocational interests and appears to involve a preference for practical and theoretical concepts over social interaction.

The tenth factor was *Cognitive Flexibility*, and it involved high loadings on vocational interests and cognitive abilities. It involves a preference for unconventional interests, and perceptual flexibility of closure. Correlations between the extracted factors are shown in Table 15.

Table 15: Inter-factor correlations from the ten factor EFA with Promax rotation

	1	2	3	4	5	6	7	8	9	10
1. Conforming Values	1.0									
2. Verbal Ability	**-.40**	1.0								
3. Independent Values	.10	.15	1.0							
4. Interaction Interests	.13	-.01	.11	1.0						
5. Personable Behaviour	-.06	.19	.08	.11	1.0					
6. Sensation Seeking	**.34**	-.08	.12	**.32**	-.07	1.0				
7. Speeded Numeric Ability	.14	.17	-.06	-.03	-.21	-.09	1.0			
8. Stable Competence	**.39**	-.03	-.19	.17	-.07	**.42**	.07	1.0		
9. Conceptual Interests	-.17	.23	**.45**	.06	-.02	-.07	.16	-.09	1.0	
10. Cognitive Flexibility	**-.50**	.28	-.08	.22	.27	-.02	-.12	-.16	.13	1.0

Correlations >.30 bolded.

As can be seen in Table 15, very weak to moderate correlations were found between the factor scores. The *Conforming Values* factor was positively related to increases in *Sensation Seeking* and *Stable Competence*, and negatively related to *Verbal Ability*. Further, *Sensation Seeking* and *Stable Competence* were themselves related. *Conforming Values* and its relationship with *Stable Competence* could be explained by the highest loadings relating to the Conservation grouping

within the Theory of Basic Universal Values (Schwartz, 1992; Schwartz & Bardi, 2001), and the negative relationships with *Verbal Ability* and *Cognitive Flexibility* explained by Stankov's (2009) findings on Conservatism and cognitive abilities. The negative relationships between *Conforming Values* with *Verbal Ability* and *Cognitive Flexibility* suggest that Conservation values by their nature are in opposition to the fluency of ideas and flexible thinking involved in high performance on measures of cognitive ability. It is an interesting parallel to Calogero, Bardi, & Sutton's (2009) finding of a positive relationship between the Conservation values grouping (Conformity, Tradition, Security) and the personality-based concept of Need for Cognitive Closure. The relationship with *Sensation Seeking* is less apparent but strengthened by its own relationship with *Stable Competence*. *Independent Values* had a moderate, positive correlation with *Conceptual Interests*, and *Interaction Interests* had a weak positive correlation with *Sensation Seeking*. Theoretically, *Independent Values* and *Conceptual Interests* are linked by their preference for thinking for oneself and being open to a range of ideas, whilst *Interaction Interests* and *Sensation Seeking* are linked by their preference of social stimulation.

4.5.2 Regression

Hierarchical regression was performed to identify the predictors of psychology course grade, overall GPA, and academic satisfaction with psychology, while taking into account possible effects of age and gender, which were entered into the first step to control for potential intra-sample differences. Table 16 contains the three hierarchical regressions.

Table 16: Multiple regressions using the ten factor scores to predict psychology grade, GPA and academic satisfaction with psychology

Psychology Grade								
Step and Predictors		β	*T*	sr^2	R^2	aR^2	ΔR^2	ΔF
1	Age	-.008	-.135	.000	.050	.042	.050	6.423**
	Gender	.224	3.577***	**.050**				
2	Age	-.076	-1.183	.004	.224	.184	.174	5.225***
	Gender	.200	2.718**	**.024**				
	Conforming Values	-.208	-2.102*	**.014**				
	Verbal Ability	.288	3.661***	**.044**				
	Independent Values	-.139	-1.554	.008				
	Interaction Interests	-.085	-1.195	.004				
	Personable Behaviour	.138	1.903	**.012**				
	Sensation Seeking	.122	1.489	.007				
	Speeded Numeric Ability	.052	.718	.001				
	Stable Competence	.103	1.285	.005				
	Conceptual Interests	.103	1.188	.004				
	Cognitive Flexibility	-.178	-2.040*	**.013**				
GPA								
Step and Predictors		β	*T*	sr^2	R^2	aR^2	ΔR^2	ΔF
1	Age	.010	.165	.000	.022	.014	.022	2.685
	Gender	.147	2.315*	**.021**				
2	Age	-.059	-.899	.002	.188	.146	.166	4.760***
	Gender	.103	1.365	.006				

	Conforming Values	-.195	-1.925	**.012**
	Verbal Ability	.214	2.660**	**.024**
	Independent Values	-.039	-.430	.000
	Interaction Interests	-.069	-.954	.003
	Personable Behaviour	.167	2.241*	**.017**
	Sensation Seeking	-.006	-.072	.000
	Speeded Numeric Ability	.135	1.813	**.011**
	Stable Competence	.234	2.860**	**.028**
	Conceptual Interests	.001	.013	.000
	Cognitive Flexibility	-.081	-.904	.002

Academic Satisfaction

Step and Predictors		β	*T*	sr^2	R^2	aR^2	ΔR^2	ΔF
1	Age	.162	2.748**	**.026**	.033	.026	.033	4.785**
	Gender	.091	1.545	.008				
2	Age	.099	1.574	.007	.139	.100	.106	3.273***
	Gender	-.055	-.764	.001				
	Conforming Values	-.089	-.914	.002				
	Verbal Ability	-.070	-.883	.002				
	Independent Values	.244	2.741**	**.024**				
	Interaction Interests	.198	2.873**	**.026**				
	Personable Behaviour	.110	1.516	.007				
	Sensation Seeking	-.216	-2.631**	**.022**				
	Speeded Numeric Ability	-.040	-.539	.000				

Stable Competence	.181	2.270*	**.016**
Conceptual Interests	-.244	-2.846**	**.026**
Cognitive Flexibility	-.110	-1.270	.005

*p<.05, **p<.01, ***p<.001.

Verbal Ability, Conforming Values (negative predictor), and *Cognitive Flexibility* (negative predictor) significantly predicted 18.4% of the variance in psychology grade in the second step $F(12,233)=5.611$, $p<.001$, along with gender, which was still a significant predictor beyond the addition of the factor scores, showing that females received higher psychology grades than males. The factor scores demonstrate that having higher levels of verbal ability, holding fewer traditional values, and lower levels of unconventional, visual flexibility were positively related to higher psychology grades.

Stable Competence, *Verbal Ability*, and *Personable Behaviour* significantly predicted 14.6% of the variance in GPA in the second step $F(12,233)=4.484$, $p<.001$. The factor scores demonstrate that higher levels of emotional stability and conscientiousness-based behaviour, along with higher levels of verbal ability and increased friendly sociability were positively related to higher overall GPA.

Independent Values, *Conceptual Interests* (negative predictor), *Sensation Seeking* (negative predictor), *Interaction Interests* and *Stable Competence* predicted 10% of the variance in academic satisfaction with the psychology course in the second step $F(12, 267)=3.591$, $p<.001$. The factor scores showed that higher valuation of independence and choice, lower levels of practical and theoretical interests, lower need for continual stimulation, more interest in socially interactive behaviour, emotional stability and sense of competency were positively related to increased satisfaction with the psychology course content.

Table 17 displays the spread of factor scores between the dependent variables.

Table 17: Relevant factor scores for prediction of psychology grade, GPA and academic satisfaction with psychology

	Psychology Grade	GPA	Academic Satisfaction
Conforming Values	-		
Verbal Ability	+	+	
Independent Values			+
Interaction Interests			+
Personable Behaviour		+	
Sensation Seeking			-
Speeded Numeric Ability			
Stable Competence		+	+
Conceptual Interests			-
Cognitive Flexibility	-		

+ = positive relationship, - = negative relationship

4.6 Discussion

The current study aimed to investigate whether factors identified by exploratory factor analysis from ability, personality, vocational interests and values measures might be used to successfully predict academic performance and satisfaction outcomes. In line with the first hypothesis, a ten factor structure was extracted, with clear, interpretable factors after rotation, and the factor structure demonstrated dispersion of the individual differences domains throughout the factors. Five of the ten factors involved variables from more than one of the individual differences domains; factors were found that loaded upon personality and vocational interests, personality and values, personality and cognitive ability, vocational interests and cognitive abilities, with one factor loading upon values, personality and vocational interests.

The results are supported by consistent findings in the literature of low to moderate yet significant relationships, and the unique variance that these domains have been found to demonstrate in prediction (Ackerman & Heggestad, 1997; Parks-Leduc et al., 2015; Sagiv, 2002; Volodina et al., 2015). The only domain combination that did not emerge within the ten factors was that of cognitive abilities and personal values. This is unsurprising considering the dearth of research on the relationship between the two. However, the fact that both were included within independent, significantly predictive factors supports research finding that values could explain variance over abilities, and that abilities could explain variance over values within specific academic courses (Sagiv & Schwartz, 2004).

In comparison to Ackerman & Heggestad's (1997) four trait complexes, it was found that *Interaction Interests* was directly comparable with the Social trait complex due to its inclusion of Enterprising interests, Social Interests, and Extraversion. When *Speeded Numeric Ability*, *Stable Competence* and *Cognitive Flexibility* are considered together in terms of their variables (Number Comparison, Conscientiousness, Conventional interests, Mental Rotation) they align rather closely with Clerical/Conventional. Additionally, the trait complex structure shares similarities with the current findings; there is overlap between the neighbouring complexes of Clerical/Conventional and

Science/Math that corresponds to overlap between the variables *Speeded Numeric Ability*/*Stable Competence/Cognitive Flexibility* with *Conceptual Interests/Cognitive Flexibility* (Investigative interests, Realistic interests, Mental Rotation). Intellectual/Cultural also appears similar to the two factors of *Verbal Ability* and *Independent Interests* (Incomplete Words, Word Beginnings, Advanced Vocabulary II, Openness to Experience, Artistic interests), and may include overlap with *Stable Competence* through ideational - albeit figural - fluency (Elaboration). However, contrary to Ackerman & Heggestad's (1997) findings, no overlap occurred for Investigative interests. Interrelationships between the factors demonstrated an interesting negative correlational pattern between the factor of *Conforming Values* with *Verbal Ability* and *Cognitive Flexibility*, which is supported by previous research that found that a related construct of Conservatism – itself moderately and significantly correlated with the Schwartz Conservation and Self Enhancement value orientations – had negative relationships with cognitive ability and academic performance (Stankov, 2009).

In terms of prediction, nine of the ten factors were significant; *Speeded Numeric Ability* was the only factor that did not relate to academic outcomes. Considering the vast literature on cognitive abilities predicting academic outcomes (see for example, Deary et al., 2007) it seems possible that not enough relevant measures were included in the test battery to allow a stronger factor to emerge. Notably, factors were dispersed in their prediction of the three academic outcomes with little overlap; in particular, factors that predicted psychology course grades were distinct from those that predicted academic satisfaction with psychology. Further, there appears evidence for a latent structure. *Verbal Ability* was a shared predictor of psychology course grades and GPA, whilst *Stable Competence* was a shared predictor of GPA and academic satisfaction with psychology.

The second hypothesis was that the factor scores would be predictive of academic performance. This was supported by the findings for psychology course grades and overall GPA, with 18.4% of the variance in grades explained by gender plus three factors (*Verbal Ability*, *Conforming Values, Cognitive Flexibility*) and 14.6% of the variance in GPA also explained by three factors (*Stable*

Competence, *Verbal Ability*, *Personable Behaviour*). Both of the two unique predictors of psychology course grades (*Conforming Values*, *Cognitive Flexibility*) were negatively and moderately correlated with each other, which should be considered in light of Calogero et al.'s (2009) finding of positive relationships between the Need For Cognitive Closure (NFCC) and values within the Conservation grouping, and negative relationships between NFCC with academic performance. Only *Personable Behaviour* was a unique predictor of GPA. *Verbal Ability* was shared with psychology course grades, and *Stable Competence* was shared with academic satisfaction. This suggests a latent structure, and when considering GPA's predictive factors, it appears central in relation to the other criterion variables. Further, when course grades and GPA are examined together, the shared predictor of *Verbal Ability* has predictive power over *Speeded Numeric Ability*, which was not significant for either criterion. This may support Schmidt's (2014) theoretical integrative model to some extent, in which fluid abilities only indirectly affect academic performance. Further, psychology course grades and GPA were not predicted by an identical set of variables, nor were these factors composed of the same combinations of individual differences; factors predictive of grades included vocational interests but not personality traits, and factors predictive of GPA displayed the inverse combination. The implications are that they are distinct criterion variables requiring distinct combinations of predictive factors, and that other academic courses may also require different predictors from those significant for either psychology or overall GPA. This lends much weight to research that focuses on the separation of academic outcomes by academic major (De Fruyt & Mervielde, 1997; Vedel et al., 2015).

The third hypothesis was that the factor scores would be predictive of academic satisfaction, and this was supported by the findings, with 10% of the variance explained by five factors (*Independent Values*, *Conceptual Interests*, *Sensation Seeking*, *Interaction Interests*, *Stable Competence*). More factors were predictive of satisfaction with psychology than for psychology course grades or GPA, and yet less of the variance was explained. It appears that different variables may be relevant that were not included in the current study. Additionally, it is also possible that the fine-grained measurement of academic satisfaction with the AcSat did not align well with the usage of broader

personality factors within the factor scores, in accordance with Brunswik's theory (Wittmann, & Süß, 1999). Four of the factors that predicted satisfaction loaded strongly on Neuroticism, Conscientiousness, Openness to Experience and Extraversion. Potentially, factor scores that are developed using personality facets instead of personality factors might significantly improve prediction of academic satisfaction.

The results of the hierarchical regressions suggest that it is possible to identify and refine brief factor score based tests that use a minimum of variables and time to determine career suitability, rather than having to use a number of lengthy and costly tests in combination. Relevant individual differences can then be used independent of larger batteries, or the relevant combinations can be developed into brief, narrow measures. The results of this study have demonstrated which individual differences combinations are best used for prediction of overall achievement within a university degree, in addition to achievement within psychology and satisfaction within psychology.

However, limitations of the present research must be considered. The scope of this study was limited by the size of the sample and the length of the test battery. A less time-consuming test battery may have attracted a greater number of participants and would perhaps provide less bias in participant motivations. Additionally, a greater sample would have allowed cross validation of the factors and their predictive validity, and the opportunity to examine academic courses other than psychology. Recent research by Vedel et al. (2015) demonstrates the importance of investigating academic outcome prediction separately for different academic courses.

Future research should further examine whether different variable combinations are needed to predict academic performance and satisfaction for different academic courses and which, if any, of the factors that emerged in the current study are relevant to academic outcomes for courses other than psychology. Cross validation would additionally improve our understanding of the factors found, and inclusion of additional or different narrow cognitive ability measures might improve the strength of specific factors that emerge. Finally, future research should utilise personality facets for prediction. Current results, with significant prediction from narrow cognitive abilities and values

lend support to the argument that Brunswik's theory could be usefully applied to individual differences research (Ackerman et al., 2013; Vedel et al., 2015), and the prediction of academic satisfaction in the current study suggests that usage of facets within the development of predictive factors may be beneficial to improving how much of the variance can be explained.

4.6.1 Conclusion

In conclusion, personality, vocational interests, cognitive abilities and personal values are related but distinct individual differences domains. The nature of how they interact can be harnessed for further theoretical understanding of potential latent factors and practical prediction of academic performance and academic satisfaction for career counselling. Of key importance, prediction of academic outcomes with factor scores condenses time-consuming measures and demonstrates which specific aspects are relevant for successful prediction. The implications of the current research are that personality facets, vocational interests, cognitive abilities and personal values are relevant but underutilised for career counselling purposes, and if new measures based on latent factors were to be developed and used in career counselling activities, the process would be streamlined, taking less time and resources to assist students, and providing students with improved advice that increased their likelihood of experiencing academic satisfaction and receiving increased academic grades and a higher GPA. Further, universities would experience reduced student drop out rates and increased student retention, less wasted resources and higher comparative academic ranking in regards to successful completions, while students would experience increases in life satisfaction and QOL, including the potential for increased earnings within a career that maximally utilises their capabilities.

4.7 References

Ackerman, P. L., & Heggestad, E. D. (1997). Intelligence, personality, and interests: evidence for overlapping traits. *Psychological bulletin*, *121*(2), 219.

Allen, J., Robbins, S. B., Casillas, A., & Oh, I. S. (2008). Third-year college retention and transfer: Effects of academic performance, motivation, and social connectedness. *Research in Higher Education*, *49*(7), 647-664.

Kusurkar R, Croiset G. Critical synthesis package: Schwartz value survey (SVS). MedEdPORTAL Publications. 2015;11:10002. http://doi.org/10.15766/mep_2374-8265.10002

Calogero, R. M., Bardi, A., & Sutton, R. M. (2009). A need basis for values: Associations between the need for cognitive closure and value priorities. *Personality and Individual Differences*, *46*(2), 154-159.

Chamorro-Premuzic, T., & Furnham, A. (2008). Personality, intelligence and approaches to learning as predictors of academic performance. *Personality and individual differences*, *44*(7), 1596-1603.

Costa, P. T., & McCrae, R. R. (1992). Neo PI-R professional manual.

Deary, I. J., Strand, S., Smith, P., & Fernandes, C. (2007). Intelligence and educational achievement. *Intelligence*, *35*(1), 13-21.

De Fruyt, F., & Mervielde, I. (1997). The five-factor model of personality and Holland's RIASEC interest types. *Personality and individual differences*, *23*(1), 87-103.

DeYoung, C. G., Quilty, L. C., Peterson, J. B., & Gray, J. R. (2014). Openness to experience, intellect, and cognitive ability. *Journal of personality assessment*, *96*(1), 46-52.

Douglas, H. E., Bore, M., & Munro, D. (2016). Openness and Intellect: An analysis of the motivational constructs underlying two aspects of personality. *Personality and Individual Differences*, *99*, 242-253.

Ekstrom, R. B., French, J. W., Harman, H. H., & Dermen, D. (1976). Manual for kit of factor referenced cognitive tests. *Princeton, NJ: Educational testing service*.

Ekstrom, R. B., French, J. W., & Harman, H. H. (1979). Cognitive factors: Their identification and replication. *Multivariate Behavioral Research Monographs*.

Harris, J. A., Vernon, P. A., Johnson, A. M., & Jang, K. L. (2006). Phenotypic and genetic relationships between vocational interests and personality. *Personality and Individual Differences*, *40*(8), 1531-1541.

Holland, J. L. (1997). *Making vocational choices: A theory of vocational personalities and work environments*. Psychological Assessment Resources.

Holland, J.L., Shears, M. & Harvey-Beavis, A. (2001). *Self Directed Search Australian Manual* (Second Australian Edition ed.). Melbourne: ACER Press.

Larson, L. M., Rottinghaus, P. J., & Borgen, F. H. (2002). Meta-analyses of Big Six interests and Big Five personality factors. *Journal of Vocational Behavior*, *61*(2), 217-239.

Lechner, C., Danner, D., & Rammstedt, B. (2017). How is personality related to intelligence and achievement? A replication and extension of Borghans et al. and Salkever. *Personality and Individual Differences*, *111*, 86-91.

Logue, C. T., Lounsbury, J. W., Gupta, A., & Leong, F. T. L. (2007). Vocational interest themes and personality traits in relation to college major satisfaction of business students. Journal of Career Development, 33(3), 269-295. doi: Doi 10.1177/0894845306297348

Lounsbury, J. W., Saudargas, R. A., Gibson, L. W., & Leong, F. T. (2005). An investigation of broad and narrow personality traits in relation to general and domain-specific life satisfaction of college students. *Research in Higher Education*, *46*(6), 707-729.

Lounsbury, J. W., Sundstrom, E., Loveland, J. M., & Gibson, L. W. (2003). Intelligence, "Big Five" personality traits, and work drive as predictors of course grade. *Personality and Individual Differences*, *35*(6), 1231-1239.

McGrew, K. S. (2009). CHC theory and the human cognitive abilities project: Standing on the shoulders of the giants of psychometric intelligence research.

Nye, C. D., Su, R., Rounds, J., & Drasgow, F. (2012). Vocational interests and performance: A quantitative summary of over 60 years of research. *Perspectives on Psychological Science*, *7*(4), 384-403.

O'Connor, M. C., & Paunonen, S. V. (2007). Big Five personality predictors of post-secondary academic performance. *Personality and Individual differences*, *43*(5), 971-990.

Parks, L., & Guay, R. P. (2009). Personality, values, and motivation. *Personality and individual differences*, *47*(7), 675-684.

Parks, L., & Guay, R. P. (2012). Can personal values predict performance? Evidence in an academic setting. *Applied psychology*, *61*(1), 149-173.

Parks-Leduc, L., Feldman, G., & Bardi, A. (2015). Personality traits and personal values: A meta-analysis. *Personality and Social Psychology Review*, *19*(1), 3-29.

Pozzebon, J. A., Ashton, M. C., & Visser, B. A. (2014). Major changes: Personality, ability, and congruence in the prediction of academic outcomes. *Journal of Career Assessment*, *22*(1), 75-88.

Rammstedt, B., Danner, D., & Martin, S. (2016). The association between personality and cognitive ability: Going beyond simple effects. *Journal of Research in Personality*, *62*, 39-44.

Robertson, K. F., Smeets, S., Lubinski, D., & Benbow, C. P. (2010). Beyond the threshold hypothesis: Even among the gifted and top math/science graduate students, cognitive abilities, vocational interests, and lifestyle preferences matter for career choice, performance, and persistence. *Current Directions in Psychological Science*, *19*(6), 346-351.

Roccas, S., Sagiv, L., Schwartz, S. H., & Knafo, A. (2002). The big five personality factors

and personal values. *Personality and social psychology bulletin*, *28*(6), 789-801.

Rothstein, M. G., Paunonen, S. V., Rush, J. C., & King, G. A. (1994). Personality and cognitive ability predictors of performance in graduate business school. *Journal of educational psychology*, *86*(4), 516.

Sagiv, L. (2002). Vocational interests and basic values. *Journal of Career Assessment*, *10*(2), 233-257.

Sagiv, L., & Schwartz, S. H. (2004). Values, intelligence and client behavior in career counseling: A field study. *European Journal of Psychology of Education*, *19*(3), 237-254.

Strahan, S., & Credé, M. (2015). Satisfaction With College Re-Examining Its Structure and Its Relationships with The Intent to Remain in College and Academic Performance. *Journal of College Student Retention: Research, Theory & Practice*, *16*(4), 537-561.

Schmidt, F. L. (2014). A general theoretical integrative model of individual differences in interests, abilities, personality traits, and academic and occupational achievement: A commentary on four recent articles. *Perspectives on Psychological Science*, *9*(2), 211-218.

Schwartz, S. H., & Bardi, A. (2001). Value hierarchies across cultures taking a similarities perspective. *Journal of cross-cultural Psychology*, *32*(3), 268-290.

Schwartz, S. H. (1992). Universals in the content and structure of values: Theoretical advances and empirical tests in 20 countries. *Advances in experimental social psychology*, *25*, 1-65.

Stankov, L. (2009). Conservatism and cognitive ability. *Intelligence*, *37*(3), 294-304.

Vandenberg, S. G., & Kuse, A. R. (1978). Mental rotations, a group test of three-dimensional spatial visualization. *Perceptual and motor skills*, *47*(2), 599-604.

Vedel, A. (2014). The Big Five and tertiary academic performance: A systematic review and meta-analysis. *Personality and Individual Differences*, *71*, 66-76.

Vedel, A., Thomsen, D. K., & Larsen, L. (2015). Personality, academic majors and performance: Revealing complex patterns. *Personality and Individual Differences*, *85*, 69-76.

Volodina, A., Nagy, G., & Köller, O. (2015). Success in the first phase of the vocational career: The role of cognitive and scholastic abilities, personality factors, and vocational interests. *Journal of Vocational Behavior*, *91*, 11-22.

Wittmann, W. W., & Süß, H. M. (1999). Investigating the paths between working memory, intelligence, knowledge, and complex problem-solving performances via Brunswik symmetry.

Wolniak, G. C., & Pascarella, E. T. (2005). The effects of college major and job field congruence on job satisfaction. *Journal of Vocational Behavior*, *67*(2), 233-251.

4.8 Contextual Statement: Study 3 to Studies 4 & 5

The third study aimed to investigate usage of a wider range of individual differences in combination than had previously been attempted within the literature. This involved the emergence of ten factors from the combination of personality factors, vocational interests, cognitive abilities and values, and their use as factor scores for prediction of psychology grades, GPA and academic satisfaction.

The fourth study followed on by investigating the importance, interactions and usage of narrow personality facets, in addition to breadth of individual differences examined in combination, and demonstrated that eight factors formed from personality facets, vocational interests, cognitive abilities and values could provide factor scores which predicted psychology grades, GPA and academic satisfaction even more successfully.

Finally, the fifth study incorporated the previous studies' findings on breadth and narrow detail, along with an investigation of the importance and practicability of customising the factor scores for specific prediction of the differential academic outcomes. Namely, this involved using personality facets, vocational interests, cognitive abilities and values in combination to create streamlined factor scores of specific relevance for the prediction of psychology grades, overall GPA and academic satisfaction. Results demonstrated that nine factor scores accounted for 25.2% of the variance in psychology course grade, eight factor scores accounted for 16.8% of the variance in GPA and six factor scores accounted for 15.8% of the variance in academic satisfaction.

.

Chapter 5: Personality Facets as a unifying domain of Cognitive Abilities, Vocational Interests, and Values for the prediction of Academic Performance and Academic Satisfaction

5.1 Statement of Authorship

Statement of Authorship

Title of Paper	Personality facets as a unifying domain of cognitive abilities, vocational interests and values for the prediction of academic performance and academic satisfaction.
Publication Status	☐ Published ☐ Accepted for Publication ☐ Submitted for Publication ☑ Unpublished and Unsubmitted work written in manuscript style
Publication Details	

Principal Author

Name of Principal Author (Candidate)	Annamaria R. Quaresima		
Contribution to the Paper	Designed the study, compiled the test battery, designed the satisfaction survey, collected the data, analysed and interpreted data, and wrote the manuscript.		
Overall percentage (%)	80%		
Certification:	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.		
Signature		Date	11/08/2020

Co-Author Contributions

By signing the Statement of Authorship, each author certifies that:

i. the candidate's stated contribution to the publication is accurate (as detailed above);

ii. permission is granted for the candidate in include the publication in the thesis; and

iii. the sum of all co-author contributions is equal to 100% less the candidate's stated contribution.

Name of Co-Author	Dr. Neil Kirby		
Contribution to the Paper	Supervised work, assisted in study design, reviewed and edited manuscript.		
Signature		Date	31/08/2020

Name of Co-Author	Dr. Aspa Sarris		
Contribution to the Paper	Supervised work, assisted in study design, reviewed and edited manuscript.		
Signature		Date	27/08/2020

Please cut and paste additional co-author panels here as required.

5.2 Abstract

The use of personality facets, cognitive abilities, vocational interests and values in combination for the prediction of academic performance and satisfaction represents a significant gap in the literature. To date, only one study has explored factor scores derived from Exploratory Factor Analysis for the prediction of Grade Point Average (GPA) (Kanfer, Wolf, Kantrowitz, & Ackerman, 2010). This chapter comprises two studies. The aims of Study 1 were: (i) to use these four individual differences domains to generate trait complexes, and to (ii) apply the resulting factor scores to predict psychology grade, GPA, and satisfaction with an undergraduate psychology program, whilst the aim of Study 2 was to (iii) reduce and optimise the resulting trait complexes for increased predictive ability and reduced assessment time. Participants (*n* = 358 psychology undergraduate students) completed a test battery comprising measures of personality (NEO-PI-R), cognitive abilities (measures from the ETS Kit of Factor Referenced Cognitive Tests and the Vandenburg & Kuse Mental Rotation Test), vocational interests (the SDS-R Australian edition), and values (the Schwartz Values Survey). Results showed that trait complexes were significant predictors, and when optimised, *Literacy*, *Aesthetic Flexibility* (negative predictor), *Values Flexibility*, *Construct Interests*, *Excitement Seeking* (negative predictor) and *Decision Closure* accounted for 25.2% of the variance in psychology grade, *Literacy Generation*, *Perfectionism* and *Operational Excitement* (negative predictor) accounted for 16.8% of the variance in GPA, and *Destructive Instability* (negative predictor), *Emotional Openness* and *Thoughtful Behaviour* accounted for 15.8% of the variance in satisfaction with psychology.

5.3 Introduction

Counselling advice at the tertiary level of education is important for both students and universities. At its core, such counselling involves guidance towards the best possible fit between students and academic courses. Benefits for students include improved academic outcomes and course satisfaction, reduced stress that could result from poor academic person – course fit and greater intention to persist within an academic course due to increased satisfaction with it (Strahan & Credé, 2015). Benefits for universities include increased degree completion rates due to reduced academic dropout rates associated with poor academic performance (Allen et al., 2008).

There are two ways in which research can improve student counselling in universities; firstly, a better understanding of factors that predict positive and negative outcomes for students and secondly, by refining measures that predict such outcomes so that they can be used effectively and efficiently within the time available for counselling. The current study aimed to address both these issues, by investigating relevant predictors of high and low academic performance and satisfaction with a course, and by examining whether prediction could be improved when using the best combinations of predictors instead of single measures.

5.3.1 Relationships between Personality, Vocational Interests, Cognitive Abilities and Values

Small yet consistent relationships have been shown between personality, vocational interests, cognitive abilities and values, which have historically been considered as separate domains of individual differences. The literature suggests that personality is a unifying domain, demonstrating established relationships with cognitive abilities (Ackerman, 2003; Ackerman & Heggestad, 1997; DeYoung, Quilty, Peterson, & Gray, 2014; Lechner, Danner, & Rammstedt, 2017; Rammstedt, Danner, & Martin, 2016; Rammstedt et al., 2018; Schaie et al., 2004) and vocational interests (De Fruyt & Mervielde, 1996; Harris, Vernon, Johnson, & Jang, 2006; Larson et al., 2002).

Investigations have also found complex, dynamic relationships between personality and values (Anglim et al., 2017; Dollinger, Leong, & Ulicni, 1996; Douglas, Bore, & Munro, 2016; Luk & Bond, 1993; Olver & Mooradian, 2003; Parks-Leduc, Feldman, & Bardi, 2015; Parks & Guay, 2009; Roccas, Sagiv, Schwartz, & Knafo, 2002; Wolfradt & Dalbert, 2003; Yik & Tang, 1996), with both theorized to affect the expression of the other (Roccas et al., 2002).

Fewer investigations have been made into the relationships between vocational interests and cognitive abilities, but low to moderate correlations have largely supported Holland's theory of vocational interests (Holland, 1997), with individual interests related to the abilities used to undertake interest-related skills (Ackerman & Heggestad, 1997; Carless, 1999; Randahl, 1991).

Research on the relationships between vocational interests and values also reinforces this theory, demonstrating meaningful patterns of relationships between personal values and interests which support or oppose their expression (Hansen & Wiernik, 2016; Knafo & Sagiv, 2004; Sagiv, 2002).

Although the relationships between values and cognitive ability are less frequently examined in the literature, a study by Sagiv and Schwartz (Sagiv & Schwartz, 2004) used both values and cognitive abilities to predict the behaviour of career counselling clients and found that values predicted unique variance in the model, over and above the inclusion of general cognitive ability (Sagiv & Schwartz, 2004), whilst another demonstrated that the Self Direction value significantly predicted full scale IQ (Guindon, 2008). However, this area represents a gap in existing research, with little examination of how these variables interact. Overall, the various interrelationships between personality, cognitive ability, vocational interests and values suggest that they are distinct yet related variables. This, in turn, suggests their potential utility when used in combination to predict academic outcomes.

5.3.2 Prediction of Academic Performance

Personality factors and their prediction of academic performance have been well-established, with consistent results demonstrating that Conscientiousness is a strong predictor of academic performance (Chowdhury & Amin, 2006; Furnham & Chamorro-Premuzic, 2004; Heaven & Ciarrochi, 2012; Vedel et al., 2015; Vitulic & Prosen, 2012). Additionally, Openness has been found to have an interaction effect with cognitive ability, predicting improved academic performance for students with high cognitive abilities (Heaven & Ciarrochi, 2012), and it has recently been found to be modestly predictive of overall Grade Point Average (GPA) in a large sample comprising Medicine, Psychology, Law, Economics, Political Science, Science and Arts students, although not predictive for any specific academic discipline (Vedel et al., 2015). In one study Extraversion was found to have a negative effect upon exam grades (Furnham & Chamorro-Premuzic, 2004), whilst in another involving a sample of teaching students it significantly predicted overall GPA and individual course grades for social pedagogy students but not primary education students (Vitulic & Prosen, 2012). Little attention appears to have been paid to Agreeableness and its relationship to academic performance, although in a study of Economics students, Agreeableness was found to have an interaction effect with Conscientiousness, with increased Agreeableness and Conscientiousness in combination predicting increases in overall GPA (Chowdhury & Amin, 2006). Thus, it appears that predictors of academic performance vary in strength and direction depending on different contexts – whether in interaction with other variables, or when used for specific academic disciplines.

Research regarding cognitive ability and the prediction of academic performance has demonstrated that higher levels of ability are strongly related to, and predictive of, increased academic performance (Deary et al., 2007; Rohde & Thompson, 2007; Roth et al., 2015; Schult & Sparfeldt, 2016). Current findings suggest that the correlations can be as strong as .54, and that the strength of this relationship is moderated by academic discipline, with Mathematics and Science grades being most closely related to cognitive ability (Roth et al., 2015). Despite this, its prediction of academic performance leaves approximately 50% of the variance unexplained (Chamorro-Premuzic

& Furnham, 2008; Rohde & Thompson, 2007), suggesting a need for combination with non-cognitive variables and possibly exploration of narrow stratum abilities, in order to better predict academic performance (Ackerman et al., 2013; Chamorro-Premuzic & Furnham, 2008). Some researchers have found that narrow cognitive abilities do not account for any additional variance beyond general ability (Rohde & Thompson, 2007) and do not offer increased predictive validity within high ability samples (McLarnon, Goffin, & Rothstein, 2018). However, other studies have found that narrow abilities can explain additional academic performance beyond general ability (Kell & Lang, 2017; Taub et al., 2008), may have increased utility for course-specific grades and GPA (Johnson, 2018; McGrew & Wendling, 2010; Saß, Kampa, & Köller, 2017), and are useful within trait complexes for efficient prediction of academic performance (Ackerman, 2003; Ackerman, Chamorro-Premuzic, & Furnham, 2011; Ackerman et al., 2013; Kanfer et al., 2010; McGrew & Wendling, 2010).

Vocational interests have been extensively examined in the past 30 years and have been found to be predictive of career and educational outcomes beyond what can be accounted for by personality and cognitive abilities (Nye et al., 2012; Nye et al., 2017; Stoll et al., 2017; Van Iddekinge, Roth, Putka, & Lanivich, 2011a). For example, Investigative interests have been shown to predict academic performance beyond abilities and personality (Krapić & Kuljanić, 2017), whilst Artistic, Investigative and Social interests have been found to have interactions with Conscientiousness and Agreeableness when predicting GPA (Fritzsche et al., 2002). Past research has also suggested that congruence – the closeness of a match between an individual's vocational interest profile and the occupational profile of a discipline or career – predicts academic and career performance well, and often more strongly than individual interests (Nye et al., 2017). However, the literature also contains conflicting findings. Although vocational interest scales provide modest yet significant prediction, particularly for academic samples (Nye et al., 2012; Van Iddekinge et al., 2011a) there are concerns regarding the limited nature of congruence indices between vocational interests and occupational or academic course profiles due to the manner in which they condense the individual scales (Edwards, 1993; Nauta, 2010; Tinsley, 2000). Recent findings suggest that whilst use of

congruence indices can be improved (Nye, Prasad, Bradburn, & Elizondo, 2018b), they are not homogenous in their predictive ability across occupations and academic disciplines, and will have varying degrees of utility, possibly providing a restricted understanding of the relationships involved (Nye, Perlus, & Rounds, 2018a). In contrast, available research suggests that the use of individual interest scales for the prediction of academic performance may capture a wider range of nuances within academic disciplines which are otherwise overlooked (Nye et al., 2018a).

Few studies have examined the predictive validity of personal values for academic performance. In regards to the theory of basic human values (Schwartz, 1992b), the Achievement value has predicted increases in exam grades over and above personality (Parks & Guay, 2012) and increases in GPA, whilst Stimulation has predicted decreases in GPA (Lietz & Matthews, 2006). Other research has found that Self Direction, Security and Power (negative predictor) significantly predicted GPA over and above ability and personality (Guindon, 2008). In a study of high school students, path analysis demonstrated that Conformity and Security were direct and negative predictors of foreign language course grades, whilst Self Direction directly predicted increases in Mathematics course grades (Liem, Martin, Porter, & Colmar, 2012). These findings both demonstrate the opposing value orientations of Conservation and Openness to Change, and the opposite manner in which they relate to learning and academic performance.

Even fewer studies have examined personality, vocational interests, cognitive abilities and personal values in combination, for the prediction of academic outcomes, despite research demonstrating that the use of trait complexes can increase the prediction of academic performance beyond what is accounted for by individual predictors (Ackerman et al., 2013).

5.3.3 Prediction of Academic Satisfaction

Few studies have examined the relationship between academic satisfaction and academic performance, although those that have suggest that academic satisfaction is predictive of GPA, is related to increased grades, and relevant due to its relationships with a variety of vocational behaviour variables (Milsom & Coughlin, 2017; Nauta, 2007; Schmitt, Oswald, Friede, Imus, &

Merritt, 2008). Further, academic satisfaction has been found to be related to the important life outcomes of wellbeing and life satisfaction (Lounsbury et al., 2005a), whilst in comparison, academic dissatisfaction has been found to be related to negative outcomes, such as switching majors (Pozzebon et al., 2014; Wolniak & Pascarella, 2005). The idea that increasing student satisfaction contributes to successful outcomes is at the very heart of academic career counselling, and supported by the extant literature, yet there is less research when compared to academic performance (Logue et al., 2007). Similarly, few studies have investigated the prediction of academic satisfaction, whether as satisfaction with a specific academic course undertaken or as satisfaction with a chosen major.

Some research has found that personality does not significantly predict academic satisfaction, although cluster analysis found two clusters of students; those with higher levels of Extraversion, Openness, Agreeableness, and Conscientiousness, and lower levels of Neuroticism, had higher levels of academic satisfaction (Trógolo & Medrano, 2012). Other studies have found that Neuroticism, Extraversion and Conscientious are significant predictors of satisfaction with an academic major (Logue et al., 2007; Pozzebon et al., 2014).

To date, cognitive ability has not been shown to predict general academic satisfaction (Pozzebon et al., 2014), although it may influence course-specific satisfaction and major-specific academic satisfaction. When examining group differences, research has shown that students undertaking business and science majors had increased levels of mathematical ability, whilst Humanities students had increased verbal ability, suggesting that congruence between abilities and academic disciplines may exist and provide another avenue for the prediction of academic satisfaction (Pozzebon et al., 2014).

Research involving the prediction of academic satisfaction using vocational interests has not reached a consensus; this may be due to the differences between studies in measurement of both interests and academic satisfaction. Whilst an earlier study found that Realistic interests predicted 7% of the variance in satisfaction with an academic major (Logue et al., 2007), other studies found

that interests were not predictive of academic satisfaction, but that interest congruence significantly predicted academic satisfaction (Etzel & Nagy, 2016; Pozzebon et al., 2014).

Only a few studies have been conducted using personal values for the prediction of academic satisfaction. One such study examined personal values longitudinally and found that university-life satisfaction was significantly predicted by Conformity and Benevolence at the second time of measurement (Ng & Ye, 2016). Other studies of this kind have mostly focused on life satisfaction in general, in relation to values congruence. For example, students have been found to select academic disciplines that are congruent with their value priorities (Sagiv, Roccas, Cieciuch, & Schwartz, 2017) and experience greater life satisfaction when values are congruent with their academic disciplines (Sortheix & Lönnqvist, 2015). Some studies have demonstrated that business students who place greater importance on Power, Achievement, and Hedonism and give lesser priority to Benevolence and Universalism experience increased life satisfaction. Conversely, studies have also shown that Psychology students who place greater importance on Self Transcendence values (Benevolence, Universalism) and give less priority to Self Enhancement values (Power, Achievement, Hedonism) also experience greater life satisfaction (Gandal, Roccas, Sagiv, & Wrzesniewski, 2005; Sagiv & Schwartz, 2000). However, recent research with other measures of values suggest these results may not be universal (Schwartz & Sortheix, 2018).

5.3.4 Inclusion of Personality Facets

Although personality and particularly the factors of the Big Five (Neuroticism, Extraversion, Openness to Experience, Agreeableness and Conscientiousness) are well-used in research (Gosling, Rentfrow, & Swann Jr, 2003), less research has historically been undertaken using personality facets, both correlational and predictive. However, the utility of facets has been increasingly recognised in the literature. The narrow and direct nature of facets appears to capture both relationships that would have been overlooked when using the broader factors of the Big Five and demonstrate stronger relationships with specific variables (Paunonen & Ashton, 2001b).

Personality facets have also been shown to vary greatly in their effects, demonstrating correlations and predictions both weaker and stronger than factors (Anglim & Grant, 2016), even within the same factor. This suggests that facets may be of greater practicality due to their brevity and directness of meaning, ideal for use in test batteries where length is an issue, and easier to interpret. Further, facets have been shown to increase prediction of academic performance when used in combination with cognitive abilities (Bergold & Steinmayr, 2018). Currently, no studies have examined the relationship between personality facets with cognitive abilities, vocational interests and personal values for combined prediction of academic outcomes.

5.3.5 Using Factor Scores to predict Academic Outcomes

Whilst there is only a modest amount of research which utilises factors comprised of various individual differences, and fewer that use the resulting factor scores for prediction of successful academic outcomes, the proposed use of aptitude complexes for this purpose has existed for some time (Snow, 1989), having its basis in earlier intelligence research (Snow, 2014). Of key importance, a comprehensive review of ability, personality and interest correlations has revealed considerable overlap between these variables – defined as trait complexes – and suggested the existence of four broad complexes, or factors, entitled Social, Clerical/Conventional, Science/Math, and Intellectual/Cultural (Ackerman, 2003; Ackerman & Heggestad, 1997).

The Social trait complex comprises only personality and interests, involving Extraversion and Enterprising interests, as well as Social Potency and Well Being, and collates variables which involve socially interactive behaviour. Clerical/Conventional includes Conscientiousness, Perceptual Speed, Conventional interests, as well as traits of Control and Traditionalism and revolves around a preference for structured behaviour (Ackerman, 2003). The Science/Math complex only includes cognitive abilities and interests – Math Reasoning, Visual Perception, Realistic and Investigative interests – whilst the Intellectual/Cultural trait complex includes all three domains but overlaps in its interests. This trait complex comprises the personality factor Openness to Experience, Crystallised Intelligence (*Gc*), Investigative and Artistic interests, Absorption and Typical Intellectual

Engagement (TIE), a variable related to both Openness and ability in terms of performance. Both complexes focus on different aspects of intellectual behaviour, with the Science/Math having a focus on logic, and the Intellectual/Cultural having a focus on knowledge acquisition.

However, there appears to be a dearth of studies using trait complexes for prediction of academic outcomes. One study used Exploratory Factor Analysis to create separate ability and non ability trait complexes (which included measures of personality factors and vocational interests), which were then used to predict GPA and job performance (Kanfer et al., 2010). Seven trait complexes were found, and in regard to academic performance, GPA was significantly predicted by the verbal ability complex, numerical ability complex, spatial ability complex (negative predictor), with Learning/Mastery Orientation (included Artistic interests and Openness to Experience), and Self-Management (included Conscientiousness) being significant predictors of GPA beyond that predicted by abilities (Kanfer et al., 2010).

To date, there do not appear to be any studies investigating personality facets, cognitive abilities, vocational interests and values in the same study, nor any studies examining trait complexes formed from these four domains in combination for the prediction of course grades and GPA. Further, there does not appear to be any usage of trait complexes for the prediction of academic satisfaction. The fact that these individual differences domains are related, but do not subsume each other, and have been shown to be successful individual predictors of academic outcomes suggests that combining these domains for prediction may further our understanding of how characteristics influence differing aspects of academic success. The investigation of potential predictors of academic satisfaction with psychology may provide valuable insights into the nature of course and major specific satisfaction, and in turn inform counselling psychology practices.

5.3.6 Aims and Hypotheses

The aims of the current research (Studies 4-5) are:

- (i): to use these four individual differences domains to generate trait complexes
- (ii): to apply the resulting factor scores to predict psychology grade, GPA, and satisfaction with an undergraduate psychology program
- (iii): reduce and optimise the resulting trait complexes for increased predictive ability and reduced assessment time

The hypotheses of the current research are:

- H1: That trait complexes predicting academic performance and academic satisfaction will include items from multiple domains
- H2: That factor scores will significantly predict academic performance in psychology, with different trait complexes predictive of grades compared to GPA
- H3: That factor scores will significantly predict academic satisfaction
- H4: That significantly predictive trait complexes will include personality facets
- H5: That the exclusion of all irrelevant items from the prediction of each academic outcome (i.e. grades, GPA, academic satisfaction) will improve predictive ability

-

5.4 Factor Scores generated to predict Academic Outcomes (Study 4)

Study 4 examined the generation of trait complexes via exploratory factor analysis, and the prediction of academic outcomes in relation to aims i and ii, and hypotheses H1-H4.

5.4.1 Methods

5.4.1.1 Participants

Participants comprised 358 undergraduate students (255 of whom were female) from an Australian university that were enrolled within a psychology course as part of an academic degree. The mean age was 20.5 years (SDS=5.56, 16-53), and 321 were first year undergraduates. Participants were recruited via the university psychology research participation website.

5.4.1.2 Measures

5.4.1.2.1 Personality

Personality was measured using the Revised NEO Personality inventory (NEO-PI-R) which is one of the most frequently used scales of the Big Five model (Costa & McCrae, 1992b). This scale measures personality on five broad factors, each comprised of six facets, for a total of 240 items. Items are self-report and measured on a five-point Likert scale, and research has demonstrated that the NEO-PI-R has good reliability and validity (Costa & McCrae, 1992b). The five factors and their narrower facets are Neuroticism (comprising *N1 Anxiety, N2 Angry Hostility, N3 Depression, N4 Self-Consciousness, N5 Impulsiveness, N6 Vulnerability*), Extraversion (comprising *E1 Warmth, E2 Gregariousness, E3 Assertiveness, E4 Activity, E5 Excitement-Seeking, E6 Positive Emotions*), Openness to Experience (*comprising O1 Fantasy, O2 Aesthetics, O3 Feelings, O4 Actions, O5 Ideas,*

O6 Values), Agreeableness (comprising *A1 Trust, A2 Straightforwardness, A3 Altruism, A4 Compliance, A5 Modesty, A6 Tender-Mindedness*) and Conscientiousness (comprising *C1 Competence, C2 Order, C3 Dutifulness, C4 Achievement Striving, C5 Self-Discipline, C6 Deliberation*).

5.4.1.2.2 Vocational Interests

Vocational interests were measured using the Self Directed Search Second Australian Edition (SDS-R) which measures Holland's RIASEC theory of vocational interests (Holland et al., 2001). This scale measures vocational interests on six broad scales, each comprised of four subscales. Items are self-report and utilise both a seven-point Likert scale and forced choice responding. Research has demonstrated both good reliabilities for the SDS-R within an Australian sample, and good validity overall (Holland et al., 2001). The six broad scales are Realistic interests, Investigative interests, Artistic interests, Social interests, Enterprising interests and Conventional interests. These individual interest scales, due to being six distinct, mutually independent scores, were deemed more flexible, fine-grained, and suitable for use within factor scores than combined Holland codes (comprising 720 combinations of an individual's highest three interest scores) and allowed for more robust data analysis.

5.4.1.2.3 Cognitive Abilities

5.4.1.2.3.1 Educational Testing Service Kit of Factor Referenced Cognitive Tests

Nine cognitive abilities were measured through the Educational Testing Service Kit of Factor Referenced Cognitive Tests (ETS Kit) (Ekstrom et al., 1976), a test battery of 72 individual scales which largely correspond to the current Stratum I abilities of the Cattell-Horn-Carroll theory of cognitive abilities (McGrew, 2009), despite being developed during the early stages of CHC theory. The ETS Kit has been shown to have adequate reliability and validity within research settings (Ekstrom, French, & Harman, 1979) and includes speeded and non-speeded tests which range from

forced choice response to free response. With regards to CHC theory, the ETS Kit corresponds to five broader Stratum II ability groups. Letter Sets (inductive reasoning) and Nonsense Syllogisms (logical reasoning) were chosen to measure the broader Stratum II group of Fluid Reasoning (*Gf*), Word Beginnings (verbal fluency) and Elaboration (figural fluency) were chosen to measure Long Term Storage & Retrieval (*Glr*), Number Comparison (perceptual speed) and Subtraction & Multiplication (speeded numeric ability) were chosen to measure Processing Speed (*Gs*), Incomplete Words (verbal closure) and Hidden Patterns (flexibility of closure) were chosen to measure Visual Processing (*Gv*), and Advanced Vocabulary II (verbal comprehension) was chosen to measure Comprehension-Knowledge (*Gc*). In combination, these measures represent five of the nine Stratum II abilities from the CHC model of cognitive ability which pertain to successful academic outcomes within a variety of academic disciplines and tertiary studies in general.

5.4.1.2.3.2 The Vandenburg and Kuse Mental Rotation Test

A tenth cognitive ability was measured via the Vandenberg and Kuse Mental Rotation Test (MRT) (Vandenberg & Kuse, 1978), a 24 item speeded scale with forced choice responding, which largely corresponds to the Stratum II group of Speeded Rotation (*SR*) within CHC theory. The MRT has been shown to have good reliability and validity (Vandenberg & Kuse, 1978).

5.4.1.2.4 Values

Personal values were measured through the Schwartz Values Survey (SVS) (Schwartz & Bardi, 2001), a scale created to measure the Theory of Basic Human Values. This scale measures ten basic values, grouped into four broad value orientations, through 56 self-report items rated on a nine-point Likert scale. Research has shown this measure to have good validity and moderate reliability in a range of countries (Kusurkar & Croiset, 2015). The four broader value orientations, each containing the ten personal values, are Conservation (comprising Conformity, Tradition and Security), Self-

Transcendence (comprising Benevolence and Universalism), Openness to Change (comprising Self-Direction and Stimulation) and Self-Enhancement (comprising Hedonism, Achievement and Power).

5.4.1.2.5 Academic Performance

Two measures of academic performance were collected. Undergraduate psychology course grades were utilized to determine psychology-specific academic performance (henceforth Psych Grade), while an unweighted GPA based on all undergraduate course grades was utilized to determine general academic performance (henceforth GPA). Both measures are in the context of the Australian tertiary grading system, which consists of marks between 0-100, with five grade bands consisting of High Distinction (85-100), Distinction (75-84), Credit (65-74), Pass (50-64), and Fail (1-49). Grades were gathered via student self-reports at the end of the first semester.

5.4.1.2.6 Academic Satisfaction

A brief measure of academic satisfaction (AcSat) was used to determine academic satisfaction within undergraduate psychology. This measure involved three self-report items rated on a five-point Likert scale, chosen due to previous research suggesting that while measures of satisfaction could be improved by including more than one item, increasing the number of items does not exponentially improve scale reliability, and further that Likert rating scales better encapsulate the nuances of satisfaction (Lounsbury et al., 2005a; Pozzebon et al., 2014). The three-item measure demonstrated moderate validity via correlations with the NEO-PI-R facets of C4 Achievement Striving (.17, $p<.01$) and N3 Depression (-.13, $p<.05$) and good reliability, demonstrated by a Cronbach's α of .81, and is comparable to a three-item measure of academic satisfaction (with similar reliability) that has been used in other studies (Etzel & Nagy, 2016; Westermann et al., 1996), but was only accessible after the AcSat had already been used in data collection.

5.4.1.2.7 Demographics

Age, gender, year level of undergraduate studies, and academic courses undertaken during the first semester were reported by participants.

5.4.1.3 Procedure

Participation involved booking a testing session online through the university website for psychology research participation. Participants were informed about the purpose of the study, that their participation was voluntary, they could leave the study at any time, and that only group results would be reported. The test battery was administered within a classroom testing situation, with an instructor reading out the details and instructions for each measure and timing the speeded cognitive measures. Sessions included between 2-30 participants and took approximately 2 hours and 30 minutes per session. Participants were compensated for their time with partial course credit and entered into a draw to win one of five cash prizes as an incentive. Grades were collected at the end of the semester.

5.4.2 Results

5.4.2.1 Factor Analysis

An exploratory factor analysis (EFA) with oblique rotation was performed on the data from 328 participants (initial data 358, missing data 30). The KMO coefficient was .79 (p<.001) and Principal Axis Factoring extraction was used in combination with Promax Rotation. Oblique rotation was preferred due to its allowance of correlations between the variables. An eight-factor solution which explained 46.1% of the variance was decided upon, after examining the Kaiser criterion and scree plot, along with the interpretability of the data. Large cross-loadings were retained over the choice of a simple structure, due to the interpretability of the data and their relevance within the

individual factors. Table 18 presents the EFA and its eight-factor solution. For descriptive statistics, see Table 2.

Table 18: Pattern matrix for eight factor EFA using PAF extraction and Promax rotation

	1	2	3	4	5	6	7	8
Tradition	**-.633**	-.019	.289	.062	-.043	.173	.082	.129
O5 Openness to Ideas	**.564**	.273	.014	-.119	-.196	**.455**	.058	-.028
Advanced Vocabulary	**.562**	.088	.036	.016	-.146	.052	-.074	.017
Incomplete Words	**.557**	.155	.208	.165	.107	-.043	-.145	.269
Letter Sets	**.553**	-.024	.051	.045	.021	-.035	-.084	**.552**
Word Beginnings	**.550**	.106	.066	.082	-.018	-.026	-.066	.297
O6 Openness to Values	**.528**	.051	.003	-.086	-.068	.219	.008	-.169
Conformity	**-.519**	.102	.224	.048	.051	.236	-.027	.186
Security	**-.504**	.070	-.046	.051	.029	**.411**	-.063	.159
Hidden Patterns	**.436**	-.051	-.005	-.005	.125	-.072	.038	**.423**
O1 Openness to Fantasy	**.395**	-.221	-.018	.109	.074	.197	.157	-.077
Nonsense Syllogisms	**.377**	-.130	.020	-.082	-.064	-.044	.131	.189
Mental Rotation	**.326**	-.201	-.118	-.205	-.001	.138	-.042	.176
C4 Achievement Striving	.010	**.818**	.013	.041	.108	.000	.025	-.104
C5 Self Discipline	-.059	**.773**	.001	-.204	-.058	.000	-.104	-.095
C1 Competence	.247	**.728**	-.036	-.161	-.052	.105	.032	-.027
C3 Dutifulness	.106	**.714**	.191	.027	-.034	.042	-.057	-.035
C2 Order	-.143	**.662**	-.021	.132	-.129	-.044	-.059	.111
C6 Deliberation	-.100	**.520**	.170	-.078	**-.324**	-.068	-.060	.042
E3 Assertiveness	.104	**.429**	-.293	-.058	**.323**	-.104	.172	-.009
A2 Straightforwardness	.019	.143	**.737**	.047	.085	-.074	-.134	-.097
A4 Compliance	-.104	-.168	**.665**	-.196	-.119	-.023	.021	.105
A3 Altruism	.040	.164	**.628**	.021	.223	-.022	.112	.005
A1 Trust	.031	-.045	**.575**	**-.327**	.210	.028	.069	.060
A6 Tender Mindedness	.071	.016	**.569**	.151	.109	.051	.034	-.011
A5 Modesty	.042	.019	**.561**	.209	-.057	-.066	-.083	-.180
Power	**-.404**	-.022	**-.450**	.031	-.023	.196	.100	.219
Benevolence	-.266	.040	**.429**	.038	.106	**.344**	.065	-.036

N3 Depression	-.009	-.066	.067	**.758**	-.116	.031	.005	.007
N1 Anxiety	-.069	.061	.067	**.748**	-.147	-.105	.059	.005
N2 Angry Hostility	-.010	.083	**-.413**	**.701**	.046	-.004	.046	-.046
N4 Self Consciousness	.054	-.090	.062	**.674**	-.273	.010	.052	.002
N6 Vulnerability	-.123	-.274	.088	**.661**	-.030	-.147	-.027	.017
N5 Impulsiveness	.114	-.187	-.037	**.484**	**.376**	.043	.048	-.026
O3 Openness to Feelings	**.354**	.173	.082	**.412**	.149	.165	.246	.021
O4 Openness to Actions	.179	-.138	.119	-.248	.144	.152	.042	-.065
E5 Excitement Seeking	.062	-.177	-.058	-.018	**.736**	.218	-.230	.025
E2 Gregariousness	-.220	-.063	.107	-.092	**.732**	-.088	-.035	-.060
E1 Warmth	-.090	.001	**.429**	-.076	**.700**	-.084	.147	.017
E6 Positive Emotions	-.001	-.067	.288	-.188	**.627**	.002	.112	-.022
E4 Activity	.005	.307	-.053	-.090	**.429**	-.151	.094	.086
Self Direction	.046	.021	-.064	-.057	-.030	**.717**	.108	-.158
Universalism	-.073	.014	.183	.031	-.186	**.645**	.221	-.059
Stimulation	.093	-.061	-.066	-.039	**.391**	**.508**	-.202	-.100
Achievement	-.236	**.335**	-.020	.105	.244	**.457**	-.182	-.003
Hedonism	-.179	-.151	-.224	.007	.227	**.409**	-.113	-.020
Investigative interests	.314	.020	.002	-.159	-.101	**.363**	-.035	.101
Realistic interests	-.002	-.143	-.094	-.272	-.084	.301	.199	.001
Artistic interests	.068	-.210	-.089	.047	-.079	.122	**.657**	-.001
Social interests	-.159	.063	.176	.062	.113	-.100	**.585**	-.036
Enterprising interests	-.207	.176	-.295	-.080	.279	-.013	**.484**	.086
O2 Openness to Aesthetics	.246	-.114	.174	.134	-.125	.244	**.460**	-.040
Conventional interests	-.202	.118	-.100	-.004	-.119	.041	**.349**	.166
Number Comparison	.103	-.058	-.036	.036	.018	-.155	.007	**.666**
Subtraction & Multiplication	.000	-.073	-.095	-.047	-.084	-.047	.054	**.608**
Elaboration	.080	.128	-.070	-.137	-.007	-.036	-.044	.243

Loadings >.32 are bolded. Factors: 1 = *Intellectual Openness*, 2 = *Conscientious Achievement*, 3 = *Personable Behaviour*, 4 = *Emotional Instability*, 5 = *Sensation Seeking*, 6 = *Self-Focused Values*, 7 = *Interaction Interests*, 8 = *Fluid Reasoning*.

The first factor *Intellectual Openness* comprised negative loadings on the Conservation values orientation, as well as positive loadings on verbal and fluid reasoning abilities, and facets of Openness to Experience. This factor focuses on high levels of broadmindedness and cognitive ability, and lower levels of narrowminded personal values.

The second factor *Conscientious Achievement* was defined by facets of Conscientiousness and the Achievement value. This factor focuses on Conscientiousness filtered through achievement and competence; the highest, most defining loading was on C4 Achievement Striving.

Personable Behaviour was the third factor that emerged. It contained facets from Agreeableness and Extraversion, and negative loadings on Neuroticism and Power from the Conservation values orientation. The focus of this factor was on expressing socially positive traits and values.

A fourth factor *Emotional Instability* largely contained facets of Neuroticism, in addition to a negative loading on A1 Trust and a positive loading on O3 Openness to Feelings. This factor's focus seems to be upon the expression of volatile emotions.

The fifth factor *Sensation Seeking* comprised facets of Extraversion, in addition to facets from Neuroticism, a negative loading on Conscientiousness, and a loading on the value Stimulation. This factor focused upon seeking excitement and stimulation in activities and expressing both impulsivity and positive emotions.

The sixth factor *Self-Focused Values* was defined by values drawn from all four value orientations, with the strongest loading on Self Direction, the facet of O5 Openness to Ideas and Investigative interests. This factor appears to focus on self-chosen independence of choice.

Interaction Interests was the seventh factor that emerged, and it contained vocational interests that involved social interaction or emotional expression, and the facet O2 Openness to Aesthetics. This

factor's focus is on the interaction between vocational tasks and personal expression, whether to help others, express ideas or engage in business.

The eighth factor was *Fluid Reasoning*, and it involved cognitive abilities of logical reasoning, numeric ability, flexibility of closure, and perceptual speed. This factor's focus was upon speeded flexibility in reasoning.

Refined factor scores were generated for the eight factors and used to predict psychology course grade, GPA and academic satisfaction with psychology. Although caution is warranted, the aims were exploratory and practical; an initial investigation into four domains of individual differences which have not previously been investigated within the same study, how they interact, and how they predict educational outcomes was of interest – as was the practicality of examining sections of measures which might be usefully combined by career counsellors for increasing streamlined prediction of educational outcomes. Table 19 presents the factor correlations for the eight factors. It can be seen that there is a significant correlation between the *Sensation Seeking* and *Interaction Interests* factors, which can be explained by the extraverted need for stimulation in the former and the social tasks that fulfill such a need inherent in the latter. The multiple regressions undertaken using the eight factor scores to predict academic performance and academic satisfaction are shown in Table 20.

Table 19: Correlations between the eight factors that emerged from EFA with Promax rotation

	1	2	3	4	5	6	7	8
1. Intellectual Openness	1.0							
2. Conscientious Achievement	-.19	1.0						
3. Personable Behaviour	-.01	.08	1.0					
4. Emotional Instability	.02	-.29	-.07	1.0				
5. Sensation Seeking	.05	.17	-.09	-.07	1.0			
6. Self-Focused Values	-.03	.10	.09	.01	.13	1.0		
7. Interaction Interests	.15	.17	.14	-.05	**.33**	.27	1.0	
8. Fluid Reasoning	-.31	.26	-.02	-.09	-.08	.15	-.05	1.0

Correlations >.32 bolded.

5.4.2.2 Regression

Table 20: Multiple regressions using eight factor scores to predict psychology course grade, GPA and academic satisfaction with psychology

Psychology Course Grade								
Step and Predictors		β	*T*	sr^2	R^2	aR^2	ΔR^2	ΔF
1	Age	-.008	-.135	.000	.050	.042	.050	6.423**
	Gender	.224	3.577***	**.050**				
2	Age	-.043	-.683	.001	.176	.141	.126	4.495***
	Gender	.242	3.492***	**.042**				
	Intellectual Openness	.358	5.458***	**.104**				
	Conscientious Achievement	.119	1.692	**.010**				
	Personable Behaviour	.087	1.328	.006				
	Emotional Instability	-.017	-.254	.000				
	Sensation Seeking	.017	.237	.000				
	Self-Focused Values	-.031	-.462	.000				
	Interaction Interests	-.180	-2.449*	**.021**				
	Fluid Reasoning	.159	2.402*	**.020**				
GPA								
Step and Predictors		β	*T*	sr^2	R^2	aR^2	ΔR^2	ΔF
1	Age	.010	.165	.000	.022	.014	.022	2.685
	Gender	.147	2.315*	**.021**				
2	Age	-.054	-.852	.002	.174	.139	.153	5.439***
	Gender	.132	1.909	**.012**				
	Intellectual Openness	.329	5.013***	**.088**				
	Conscientious Achievement	.165	2.337*	**.019**				

	Personable Behaviour	.142	2.158*	**.016**
	Emotional Instability	-.077	-.1.171	.004
	Sensation Seeking	-.021	-.300	.000
	Self-Focused Values	-.112	-1.681	**.010**
	Interaction Interests	-.099	-.1340	.006
	Fluid Reasoning	.201	3.029**	**.032**

Academic Satisfaction

Step and Predictors		β	*T*	sr^2	R^2	aR^2	ΔR^2	ΔF
1	Age	.162	2.748**	**.026**	.033	.026	.033	4.785**
	Gender	.091	1.545	.008				
2	Age	.088	1.433	.006	.123	.091	.090	3.450***
	Gender	.031	.463	.000				
	Intellectual Openness	-.110	-1.768	**.010**				
	Conscientious Achievement	.169	2.516*	**.020**				
	Personable Behaviour	.065	1.038	.003				
	Emotional Instability	-.068	-1.070	.003				
	Sensation Seeking	-.122	-1.792	**.010**				
	Self-Focused Values	-.014	-.211	.000				
	Interaction Interests	.191	2.768**	**.024**				
	Fluid Reasoning	-.166	-2.570*	**.021**				

*= p <.05, **= p <.01, ***= p <.001. Bolded text indiciates unique variance of 1% or greater.

The squared semi-partial correlation was calculated for each independent variable within Table 20. It reports the percentage of unique variance explained by each predictor in the model.

The factors *Intellectual Openness*, *Interaction Interests* (negative predictor) and *Fluid Reasoning* significantly predicted 14.1% of the variance in psychology course grade in the second step $F(10,235)=5.029$, $p<.001$, along with gender, which was still a significant predictor beyond the factor

scores, showing that female students received higher psychology course grades. Intellectual Openness was the strongest individual predictor, contributing 10.4% unique variance to the prediction of psychology grades. The factor scores demonstrate that having higher levels of open-mindedness, higher levels of reasoning, both in terms of verbal ability and fluid ability, in addition to lower levels of traditional values and lowered interest in tasks involving social interaction and expression, were predictive of higher psychology course grades.

Intellectual Openness, *Conscientious Achievement*, *Personable Behaviour*, and *Fluid Reasoning* significantly predicted 13.9% of the variance in GPA in the second step $F(10,235)=4.967$, $p<.001$. The factor scores demonstrate that having higher levels of open-mindedness, higher levels of reasoning, again in terms of both verbal ability and fluid ability, higher levels of conscientious and achievement-oriented traits, higher levels of agreeable, socially positive traits, and lower levels of traditional values, and socially negative, neurotic traits were predictive of higher GPA in university. Again, Intellectual Openness contributed the most unique variance to the prediction of GPA, at 8.8%.

Conscientious Achievement, *Interaction Interests*, and *Fluid Reasoning* (negative predictor) significantly predicted 9.1% of the variance in academic satisfaction with psychology in the second step $F(10,269)=3.785$, $p<.001$. Less unique variance was predicted overall, with Interaction Interests contributing the most unique variance to the prediction of academic satisfaction, at 2.4%. The factor scores demonstrate that having higher levels of conscientious and achievement-oriented traits, higher levels of interest in tasks involving social interaction and expression, and lower levels of reasoning and speeded numerical ability were predictive of increased academic satisfaction with psychology and the courses undertaken.

Table 21 illustrates the spread of factor scores between the dependent variables.

Table 21: Relevant and facet inclusionary factor scores for the prediction of psychology grades, GPA and academic satisfaction with psychology

	Psychology Grade	GPA	Academic Satisfaction
Intellectual Openness	+	+	
Conscientious Achievement		+	+
Personable Behaviour		+	
Emotional Instability			
Sensation Seeking			
Self-Focused Values			
Interaction Interests	-		+
Fluid Reasoning	+	+	-

+ = positive relationship, - = negative relationship

5.5 Optimised Factor Scores generated to predict Academic Outcomes (Study 5)

Study 5 investigated whether the resulting trait complexes could be condensed and optimised for increased prediction of academic outcomes, as detailed in aim iii, and hypothesis H5.

5.5.1 Methods

Participants, measures and testing procedure were the same as Study 4 (see section 5.4.1).

5.5.2 Results

In Study 4, factor analysis of personality facets, cognitive abilities, vocational interests and values was undertaken to provide factor scores for use in multiple regressions to predict psychology grades, GPA and academic satisfaction. In Study 5, a process of optimisation was undertaken wherein three factor analyses were performed to provide individualised factors for the prediction of psychology grades, GPA and academic satisfaction with psychology. Variables were included in the

analysis if they were significantly predictive of academic outcomes or contributed unique variance to the prediction in Studies 1 and 2 (see chapters 2 & 3).

5.5.2.1 Factor Analysis

Three EFAs with Principal Axis Factoring extraction and Promax rotation were performed to generate specific factor scores for the three criterion variables (psychology grades, GPA, academic satisfaction) using data from 328 participants (initial data 358, missing data 30).

The first EFA performed was streamlined for psychology grades, with a KMO coefficient of .69, and a nine-factor solution that explained 48.5% of the variance. The second EFA performed was optimised for GPA, which produced a KMO coefficient of .73, and an eight-factor solution that explained 48% of the variance. The third EFA was refined for academic satisfaction with psychology; this produced a KMO coefficient of .69 and a six-factor solution which explained 42.4% of the variance. For all three analyses, solutions were chosen after examining the scree plot and the general interpretability of the data, and large cross-loadings were retained over the choice of simple structure because of their factorial relevance and interpretability. The nine factors which emerged from EFA for the prediction of psychology grades are shown in Table 22.

Table 22: Pattern matrix for psychology grade honed EFA using PAF extraction and Promax rotation

	1	2	3	4	5	6	7	8	9
N1 Anxiety	**.865**	-.066	.075	-.025	.108	-.034	.057	-.105	.277
N4 Self Consciousness	**.802**	.076	-.029	.051	.022	.088	.053	-.117	.109
N6 Vulnerability	**.795**	.045	.005	.034	-.092	-.019	.004	.124	-.039
C1 Competence	**-.368**	.101	.066	-.093	.174	-.041	.206	-.181	.172
Word Beginnings	-.047	**.669**	-.026	.027	-.021	-.093	.127	-.043	-.111
Incomplete Words	.010	**.653**	.142	.037	.026	-.150	.038	.108	.122
Letter Sets	.047	**.542**	-.051	-.061	-.076	.151	-.051	.045	.107
Hidden Patterns	-.054	**.451**	-.047	.072	-.116	.088	-.209	.116	**.342**
Advanced Vocabulary	.014	**.421**	-.045	.060	.263	-.075	.089	-.138	-.269
Elaboration	-.225	.228	-.065	-.082	-.169	-.012	.074	-.010	.067
Nonsense Syllogisms	.007	.211	-.043	.008	.118	.177	-.191	-.050	-.034
A2 Straightforwardness	.073	-.044	**.810**	-.145	.038	-.031	.040	.001	-.146
A3 Altruism	-.027	.008	**.687**	.077	-.019	-.045	.021	.101	.239
A4 Compliance	-.019	.056	**.530**	.063	**-.344**	.119	-.049	-.133	-.149
Power	.028	-.041	**-.456**	.049	-.298	-.018	**.351**	-.066	.136
Artistic interests	-.005	-.019	-.100	**.814**	-.120	-.052	-.100	-.009	.007
O2 Openness to Aesthetics	.083	.086	.083	**.752**	-.074	.006	-.007	-.077	-.130
O1 Openness to Fantasy	.123	.063	-.052	**.449**	.298	-.060	-.065	.176	-.036
Self Direction	-.065	-.177	-.041	**.376**	.189	.051	**.356**	.049	-.077
O6 Openness to Values	.000	-.079	.046	.047	**.749**	-.027	-.018	-.007	-.080
Tradition	-.021	-.060	.224	.179	**-.702**	-.003	.215	-.100	.063
Investigative interests	.133	.047	.022	-.154	-.009	**.889**	.073	.063	-.090
Realistic interests	-.128	-.154	-.029	.115	-.118	**.514**	-.102	.060	-.022
O5 Openness to Ideas	-.041	.101	.030	.126	.248	**.493**	.106	-.120	.032

Achievement	.053	.045	.005	-.094	-.161	.026	**.963**	.217	-.091
E5 Excitement Seeking	-.040	.063	.011	-.001	.070	.067	.258	**.789**	-.060
O4 Openness to Actions	-.215	-.019	.106	.125	.105	.117	.029	.106	**-.380**

Loadings >.32 are bolded.

The first factor *Self Esteem* involves facets of Neuroticism and a negative loading upon C1 Competence, and it focuses on negative self-perception.

The second factor *Literacy* involved various abilities from the broad Stratum II groupings of *Glr* (Long Term Storage & Retrieval), *Gv* (Visual Processing), *Gf* (Fluid Reasoning), and *Gc* (Comprehension-Knowledge). This factor was not deemed to be a general abilities factor because of the exclusion of numeric and spatial abilities, and processing speed. The focus of this factor appears to be on the elements of literacy; processes such as perception, memory, reasoning, comprehension, and verbal closure are all aspects involved in reading, whilst speeded numeric and spatial abilities are not involved.

The third factor *Social Pleasantness* was a simplified, refined version of the factor *Personable Behaviour* from Study 4. It involved facets of Agreeableness and a negative loading on Power. In differentiating it from the original factor, *Social Pleasantness* focuses on external socially pleasant behaviour but removes emphasis on internal consideration of others' feelings.

Aesthetic Flexibility is the fourth factor that emerged, and it includes personality traits, plus loadings on values and vocational interests. The focus of this factor appears to be independent and openminded aesthetic appreciation.

The fifth factor *Values Flexibility* included a loading on an Openness facet, and negative loadings on an Agreeableness facet and the value of Tradition; this factor's focus is on being openminded about values and actively rejecting societally established values.

Construct Interests involved both Realistic and Investigative vocational interests and O5 Openness to Ideas. The focus of this factor was an equal focus on the creation of ideas and creation of objects.

The seventh factor *Competitive Independence* involved the values of Achievement and Power from the Self Enhancement value orientation, and Self Direction from the Openness to Change value orientation. The focus of the factor is on valuing enhancement of self over others (via Achievement and Power) including the freedom of choice to maintain self enhancement (via Self Direction and Power).

Excitement Seeking is the eighth factor that emerged. It involved a single facet of Extraversion, E5 Excitement Seeking, and appears to be a basic format of the factor *Sensation Seeking* which emerged in Study 4. This factor's focus is on behaviour involving stimulation and novelty.

The ninth factor was *Decision Closure*. It involved only two items; Hidden Patterns, a measure of flexibility of closure, and a negative loading on the Openness facet of O4 Openness to Actions. Although Hidden Patterns measures flexibility of closure which involves quick perceptions, receiving high scores on this scale might involve sticking with decisions once made. This factor appears to focus on making firm decisions, whether brief perceptual ones or more complex decisions regarding behaviour.

Eight factors emerged from EFA for the prediction of GPA, which are shown in Table 23.

Table 23: Pattern matrix for GPA honed EFA using PAF extraction and Promax rotation

	1	2	3	4	5	6	7	8
N3 Depression	**.811**	.033	.017	.096	-.050	.087	-.053	.042
N1 Anxiety	**.806**	-.105	.002	-.108	.169	-.039	.026	-.017
N6 Vulnerability	**.733**	.003	-.125	-.050	-.167	.010	.002	.053
N4 Self Consciousness	**.731**	.067	.078	.040	-.024	.030	-.055	-.163
Word Beginnings	-.049	**.792**	-.026	-.059	-.032	.120	-.060	-.038
Incomplete Words	.033	**.628**	-.021	-.123	.024	-.009	.144	.128
Advanced Vocabulary	-.037	**.504**	.153	-.073	-.006	-.138	-.054	-.177
Letter Sets	.023	**.434**	-.160	.141	.002	-.083	.010	.043
Elaboration	-.136	.191	-.132	.007	.122	.132	-.068	.055
Self Direction	-.071	-.139	**.822**	-.005	.001	.250	-.114	-.070
O2 Openness to Aesthetics	.103	.089	**.483**	.071	-.169	.042	.206	-.045
O1 Openness to Fantasy	.056	.051	**.475**	-.049	-.252	-.207	.062	.063
Investigative interests	.092	.024	-.077	**.783**	.052	-.042	-.018	.082
Realistic interests	-.157	-.166	.063	**.520**	-.174	.030	.007	.057
O5 Openness to Ideas	.023	.112	**.329**	**.481**	.228	-.093	.034	-.038
C6 Deliberation	.063	-.105	-.234	.017	**.713**	.048	.148	-.249
C1 Competence	-.122	.078	.038	-.043	**.708**	-.008	-.023	.046
Tradition	-.006	-.034	.083	-.012	-.038	**.743**	.246	-.105
Achievement	.082	.049	.232	-.003	.231	**.547**	-.103	.221
O6 Openness to Values	-.038	-.039	**.411**	-.083	.114	**-.521**	.044	-.053
Nonsense Syllogisms	-.014	.158	-.092	.183	-.019	**-.301**	.029	-.049
A3 Altruism	.030	-.029	.075	-.072	.193	-.006	**.651**	.271
A4 Compliance	-.104	.063	-.026	.063	-.040	.145	**.609**	-.186
E5 Excitement Seeking	-.018	.000	.017	.079	-.277	.031	.041	**.743**
E4 Activity	-.108	-.007	-.183	.044	.158	.045	.029	**.467**

Loadings >.32 are bolded.

The first factor *Passive Instability* shared much of its loadings in common with *Emotional Instability* from Study 4; it included loadings on facets of Neuroticism. However, it differed slightly from *Emotional Instability* due to its exclusion of loadings that involved negative social interactions, such as N2 Angry Hostility. *Passive Instability* is characterized by loadings upon internal behaviours of Neuroticism, such as N6 Vulnerability which have less bearing on interactions with others.

Literacy Generation was the second factor that emerged from the data. This factor appeared to be a limited version of the previous factor *Literacy* which emerged from the predictors of psychology grades. It included loadings on verbal abilities related to memory, visual processing, and comprehension (Word Beginnings, Incomplete Words, and Advanced Vocabulary II, respectively). Additionally, the exclusion of an additional measure of visual closure (Hidden Patterns) from *Literacy* and the inclusion of a measure of inductive reasoning (Letter Sets) from *Literacy* suggest that this factor's focus is on the process of writing and abilities that produce writing, rather than the visual processing focus aspects of reading.

The third factor was *Decision Flexibility*, and it included the Self Direction value and facets of Openness. While sharing overlap with *Aesthetic Flexibility* it excluded that factor's strongest loading of Artistic interests, and included Self Direction, O6 Openness to Values and O5 Openness to Ideas, suggesting a greater emphasis on freedom of ideas. This factor's focus was on independence of choice and open-mindedness regarding values, ideas, aesthetics and fantasy.

Construct Interests II was the fourth factor and a replication of the previous factor *Construct Interests*. It contained the same items of Realistic interests, Investigative interests, and O5 Openness to Ideas with similar loadings for each item. However, *Construct Interests II* emerged from the predictors of GPA rather than the predictors of psychology grades.

Perfectionism was the fifth factor and it involved only two equally strong loadings upon facets from Conscientiousness. When examined in combination, C6 Deliberation and C1 Competence suggest that this factor's focus is upon achievement-related perfectionism.

The sixth factor was *Traditional Values*, which drew upon the values of Tradition and Achievement, as well as negative loadings on O6 Openness to Values and on Nonsense Syllogisms, a measure of fluid reasoning. The focus of this factor was on holding long-established values and defined, consistent patterns of thought.

The seventh factor was *Selflessness*, and it contained only two loadings on facets of Agreeableness, A3 Altruism and A4 Compliance. It appears to be a simpler version of the similar factor *Social Pleasantness*, which emerged from the predictors of psychology grades, yet the focus is different; whilst *Social Pleasantness* involved kind behaviours, it appears in the context of social interactions. *Selflessness*, by contrast, appears as a refined version of selfless behaviour without a social context.

Operational Excitement was the eighth factor and it included two loadings on facets of Extraversion, E5 Excitement Seeking and E4 Activity. Although similar to *Excitement Seeking* which emerged from the predictors of psychology grades, this factor's inclusion of a secondary loading suggests that this factor is defined by the desire for stimulation via continuous meaningful behaviour, rather than through novelty and fun, which appears relevant to this factor emerging from the predictors of overall GPA.

Six factors emerged from EFA for the prediction of academic satisfaction with psychology, which are shown in Table 24.

Table 24: Pattern matrix for academic satisfaction with psychology honed EFA using PAF extraction and Promax rotation

	1	2	3	4	5	6
N3 Depression	**.857**	-.031	.064	-.162	.079	-.005
N4 Self Consciousness	**.796**	.024	-.101	-.038	.094	.096
C5 Self Discipline	**-.443**	.030	.151	**-.315**	.069	.048
Word Beginnings	.032	**.762**	.110	-.204	-.147	.066
Incomplete Words	-.124	**.629**	.065	.060	.239	-.208
Advanced Vocabulary	.047	**.568**	-.226	.129	.028	.170
O3 Openness to Feelings	.074	.168	**.613**	.047	-.098	.083
Social interests	-.114	-.099	**.586**	-.190	.094	-.034
O1 Openness to Fantasy	-.061	.022	-.120	**.837**	.023	.120
N5 Impulsiveness	.295	-.068	.265	**.312**	-.078	-.280
Number Comparison	.013	.098	.034	-.219	-.121	-.038
A5 Modesty	.181	.054	-.043	-.007	**.654**	-.078
A6 Tender Mindedness	-.087	.041	.208	.139	**.474**	-.027
Universalism	-.024	-.156	.251	.060	.075	**.469**
O2 Openness to Aesthetics	.062	.044	**.321**	.183	.038	**.401**
Investigative interests	.011	.065	-.065	.043	-.109	**.318**

Loadings >.32 are bolded.

As seen in Table 24, six factors emerged from EFA for the prediction of academic satisfaction with psychology. The first factor *Destructive Instability* comprised loadings on traits from Neuroticism and a negative loading on C5 Self Discipline and appears to focus upon emotional instability which may impact productivity in an academic course.

The second factor *Verbal Ability* was defined by disparate but verbal-centric abilities of verbal fluency, verbal closure and verbal comprehension, which represent the broad Stratum II abilities of *Glr* (Long Term Storage & Retrieval), *Gv* (Visual Processing) and *Gc* (Comprehension-Knowledge).

When viewed in the context of the previous factors of *Literacy* and *Literacy Generation* which include more measures involving reasoning, it seems that this factor's focus is on reading and processing language visually.

Emotional Openness was the third factor, and its two loadings on Social interests and O3 Openness to Feelings demonstrated a focus on emotional expression and examination.

The fourth factor *Destructive Inattentiveness* contained loadings upon traits from Openness, Neuroticism, and a negative loading on C5 Self Discipline. It seems to focus on distraction and inattentive behaviours which may impact productivity in an academic course, similarly to *Destructive Instability*.

Thoughtful Behaviour was the fifth factor, and it comprised loadings upon two Agreeableness facets. This factor focuses on socially agreeable behaviour – specifically consideration of others' feelings.

The sixth factor *Self Transcendence* is named for the value orientation of its strongest loading on Universalism. This factor focuses upon the societally beneficial aspects of Intellectual Openness; valuing tolerance and goodwill, openminded appreciation of aesthetics, and interest in scientific exploration.

Correlations between the factors, for all three analyses, are shown in Table 25.

Table 25: Correlations between factors for the three criterion honed EFAs

Psychology Grades 9 Honed Factors									
	1	2	3	4	5	6	7	8	9
Self Esteem	1.0								
Literacy	-.04	1.0							
Social Pleasantness	-.11	.15	1.0						
Aesthetic Flexibility	-.05	.15	.16	1.0					
Values Flexibility	-.21	**.52**	.12	**.36**	1.0				
Construct Interests	**-.33**	.22	.11	**.39**	**.37**	1.0			
Competitive Independence	-.29	-.08	.09	.17	.08	.21	1.0		
Excitement Seeking	-.01	-.17	-.16	.01	-.10	-.05	-.21	1.0	
Decision Closure	-.28	-.04	.01	.11	.08	.18	**.33**	.08	1.0
GPA 8 Honed Factors									
	1	2	3	4	5	6	7	8	
Passive Instability	1.0								
Literacy Generation	.02	1.0							
Decision Flexibility	-.07	**.36**	1.0						
Construct Interests II	-.16	.22	**.40**	1.0					
Perfectionism	**-.40**	.21	.23	.22	1.0				
Traditional Values	-.03	**-.47**	-.29	-.12	.04	1.0			
Selflessness	.06	.07	.03	.09	.04	.07	1.0		
Operational Excitement	-.26	.03	.26	.09	.18	-.01	-.22	1.0	
Academic Satisfaction 6 Honed Factors									
	1	2	3	4	5	6			
Destructive Instability	1.0								
Verbal Ability	.14	1.0							
Emotional Openness	.29	.14	1.0						

Destructive Inattentiveness	**.40**	**.34**	**.48**	1.0		
Thoughtful Behaviour	.09	-.01	.20	-.12	1.0	
Self-Transcendence Values	-.11	.11	.23	.10	**.32**	1.0

Correlations >.32, p <.05, bolded.

5.5.2.2 Regression

Multiple regressions using the three sets of honed factor scores to predict psychology grade, GPA and academic satisfaction with psychology are shown in Table 26.

Table 26: Multiple regressions using 9, 8 and 6 honed factor scores to predict psychology grade, GPA and academic satisfaction with psychology and unique variance contributed by the squared semi-partial correlation

Psychology grade								
Step and Predictors		β	*T*	sr^2	R^2	aR^2	ΔR^2	ΔF
1	Age	-.006	-.090	.00	.051	.043	.051	6.598**
	Gender	.225	3.628***	**.05**				
2	Age	-.139	-2.250*	**.02**	.286	.252	.235	8.650***
	Gender	.231	3.660***	**.04**				
	Self Esteem	-.001	-.024	.00				
	Literacy	.318	5.732***	**.10**				
	Social Pleasantness	.055	.920	.00				
	Aesthetic Flexibility	-.163	-2.960**	**.03**				
	Values Flexibility	.123	2.214*	**.01**				
	Construct Interests	.123	2.119*	**.01**				
	Competitive Independence	.051	.917	.00				
	Excitement Seeking	-.160	-2.672**	**.02**				
	Decision Closure	-.231	-4.121***	**.05**				
GPA								
Step and Predictors		β	*T*	sr^2	R^2	aR^2	ΔR^2	ΔF
1	Age	.015	.239	.00	.020	.012	.020	2.544
	Gender	.142	2.248*	**.02**				
2	Age	-.091	-1.456	**.01**	.202	.168	.182	6.800***
	Gender	.143	2.193*	**.02**				
	Passive Instability	-.098	-1.652	**.01**				
	Literacy Generation	.315	5.344***	**.10**				

	Decision Flexibility	-.109	-1.874	**.01**
	Construct Interests II	.077	1.265	**.01**
	Perfectionism	.197	3.305***	**.04**
	Traditional Values	-.113	-1.943	**.01**
	Selflessness	.023	.391	.00
	Operational Excitement	-.127	-2.084*	**.01**

Academic Satisfaction

Step	and Predictors	β	*T*	sr^2	R^2	aR^2	ΔR^2	ΔF
1	Age	.159	2.730**	**.02**	.034	.027	.034	5.049**
	Gender	.102	1.760	**.01**				
2	Age	.137	2.421*	**.02**	.181	.158	.147	8.404***
	Gender	-.017	-.283	.00				
	Destructive Instability	-.191	-3.519***	**.04**				
	Verbal Ability	-.086	-1.568	**.01**				
	Emotional Openness	.279	4.883***	**.07**				
	Destructive Inattentiveness	-.058	-1.058	.00				
	Thoughtful Behaviour	.196	3.482***	**.04**				
	Self-Transcendence Values	-.033	-.581	.00				

*= *p* <.05, **= *p* <.01, ***= *p* <.001. Bolded type indicates unique variance of 1% or greater.

The optimised factors of *Literacy*, *Aesthetic Flexibility* (negative predictor), *Values Flexibility*, *Construct Interests*, *Excitement Seeking* (negative predictor), and *Decision Closure* significantly predicted 25.2% of the variance in psychology course grade in the second step *F*(11,237)= 8.612, *p*<.001. Additionally, gender was still a significant predictor beyond the factor scores, with female psychology students receiving higher grades. Literacy was the strongest predictor, contributing 10% unique variance to the prediction of psychology grades. Increases in reading-related cognitive

abilities, open-mindedness towards values, interest in practical and scientific activities, and firm decision-making, along with decreases in aesthetic interests and seeking excitement, were predictive of receiving higher course grades in psychology. When compared to Study 4, which predicted 14.1% of the variance (see section 5.4.2), these refined factors of Study 5 predicted an additional 11.1% of the variance in psychology grades.

Literacy Generation, *Perfectionism* and *Operational Excitement* (negative predictor) significantly predicted 16.8% of the variance in GPA in the second step $F(10,239)= 6.045$, $p<.001$; these results explained an additional 2.9% of the variance when compared to the findings of Study 4. Again, gender remained a significant predictor in the second step, with female students receiving higher GPAs. Literacy Generation was the strongest predictor, contributing 10% unique variance to the prediction of GPA. These results demonstrated that higher levels of verbal and verbal-related abilities necessary to the generation of writing, traits involving deliberate efforts towards achievement, and reduced traits involving excitement and need for activity, were predictive of higher GPAs for undergraduate students.

Destructive Instability (negative predictor), *Emotional Openness* and *Thoughtful Behaviour* significantly predicted 15.8% of the variance in academic satisfaction with psychology in the second step $F(8,281)= 7.761$, $p<.001$, and explained an additional 6.7% than the findings of Study 4. Contrary to the previous results, age remained a significant predictor, with older students experiencing greater academic satisfaction with psychology. Emotional Openness was the strongest predictor of academic satisfaction with psychology, contributing 7% unique variance. Increases in open-mindedness towards emotional expression, socially considerate behaviour, and self-discipline, along with decreases in negative emotion were predictive of increased satisfaction with psychology courses undertaken.

Table 27 demonstrates the spread of honed factors that were predictive of their respective dependent variables.

Table 27: Relevant honed factor scores for the prediction of psychology grade, GPA and academic satisfaction with psychology

	Psychology Grade	GPA	Academic Satisfaction
Self Esteem			
Literacy	+		
Social Pleasantness			
Aesthetic Flexibility	-		
Values Flexibility	+		
Construct Interests	+		
Competitive Independence			
Excitement Seeking	-		
Decision Closure	+		
Passive Instability			
Literacy Generation		+	
Decision Flexibility			
Construct Interests II			
Perfectionism		+	
Traditional Values			
Selflessness			
Operational Excitement		-	
Destructive Instability			-
Verbal Ability			
Emotional Openness			+
Destructive Inattentiveness			
Thoughtful Behaviour			+
Self-Transcendence Values			

+ = positive relationship, - = negative relationship

5.6 Discussion

5.6.1 Trait Complexes and inclusion of multiple Individual Differences domains

Study 4 showed that *Intellectual Openness*, *Interaction Interests*, *Fluid Reasoning, Conscientious Achievement*, *Personable Behaviour* and *Interaction Interests* were significantly predictive of all academic outcomes. Of these, *Intellectual Openness* demonstrated the strongest combination of variables, comprising personality facets, cognitive abilities and values, whilst *Fluid Reasoning* demonstrated the least, containing only cognitive abilities. *Conscientious Achievement* and *Personable Behaviour* contained personality facets and values, whilst *Interaction Interests* was the only factor with vocational interests and personality facets.

Study 5 found that *Literacy*, *Aesthetic Flexibility*, *Values Flexibility*, *Construct Interests*, *Excitement Seeking*, and *Decision Closure* were predictive of psychology course grades. *Aesthetic Flexibility* contained personality facets, vocational interests and values, whilst *Literacy* and *Excitement Seeking* contained only cognitive abilities and personality facets, respectively. It appears that personality facets are central to factor scores predictive of psychology course grades. For the prediction of GPA, *Literacy Generation*, *Perfectionism*, and *Operational Excitement* were significantly predictive factor scores. Interestingly, all three were singular variable factor scores, with *Literacy Generation* only containing cognitive abilities, and the others only containing personality facets. *Destructive Instability*, *Emotional Openness* and *Thoughtful Behaviour* predicted academic satisfaction with psychology. *Emotional Openness* comprised both personality facets and vocational interests, whilst the other factor scores only contained personality facets.

As was hypothesised, these results demonstrate that trait complexes can incorporate multiple individual differences domains to successfully predict academic outcomes. Further, they suggest that intra-trait complex diversity, and the inclusion of vocational interests and values may be of increased importance for significant prediction of course-specific or discipline-specific dependent

variables. The generalised nature of GPA appears to only require specific abilities and personality facets of behaviour in order to be successfully predicted.

5.6.2 Inclusion of Personality Facets

As was suggested by the many relationships with cognitive abilities, vocational interests and values within the literature, personality can be considered a unifying domain, linking cognitive abilities, vocational interests and values. While many of the factors contained items from two or more individual differences domains, all that did so contained personality facets in addition to other domains. As hypothesised, personality facets were important, both as a link between individual differences domains and due to being contained within predictive factors in both Study 4 and 5. This demonstrates the necessity of their inclusion within such research. They appear able to capture aspects of prediction eluded by broad personality factors, and can provide both specificity and brevity, both crucial in practical applications within career counselling. Despite a difference in outcome variables utilised, this was supported by research demonstrating that enrolment within a social sciences course could be predicted by most facets of Openness (O3 Feelings, O5 Ideas, O6 Values, O2 Aesthetics) in addition to E2 Gregariousness (Paunonen & Ashton, 2001b), which seems mirrored in Study 4's factors *Intellectual Openness* and *Interaction Interests*, both of which were predictive of psychology course grades and academic satisfaction with psychology. Whilst the division of facets differs within Study 5, similar results can be seen within, for example, *Values Flexibility*'s prediction of course grades, and *Emotional Openness*' prediction of academic satisfaction.

5.6.3 Prediction of Academic Performance

The results of this research supported the hypothesis that trait complexes would significantly predict academic performance, operationalised as GPA and psychology course grades. When using the general trait complexes of Study 4, psychology course grades were predicted by *Intellectual Openness*, *Interaction Interests* (negative predictor) and *Fluid Reasoning*, whilst GPA was predicted by *Intellectual Openness*, *Conscientious Achievement*, P*ersonable Behaviour*, and *Fluid Reasoning*. These results suggest that students with increased openness and knowledge-seeking behaviours, a lack of interest in socially interactive tasks, and increased reasoning and numeric abilities receive higher psychology course grades, whilst students with increased openness and knowledge seeking behaviours, but additionally, conscientious, assertive behaviours, socially positive values and behaviours, and increased reasoning and numeric abilities receive higher GPAs overall. When using the optimised trait complexes of Study 5, psychology grades were predicted by *Literacy*, *Aesthetic Flexibility* (negative predictor), *Values Flexibility*, *Construct Interests*, *Excitement Seeking* (negative predictor) and *Decision Closure*, whilst GPA was predicted by *Literacy Generation*, *Perfectionism* and *Operational Excitement* (negative predictor). The findings suggest that students with increased levels of verbal and reasoning abilities, reduced interest in aesthetics but increased interest in open-mindedness towards values, interest in constructive, productive or conceptual tasks, lower need for stimulating, social activities, and increased abilities to make decisions received higher psychology grades, and that students with increased writing related abilities, a focus on competency and less need to be consistently occupied received higher grades in all subjects overall. The present research supports the findings that factor scores can significantly predict GPA, and that abilities, personality, and vocational interest were all predictive domains of academic performance (Kanfer et al., 2010). Further, past research demonstrated that verbal and numeric ability trait complexes, in addition to a trait complex which included both Artistic Interests and Openness (Learning/Mastery Orientation), and another which included Conscientiousness (Self Management), could significantly predict overall GPA. Interestingly, these complexes seem to align moderately with the predictive factors from Study 4 (*Intellectual Openness*, *Conscientious Achievement* and *Fluid Reasoning*) as well

as Study 5 (*Literacy Generation*, *Perfectionism*). Study 4's trait complexes may match closer than Study 5 due to their shared nature of generalised factors for prediction of multiple outcomes (rather than optimised trait complexes for specific outcomes). However, it must be noted that Kanfer et al. (2010) explained 51.3% of the variance in GPA (R^2 reported). Whilst this result is vastly more predictive than the current study's finding of 20.2%, they used a sample of engineering students, and additional measures involving motivation.

Partial overlap was shown between the predictors of GPA and psychology grades in both studies (*Intellectual Openness* and *Fluid Reasoning* in Study 4 for both academic outcomes; similarly, between Literacy-related and Excitement-related trait complexes for both academic outcomes). However, it is not surprising that overlap exists between two aspects of academic performance and it demonstrates that while some of the variance explained may be unique to an academic discipline, some is also universal to good academic performance. With partial overlap, it would seem that there is partial support for this hypothesis; unique nuances to performance within psychology, such as increased levels of *Values Flexibility*, suggest that successful psychology students, in comparison to students overall, need to be understanding of, and interested in, how individuals differ in their personal values, if they are to succeed. Although overlap exists in terms of relevant predictive variables, the differences support previous research which found that personality facets differed in their strength of prediction, and that different facets significantly predicted GPA for different academic majors (Vedel et al., 2015).

5.6.4 Prediction of Academic Satisfaction with Psychology

As hypothesised, the results demonstrated that student satisfaction with psychology could be significantly predicted by the trait complexes examined in the studies. When using more general trait complexes in Study 4, *Conscientious Achievement*, *Interaction Interests* and *Fluid Reasoning* (negative predictor) significantly predicted academic satisfaction. This suggests that students with assertive, achievement-focused behaviours, a preference for a wide range of social interaction

related tasks, but lower levels of logical reasoning and numerical ability, have greater satisfaction with undertaking psychology. It seems probable that individuals with high levels of reasoning and numeric ability find themselves less satisfied with a course which does not have a heavy emphasis on mathematical reasoning, and that interest in diverse but socially engaged activities is beneficial for satisfaction with introductory-level psychology. The optimised trait complexes of Study 5 found that *Destructive Instability* (negative predictor), *Emotional Openness*, and *Thoughtful Behaviour* significantly predicted satisfaction with psychology. These results indicate that students with a lack of emotional instability and disorganisation, but increased interest in social activities, openness to feelings, and consideration for others, express greater satisfaction with undertaking psychology, and on the whole, suggest that stable yet emotionally open individuals interested in people will be most satisfied with psychology as a discipline.

Of note, there appears to be a discrepancy between the characteristics necessary for students to receive high grades in psychology, and those necessary to experience increased satisfaction with psychology in Study 4. Due to the customised factors of Study 5 which were optimised for specific dependent variables, this could not occur. However, in Study 5, academic performance was significantly predicted by *Interaction Interests* (negative predictor) and *Fluid Reasoning*, whilst academic satisfaction was conversely predicted by *Interaction Interests* and *Fluid Reasoning* (negative predictor). It appears that students who perform well academically may not feel satisfied with the level of challenge presented by a course, which may present further issues for exploration.

5.6.5 Customising Trait Complexes for dependent variables and Comparison between the Current Studies and with Previous Research

As hypothesised, it can be seen that the optimised factor scores of Study 5 were stronger predictors of academic outcomes than Study 4. This is not surprising, considering that only variables found to be predictive or accounting for unique variance were included in the analysis. For psychology course grades, Study 4 provides three factors which explain 14.1% of the variance, whilst Study 5 has six

predictive factors accounting for 25.2% of the variance. It is noted that the number of variables increased along with the variance explained. For the prediction of GPA, Study 4 predicted 13.9% of the variance with four factors, compared to three factors predicting 16.8% in Study 5. However, these results are very slightly less predictive than that of Study 2, which explained 17% of the variance in GPA using four cognitive abilities, although it may be argued that 0.2% less variance explained is compensated by the utility of one less factor for prediction (and thus less testing resources and time taken). For academic satisfaction with psychology, Study 4 accounted for 9.1% of the variance in academic satisfaction using three factors, while Study 5 accounted for 15.8% with the same amount of factors. It appears that the optimised trait complex factors of Study 5 have greater utility for the prediction of psychology course grades and academic satisfaction with psychology. These results suggest that trait complexes which have been customised for prediction of specific academic outcomes using narrow measures, may be of practical use for career counsellors, both in terms of reducing assessment and increasing successful prediction of probable student outcomes.

5.6.6 Limitations and Future Directions

The current research was exploratory, and due to limitations with the sample, it was not feasible to examine other academic disciplines in addition to Psychology, but the comparison would have provided insight into whether other academic disciplines differ in their predictive factors and ability to have academic outcomes successfully predicted. Future studies could benefit greatly from including a wider range of academic disciplines for comparison. Further, the current research attempted to examine a broad swathe of variables, but the test battery was constrained by issues of time and practicality. Whilst narrow Stratum I cognitive abilities tests were chosen to represent broader Stratum II, the inclusion of additional measures could have been informative. Additionally, the inclusion of motivation measures may also be very informative. Self-reported grades were additionally used in the current research, which both reduced the quantity collected, and may have biased the results towards better grades, if only students who felt happy with the grades self-

reported them. Thus, the findings of this study may have less relevance to the prediction of poor academic performance, which could be addressed by future research. Finally, the findings of this research suggest that specific prediction of academic outcomes for individual academic disciplines, using combinations of narrow measures from multiple individual differences domains should be addressed by future research to broaden the available knowledge, which may assist practical aspects of career counselling.

5.6.7 Conclusion

The findings of this research have produced several useful conclusions which, with future research could enable practical advances in the prediction of academic performance and satisfaction. It has been demonstrated that personality, vocational interests, cognitive abilities and values combine within trait complexes to enable prediction of academic outcomes. It has also been shown that personality facets are crucial to this process and should not be overlooked. And finally, the results of these studies suggest that customising prediction for specific academic outcomes and specific academic disciplines and building up an extensive database of research for both, may provide useful knowledge for guiding students towards areas of study that they will enjoy and perform well in academically. The greater implications of this research are that universities could be transformed and improved by the incorporation of new measures into current career counselling activities, providing increased efficiency and accuracy for the career counselling service, increased retention rates and successful degree completion for the universities, and increased academic grades and GPA, life satisfaction, and QOL for the students.

5.7 References

Ackerman, P. L. (2003). Aptitude complexes and trait complexes. *Educational Psychologist, 38*(2), 85-93.

Ackerman, P. L., Chamorro-Premuzic, T., & Furnham, A. (2011). Trait complexes and academic achievement: Old and new ways of examining personality in educational contexts. *British Journal of Educational Psychology, 81*(1), 27-40.

Ackerman, P. L., & Heggestad, E. D. (1997). Intelligence, personality, and interests: evidence for overlapping traits. *Psychological Bulletin, 121*(2), 219.

Ackerman, P. L., Kanfer, R., & Beier, M. E. (2013). Trait complex, cognitive ability, and domain knowledge predictors of baccalaureate success, STEM persistence, and gender differences. *Journal of Educational Psychology, 105*(3), 911.

Allen, J., Robbins, S. B., Casillas, A., & Oh, I. S. (2008). Third-year college retention and transfer: Effects of academic performance, motivation, and social connectedness. *Research in Higher Education, 49*(7), 647-664. doi:10.1007/s11162-008-9098-3

Anglim, J., & Grant, S. (2016). Predicting psychological and subjective well-being from personality: Incremental prediction from 30 facets over the Big 5. *Journal of Happiness studies, 17*(1), 59-80.

Anglim, J., Knowles, E. R. V., Dunlop, P. D., & Marty, A. (2017). HEXACO personality and Schwartz's personal values: A facet-level analysis. *Journal of Research in Personality, 68*, 23-31.

Bergold, S., & Steinmayr, R. (2018). Personality and intelligence interact in the prediction of academic achievement. *Journal of Intelligence, 6*(2), 27.

Carless, S. A. (1999). Career Assessment: Holland's Vocational Interests, Personality Characteristics, and Abilities. *Journal of Career Assessment, 7*(2), 125-144. doi:10.1177/106907279900700203

Chamorro-Premuzic, T., & Furnham, A. (2008). Personality, intelligence and approaches to learning as predictors of academic performance. *Personality and Individual Differences, 44*(7), 1596-1603.

Chowdhury, M. S., & Amin, M. N. (2006). PERSONALITY AND STUDENTS' ACADEMIC ACHIEVEMENT: INTERACTIVE EFFECTS OF CONSCIENTIOUSNESS AND AGREEABLENESS ON STUDENTS' PERFORMANCE IN PRINCIPLES OF ECONOMICS. *Social Behavior & Personality: an international journal, 34*(4), 381-388.

Costa, P. T., & McCrae, R. R. (1992). *Neo PI-R professional manual* (Vol. 396). Odessa, FL: Psychological Assessment Resources.

De Fruyt, F., & Mervielde, I. (1996). Personality and interests as predictors of educational streaming and achievement. *European Journal of Personality, 10*(5), 405-425. doi:http://dx.doi.org/10.1002/%28SICI%291099-0984%28199612%2910:5%3C405::AID-PER255%3E3.0.CO;2-M

Deary, I. J., Strand, S., Smith, P., & Fernandes, C. (2007). Intelligence and educational achievement. *Intelligence, 35*(1), 13-21.

DeYoung, C. G., Quilty, L. C., Peterson, J. B., & Gray, J. R. (2014). Openness to experience, intellect, and cognitive ability. *Journal of personality assessment, 96*(1), 46-52.

Dollinger, S. J., Leong, F. T. L., & Ulicni, S. K. (1996). On Traits and Values: With Special Reference to Openness to Experience. *Journal of Research in Personality, 30*(1), 23-41. doi:https://doi.org/10.1006/jrpe.1996.0002

Douglas, H. E., Bore, M., & Munro, D. (2016). Openness and Intellect: An analysis of the motivational constructs underlying two aspects of personality. *Personality and Individual Differences, 99*, 242-253.

Edwards, J. R. (1993). Problems With The Use Of Profile Similarity Indices In The Study Of Congruence In Organizational Research. *Personnel psychology, 46*(3), 641-665.

Ekstrom, R. B., French, J. W., & Harman, H. H. (1979). Cognitive factors: Their identification and replication. *Multivariate Behavioral Research Monographs*.

Ekstrom, R. B., French, J. W., Harman, H. H., & Dermen, D. (1976). *Manual for kit of factor-referenced cognitive tests*. Princeton, NJ:: Educational testing service.

Etzel, J. M., & Nagy, G. (2016). Students' Perceptions of Person–Environment Fit:Do Fit Perceptions Predict Academic Success Beyond Personality Traits? *Journal of Career Assessment, 24*(2), 270-288. doi:10.1177/1069072715580325

Fritzsche, B. A., McIntire, S. A., & Yost, A. P. (2002). Holland Type as a Moderator of Personality–Performance Predictions. *Journal of Vocational Behavior, 60*(3), 422-436. doi:https://doi.org/10.1006/jvbe.2001.1841

Furnham, A., & Chamorro-Premuzic, T. (2004). Personality and intelligence as predictors of statistics examination grades. *Personality and Individual Differences, 37*(5), 943-955.

Gandal, N., Roccas, S., Sagiv, L., & Wrzesniewski, A. (2005). Personal value priorities of economists. *Human Relations, 58*(10), 1227-1252.

Gosling, S. D., Rentfrow, P. J., & Swann Jr, W. B. (2003). A very brief measure of the Big-Five personality domains. *Journal of Research in Personality, 37*(6), 504-528.

Guindon, A. (2008). *Individual Difference Correlates of Human Values as Measured by a Novel Revision of the Schwartz Values Survey.* ProQuest,

Hansen, J.-I. C., & Wiernik, B. M. (2016). Work preferences: vocational interests and values. In *The SAGE Handbook of Industrial, Work & Organizational Psychology: V1: Personnel Psychology and Employee Performance* (pp. 408).

Harris, J. A., Vernon, P. A., Johnson, A. M., & Jang, K. L. (2006). Phenotypic and genetic relationships between vocational interests and personality. *Personality and Individual Differences, 40*(8), 1531-1541. doi:https://doi.org/10.1016/j.paid.2005.11.024

Heaven, P. C. L., & Ciarrochi, J. (2012). When IQ is not everything: Intelligence, personality and academic performance at school. *Personality and Individual Differences, 53*(4), 518-522. doi:https://doi.org/10.1016/j.paid.2012.04.024

Holland, J. L. (1997). *Making vocational choices: A theory of vocational personalities and work environments, 3rd ed*. Odessa, FL, US: Psychological Assessment Resources.

Holland, J. L., Shears, M., & Harvey-Beavis, A. (2001). *Self-Directed Search* (Australian ed.). Camberwell, Victoria: Australian Council for Educational Research.

Johnson, W. (2018). A Tempest in A Ladle: The Debate about the Roles of General and Specific Abilities in Predicting Important Outcomes. *Journal of Intelligence, 6*(2), 24.

Kanfer, R., Wolf, M. B., Kantrowitz, T. M., & Ackerman, P. L. (2010). Ability and trait complex predictors of academic and job performance: A person–situation approach. *Applied Psychology, 59*(1), 40-69.

Kell, H., & Lang, J. (2017). Specific Abilities in the Workplace: More Important Than g? *Journal of Intelligence, 5*(2), 13.

Knafo, A., & Sagiv, L. (2004). Values and work environment: Mapping 32 occupations. *European Journal of Psychology of Education, 19*(3), 255-273.

Krapić, N., & Kuljanić, P. (2017). Intelligence, Personality Traits and Vocational Interests as Predictors of School Achievement. *Psihologijske teme, 26*(2), 431-450.

Kusurkar, R., & Croiset, G. (2015). Critical synthesis package: Schwartz value survey (SVS). . *MedEdPORTAL, 11*(10002). doi:http://doi.org/10.15766/mep_2374-8265.10002

Larson, L. M., Rottinghaus, P. J., & Borgen, F. H. (2002). Meta-analyses of Big Six interests and Big Five personality factors. *Journal of Vocational Behavior, 61*(2), 217-239.

Lechner, C., Danner, D., & Rammstedt, B. (2017). How is personality related to intelligence and achievement? A replication and extension of Borghans et al. and Salkever. *Personality and Individual Differences, 111*, 86-91.

Liem, G. A. D., Martin, A. J., Porter, A. L., & Colmar, S. (2012). Sociocultural antecedents of academic motivation and achievement: Role of values and achievement motives in achievement goals and academic performance. *Asian Journal of Social Psychology, 15*(1), 1-13. doi:doi:10.1111/j.1467-839X.2011.01351.x

Lietz, P., & Matthews, B. (2006). Are values more important than learning approaches? Factors influencing student performance at an international university. *Australian Association for Research in Education*.

Logue, C. T., Lounsbury, J. W., Gupta, A., & Leong, F. T. L. (2007). Vocational interest themes and personality traits in relation to college major satisfaction of business students. *Journal of Career Development, 33*(3), 269-295. doi:10.1177/0894845306297348

Lounsbury, J. W., Saudargas, R. A., Gibson, L. W., & Leong, F. T. (2005). An investigation of broad and narrow personality traits in relation to general and domain-specific life satisfaction of college students. *Research in Higher Education, 46*(6), 707-729. doi:Doi 10.1007/11162-004-4140-6

Luk, C. L., & Bond, M. H. (1993). Personality Variation and Values Endorsement in Chinese University-Students. *Personality and Individual Differences, 14*(3), 429-437. doi:Doi 10.1016/0191-8869(93)90312-Q

McGrew, K. S. (2009). CHC theory and the human cognitive abilities project: Standing on the shoulders of the giants of psychometric intelligence research. *Intelligence, 37*(1), 1-10. doi:https://doi.org/10.1016/j.intell.2008.08.004

McGrew, K. S., & Wendling, B. J. (2010). Cattell–Horn–Carroll cognitive-achievement relations: What we have learned from the past 20 years of research. *Psychology in the Schools, 47*(7), 651-675. doi:doi:10.1002/pits.20497

McLarnon, M. J. W., Goffin, R. D., & Rothstein, M. G. (2018). Differentiation of cognitive abilities and the Medical College Admission Test. *Personality and Individual Differences, 123*, 50-55. doi:https://doi.org/10.1016/j.paid.2017.11.005

Milsom, A., & Coughlin, J. (2017). Examining Person–Environment Fit and Academic Major Satisfaction. *Journal of College Counseling, 20*(3), 250-262. doi:10.1002/jocc.12073

Nauta, M. M. (2007). Assessing college students' satisfaction with their academic majors. *Journal of Career Assessment, 15*(4), 446-462.

Nauta, M. M. (2010). The development, evolution, and status of Holland's theory of vocational personalities: Reflections and future directions for counseling psychology. *Journal of Counseling Psychology, 57*(1), 11.

Ng, T. K., & Ye, S. (2016). Human values and university life satisfaction among Hong Kong Chinese university students: A cross-lagged panel analysis. *The Asia-Pacific Education Researcher, 25*(3), 453-461.

Nye, C. D., Perlus, J. G., & Rounds, J. (2018a). Do ornithologists flock together? Examining the homogeneity of interests in occupations. *Journal of Vocational Behavior, 107*, 195-208. doi:https://doi.org/10.1016/j.jvb.2018.04.004

Nye, C. D., Prasad, J., Bradburn, J., & Elizondo, F. (2018b). Improving the operationalization of interest congruence using polynomial regression. *Journal of Vocational Behavior, 104*, 154-169.

Nye, C. D., Su, R., Rounds, J. B., & Drasgow, F. (2012). Vocational interests and performance: A quantitative summary of over 60 years of research. *Perspectives on Psychological Science, 7*(4), 384-403.

Nye, C. D., Su, R., Rounds, J. B., & Drasgow, F. (2017). Interest congruence and performance: Revisiting recent meta-analytic findings. *Journal of Vocational Behavior, 98*, 138-151.

Olver, J. M., & Mooradian, T. A. (2003). Personality traits and personal values: a conceptual and empirical integration. *Personality and Individual Differences, 35*(1), 109-125. doi:Pii S0191-8869(02)00145-9

Parks-Leduc, L., Feldman, G., & Bardi, A. (2015). Personality traits and personal values: A meta-analysis. *Personality and Social Psychology Review, 19*(1), 3-29.

Parks, L., & Guay, R. P. (2009). Personality, values, and motivation. *Personality and Individual Differences, 47*(7), 675-684.

Parks, L., & Guay, R. P. (2012). Can personal values predict performance? Evidence in an academic setting. *Applied Psychology, 61*(1), 149-173.

Paunonen, S. V., & Ashton, M. C. (2001b). Big five factors and facets and the prediction of behavior. *Journal of Personality and Social Psychology, 81*(3), 524.

Pozzebon, J. A., Ashton, M. C., & Visser, B. A. (2014). Major changes: Personality, ability, and congruence in the prediction of academic outcomes. *Journal of Career Assessment, 22*(1), 75-88.

Rammstedt, B., Danner, D., & Martin, S. (2016). The association between personality and cognitive ability: Going beyond simple effects. *Journal of Research in Personality, 62*, 39-44.

Rammstedt, B., Lechner, C., & Danner, D. (2018). Relationships between Personality and Cognitive Ability: A Facet-Level Analysis. *Journal of Intelligence, 6*(2), 28.

Randahl, G. J. (1991). A typological analysis of the relations between measured vocational interests and abilities. *Journal of Vocational Behavior, 38*(3), 333-350. doi:https://doi.org/10.1016/0001-8791(91)90034-J

Roccas, S., Sagiv, L., Schwartz, S. H., & Knafo, A. (2002). The Big Five Personality Factors and Personal Values. *Personality and Social Psychology Bulletin, 28*(6), 789-801. doi:10.1177/0146167202289008

Rohde, T. E., & Thompson, L. A. (2007). Predicting academic achievement with cognitive ability. *Intelligence, 35*(1), 83-92. doi:https://doi.org/10.1016/j.intell.2006.05.004

Roth, B., Becker, N., Romeyke, S., Schäfer, S., Domnick, F., & Spinath, F. M. (2015). Intelligence and school grades: A meta-analysis. *Intelligence, 53*, 118-137. doi:https://doi.org/10.1016/j.intell.2015.09.002

Sagiv, L. (2002). Vocational interests and basic values. *Journal of Career Assessment, 10*(2), 233-257.

Sagiv, L., Roccas, S., Cieciuch, J., & Schwartz, S. H. (2017). Personal values in human life. *Nature Human Behaviour, 1*(9), 630-639. doi:10.1038/s41562-017-0185-3

Sagiv, L., & Schwartz, S. H. (2000). Value priorities and subjective well-being: Direct relations and congruity effects. *European journal of social psychology, 30*(2), 177-198.

Sagiv, L., & Schwartz, S. H. (2004). Values, intelligence and client behavior in career counseling: A field study. *European Journal of Psychology of Education, 19*(3), 237-254.

Saß, S., Kampa, N., & Köller, O. (2017). The interplay of g and mathematical abilities in large-scale assessments across grades. *Intelligence, 63*, 33-44. doi:https://doi.org/10.1016/j.intell.2017.05.001

Schaie, K. W., Willis, S. L., & Caskie, G. I. L. (2004). The Seattle Longitudinal Study: Relationship Between Personality and Cognition. *Neuropsychology, development, and cognition. Section B, Aging, neuropsychology and cognition, 11*(2-3), 304-324. doi:10.1080/13825580490511134

Schmitt, N., Oswald, F. L., Friede, A., Imus, A., & Merritt, S. (2008). Perceived fit with an academic environment: Attitudinal and behavioral outcomes. *Journal of Vocational Behavior, 72*(3), 317-335. doi:https://doi.org/10.1016/j.jvb.2007.10.007

Schult, J., & Sparfeldt, J. R. (2016). Do non-g factors of cognitive ability tests align with specific academic achievements? A combined bifactor modeling approach. *Intelligence, 59*, 96-102. doi:https://doi.org/10.1016/j.intell.2016.08.004

Schwartz, S. H. (1992). Universals in the content and structure of values: Theoretical advances and empirical tests in 20 countries. *Advances in experimental social psychology, 25*, 1-65.

Schwartz, S. H., & Bardi, A. (2001). Value hierarchies across cultures: Taking a similarities perspective. *Journal of Cross-Cultural Psychology, 32*(3), 268-290.

Schwartz, S. H., & Sortheix, F. M. (2018). Values and subjective well-being. In E. Diener, S. Oishi, & L. Tay (Eds.), *Handbook of well-being.* . Salt Lake City, UT: DEF Publishers. .

Snow, R. E. (1989). Aptitude-treatment interaction as a framework for research on individual differences in learning. In *Learning and individual differences: Advances in theory and research.* (pp. 13-59). New York, NY, US: W H Freeman/Times Books/ Henry Holt & Co.

Snow, R. E. (2014). *Cogmtive-Conative Aptitude Interactions in Learning.* Paper presented at the Abilities, motivation and methodology: The Minnesota symposium on learning and individual differences.

Sortheix, F. M., & Lönnqvist, J. E. (2015). Person-group value congruence and subjective well-being in students from Argentina, Bulgaria and Finland: The role of interpersonal relationships. *Journal of Community & Applied Social Psychology, 25*(1), 34-48.

Stoll, G., Rieger, S., Lüdtke, O., Nagengast, B., Trautwein, U., & Roberts, B. W. (2017). Vocational interests assessed at the end of high school predict life outcomes assessed 10 years later over and above IQ and Big Five personality traits. *Journal of Personality and Social Psychology, 113*(1), 167.

Strahan, S., & Credé, M. (2015). Satisfaction With College Re-Examining Its Structure and Its Relationships with The Intent to Remain in College and Academic Performance. *Journal of College Student Retention: Research, Theory & Practice, 16*(4), 537-561.

Taub, G. E., Keith, T. Z., Floyd, R. G., & McGrew, K. S. (2008). Effects of general and broad cognitive abilities on mathematics achievement. *School Psychology Quarterly, 23*(2), 187.

Tinsley, H. E. (2000). The congruence myth: An analysis of the efficacy of the person–environment fit model. *Journal of Vocational Behavior, 56*(2), 147-179.

Trógolo, M., & Medrano, L. A. (2012). Personality traits, difficulties in emotion regulation and academic satisfaction in a sample of argentine college students. *Personalidad, dificultades en la regulación emocional y satisfacción académica en una muestra de estudiantes universitarios argentinos., 5*(2), 30-39.

Van Iddekinge, C. H., Roth, P. L., Putka, D. J., & Lanivich, S. E. (2011a). Are you interested? A meta-analysis of relations between vocational interests and employee performance and turnover. *Journal of Applied Psychology, 96*(6), 1167.

Vandenberg, S. G., & Kuse, A. R. (1978). Mental rotations, a group test of three-dimensional spatial visualization. *Perceptual and motor skills, 47*(2), 599-604.

Vedel, A., Thomsen, D. K., & Larsen, L. (2015). Personality, academic majors and performance: Revealing complex patterns. *Personality and Individual Differences, 85*, 69-76. doi:10.1016/j.paid.2015.04.030

Vitulic, H. S., & Prosen, S. (2012). PERSONALITY AND COGNITIVE ABILITIES AS PREDICTORS OF UNIVERSITY STUDENTS' ACADEMIC ACHIEVEMENT. *Drustvena Istrazivanja, 21*(3), 715-732. doi:10.5559/di.21.3.06

Westermann, R., Elke, H., Spies, K., & Trautwein, U. (1996). Identifikation und Erfassung von Komponenten der Studienzufriedenheit. [Identifying and assessing components of student satisfaction.]. *Psychologie in Erziehung und Unterricht, 43*(1), 1-22.

Wolfradt, U., & Dalbert, C. (2003). Personality, values and belief in a just world. *Personality and Individual Differences, 35*(8), 1911-1918. doi:https://doi.org/10.1016/S0191-8869(03)00040-0

Wolniak, G. C., & Pascarella, E. T. (2005). The effects of college major and job field congruence on job satisfaction. *Journal of Vocational Behavior, 67*(2), 233-251. doi:10.1016/j.jvb.2004.08.010

Yik, M. S. M., & Tang, C. S. (1996). Linking personality and values: The importance of a culturally relevant personality scale. *Personality and Individual Differences, 21*(5), 767-774. doi:https://doi.org/10.1016/0191-8869(96)00114-6

Chapter 6: General Conclusions

This thesis aimed to investigate the interrelationships between personality, cognitive abilities, vocational interests and personal values, with a focus on the prediction of psychology course grade, Grade Point Average (GPA) and academic satisfaction with psychology. The inclusion of a wide range and unique combination of measures, as well as the examination of personality facets and stratum I cognitive abilities gave this project greater breadth and depth than previous research of this kind. Additionally, the use of exploratory factor analysis to provide factor scores and their subsequent application for the prediction of the dependent variables enabled numerous novel insights concerning these relationships.

6.1 Key Findings

The second chapter examined the prediction of academic satisfaction for undergraduate students within the discipline of psychology by personality factors, personality facets, vocational interests, cognitive abilities and values. It was found that personality factors, personality facets and vocational interests were individually predictive of academic satisfaction within the discipline of psychology, with personality facets shown as better predictors than the Big Five personality factors. Cognitive abilities did not predict academic satisfaction beyond that accounted for by age and gender, and values did not add to the prediction at all.

The third chapter examined the prediction of academic performance for undergraduate psychology students, measured as both GPA and psychology course grade, by personality factors, personality facets, vocational interests, cognitive abilities and values. It was found that personality facets, vocational interests and cognitive abilities were individually predictive of both GPA and psychology course grade, while the Five Factor Model personality factors were only predictive of GPA, and values were only predictive of psychology course grade.

The fourth chapter examined the structure of personality factors, vocational interests, cognitive abilities and values in combination via exploratory factor analysis. Factor scores from the ten resulting factors of *Conforming Values*, *Verbal Ability*, *Independent Values*, *Interaction Interests*, *Personable Behaviour*, *Sensation Seeking*, *Speeded Numeric Ability*, *Stable Competence*, *Conceptual Interests*, and *Cognitive Flexibility* were used to predict the three outcomes of psychology course grade, GPA and academic satisfaction with psychology for undergraduate psychology students. Of these, *Verbal Ability, Conforming Values* (negative predictor), and *Cognitive Flexibility* (negative predictor) predicted 18.4% of the variance in psychology course grade, *Stable Competence*, *Verbal Ability*, and *Personable Behaviour* predicted 14.6% of the variance in GPA and *Independent Values*, *Conceptual Interests* (negative predictor), *Sensation Seeking* (negative predictor), *Interaction Interests* and *Stable Competence* predicted 10% of the variance in academic satisfaction with psychology.

The fifth chapter comprises two studies; Study 4 examined the structure of personality facets, vocational interests, cognitive abilities and values in combination via exploratory factor analysis. Factor scores from the eight resulting factors of *Intellectual Openness*, *Conscientious Achievement*, *Personable Behaviour*, *Emotional Instability*, *Sensation Seeking*, *Self-Focused Values*, *Interaction Interests* and *Fluid Reasoning* were used to predict the three outcomes of psychology course grade, GPA and academic satisfaction with psychology for undergraduate psychology students. *Intellectual Openness*, *Interaction Interests* (negative predictor) and *Fluid Reasoning* predicted 14.1% of the variance in psychology course grade. *Intellectual Openness*, *Conscientious Achievement*, *Personable Behaviour*, and *Fluid Reasoning* predicted 13.9% of the variance in GPA, and *Conscientious Achievement*, *Interaction Interests*, and *Fluid Reasoning* (negative predictor) predicted 9.1% of the variance in academic satisfaction with psychology.

In Study 5, factor scores were optimised for specific prediction of each of the three outcome variables, based on the findings of Studies 1 and 2. For the prediction of psychology course grade, the factor scores generated were *Self Esteem*, *Literacy, Social Pleasantness*, *Aesthetic Flexibility*, *Values Flexibility*, *Construct Interests*, *Competitive Independence*, *Excitement Seeking* and *Decision*

Closure. Of these, *Literacy*, *Aesthetic Flexibility* (negative predictor), *Values Flexibility*, *Construct Interests*, *Excitement Seeking* (negative predictor), and *Decision Closure* significantly predicted 25.2% of the variance. For the prediction of GPA, the factor scores generated were *Passive Instability*, *Literacy Generation*, *Decision Flexibility*, *Construct Interests II*, *Perfectionism*, *Traditional Values*, *Selflessness* and *Operational Excitement*. *Literacy Generation*, *Perfectionism* and *Operational Excitement* (negative predictor) significantly predicted 16.8% of the variance in GPA. For the prediction of academic satisfaction with psychology, the factor scores generated were *Destructive Instability*, *Verbal Ability*, *Emotional Openness*, *Destructive Inattentiveness*, *Thoughtful Behaviour*, and *Self-Transcendence Values. Of these, Destructive Instability* (negative predictor), *Emotional Openness* and *Thoughtful Behaviour* significantly predicted 15.8% of the variance.

6.2 Discussion of Findings

6.2.1 Summary of Findings

To aid in the discussion of findings, factor scores generated for studies 3-5 are shown in Table 28. Factor loadings >.32 for each factor are grouped within the individual differences domains of personality, vocational interests, cognitive abilities and personal values, and the direction of the factor loadings is indicated via + (positive loading) and – (negative loading). Studies 3 and 4 utilise factor scores generated for general prediction of academic outcomes, but while Study 3 includes personality factors as items, Study 4 includes personality facets. Study 5 differs from the previous studies in that it utilises optimised items; that is, items were only selected for the analysis if they had previously significantly predicted or added unique variance to the prediction of psychology course grade, GPA or satisfaction with psychology in Study 1 and 2, as demonstrated by the squared semi-partial correlation (sr^2) and were only included in the relevant factor analysis for the academic outcome(s) for which they were found to add unique variance.

Table 28: Factor scores sorted by individual differences loadings for Studies 3-5

Factor Scores	Personality	Vocational Interests	Cognitive Abilities	Personal Values
Study 3 Factor Scores for general prediction (with personality factors)				
Conforming Values				+ Conformity + Tradition + Security + Benevolence + Achievement
Verbal Ability			+ Incomplete Words + Word Beginnings + Advanced Vocabulary II	
Independent Values	+ Openness to Experience	+ Artistic interests		+ Self Direction + Universalism
Interaction Interests	+ Extraversion	+ Enterprising interests + Social interests + Conventional interests + Artistic interests		
Personable Behaviour	+ Agreeableness			- Power + Benevolence
Sensation Seeking	+ Extraversion			+ Stimulation + Hedonism + Achievement
Speeded Numeric Ability			+ Number Comparison + Subtraction & Multiplication + Letter Sets	

Stable Competence	- Neuroticism + Conscientiousness		+ Elaboration	
Conceptual Interests		+ Investigative interests + Realistic interests		
Cognitive Flexibility		- Conventional interests	+ Mental Rotation + Hidden Patterns	
Study 4 Factor Scores for general prediction (with personality facets)				
Intellectual Openness	+ O5 Openness to Ideas + O6 Openness to Values + O1 Openness to Fantasy + O3 Openness to Feelings		+ Advanced Vocabulary II + Incomplete Words + Letter Sets + Word Beginnings + Hidden Patterns + Nonsense Syllogisms + Mental Rotation	- Tradition - Conformity - Security - Power
Conscientious Achievement	+ C4 Achievement Striving + C5 Self Discipline + C1 Competence + C3 Dutifulness + C2 Order + C6 Deliberation + E3 Assertiveness			+ Achievement
Personable Behaviour	+ A2 Straightforwardness + A4 Compliance + A3 Altruism + A1 Trust + A6 Tender Mindedness + A5 Modesty + E1 Warmth			- Power + Benevolence

	- N2 Angry Hostility			
Emotional Instability	+ N3 Depression + N1 Anxiety + N2 Angry Hostility + N4 Self Consciousness + N6 Vulnerability + N5 Impulsiveness + O3 Openness to Feelings - A1 Trust			
Sensation Seeking	+ E5 Excitement Seeking + E2 Gregariousness + E1 Warmth + E6 Positive Emotions + E4 Activity + N5 Impulsiveness - C6 Deliberation + E3 Assertiveness			+ Stimulation
Self-Focused Values	+ O5 Openness to Ideas	+ Investigative interests		+ Self Direction + Universalism + Stimulation + Achievement + Security + Hedonism + Benevolence
Interaction Interests	+ O2 Openness to Aesthetics	+ Artistic interests + Social interests + Enterprising interests + Conventional interests		
Fluid Reasoning			+ Number Comparison + Subtraction & Multiplication + Letter Sets	

			+ Hidden Patterns	
Study 5 Factor Scores for Psychology Grades				
Self Esteem	+ N1 Anxiety + N4 Self Consciousness + N6 Vulnerability - C1 Competence			
Literacy			+ Word Beginnings + Incomplete Words + Letter Sets + Hidden Patterns + Advanced Vocabulary II	
Social Pleasantness	+ A2 Straightforwardness + A3 Altruism + A4 Compliance			- Power
Aesthetic Flexibility	+ O2 Openness to Aesthetics + O1 Openness to Fantasy	+ Artistic interests		+ Self Direction
Values Flexibility	+ O6 Openness to Values - A4 Compliance			- Tradition
Construct Interests	+ O5 Openness to Ideas	+ Investigative interests + Realistic interests		
Competitive Independence				+ Achievement + Self Direction + Power
Excitement Seeking	+ E5 Excitement Seeking			
Decision Closure	- O4 Openness to Actions		+ Hidden Patterns	
Study 5 Factor Scores for Grade Point Average				

Passive Instability	+ N3 Depression + N1 Anxiety + N6 Vulnerability + N4 Self Consciousness			
Literacy Generation			+ Word Beginnings + Incomplete Words + Advanced Vocabulary II + Letter Sets	
Decision Flexibility	+ O2 Openness to Aesthetics + O1 Openness to Fantasy + O6 Openness to Values + O5 Openness to Ideas			+ Self Direction
Construct Interests II	+ O5 Openness to Ideas	+ Investigative interests + Realistic interests		
Perfectionism	+ C6 Deliberation + C1 Competence			
Traditional Values	- O6 Openness to Values		- Nonsense Syllogisms	+ Tradition + Achievement
Selflessness	+ A3 Altruism + A4 Compliance			
Operational Excitement	+ E5 Excitement Seeking + E4 Activity			
Study 5 Factor Scores for Academic Satisfaction with Psychology				
Destructive Instability	+ N3 Depression + N4 Self Consciousness - C5 Self Discipline			
Verbal Ability			+ Word Beginnings + Incomplete Words + Advanced Vocabulary II	

Emotional Openness	+ O3 Openness to Feelings + O2 Openness to Aesthetics	+ Social interests		
Destructive Inattentiveness	+ O1 Openness to Fantasy + N5 Impulsiveness - C5 Self Discipline			
Thoughtful Behaviour	+ A5 Modesty + A6 Tender Mindedness			
Self-Transcendence Values	+ O2 Openness to Aesthetics	+ Investigative interests		+ Universalism

The predictive independent variables for psychology course grade, GPA and academic satisfaction with psychology, for all studies undertaken, are shown in Table 29. Each significantly predictive variable displays the relevant study, whether the variables demonstrated positive or negative prediction of the academic outcomes, and for variables included within predictive factor scores, the factor score names are provided, in addition to whether the variables demonstrated a positive or negative loading within the factor. For variables included within factor scores, positive or negative prediction refers to that of the factor scores themselves.

Table 29: Predictive variables and factor scores for Studies 1-5

Variables	Psychology Course Grade	Grade Point Average	Academic Satisfaction with Psychology
Neuroticism		S3 negative (*Stable Competence*),	S3 negative (*Stable Competence*),
Extraversion			S3 (*Interaction Interests*), S3 (*Sensation Seeking* negative)
Openness to Experience			S3 (*Independent Values*),
Agreeableness		S3 (*Personable Behaviour*),	
Conscientiousness		S2, S3 (*Stable Competence*),	S1, S3 (*Stable Competence*),
N1 Anxiety			
E1 Warmth		S4 (*Personable Behaviour*),	

O1 Fantasy	S4 (*Intellectual Openness*), S5 (*Aesthetic Flexibility* negative),	S4 (*Intellectual Openness*),	S1 negative,
A1 Trust		S4 (*Personable Behaviour*),	
C1 Competence		S2, S4 (*Conscientious Achievement*), S5 (*Perfectionism*),	S4 (*Conscientious Achievement*),
N2 Angry Hostility		P4-S1 negative (*Personable Behaviour*),	
E2 Gregariousness			
O2 Aesthetics	S4 (*Interaction Interests* negative), S5 (*Aesthetic Flexibility* negative),		S1, S4 (*Interaction Interests*), S5 (*Emotional Openness*),
A2 Straightforwardness	S2,	S4 (*Personable Behaviour*),	
C2 Order		S4 (*Conscientious Achievement*),	S4 (*Conscientious Achievement*),
N3 Depression			S1 negative, S5 (*Destructive Instability* negative),
E3 Assertiveness		S4 (*Conscientious Achievement*),	S4 (*Conscientious Achievement*),
O3 Feelings	S4 (*Intellectual Openness*),	S4 (*Intellectual Openness*),	S5 (*Emotional Openness*),
A3 Altruism	S2 negative,	S2 negative, S4 (*Personable Behaviour*),	
C3 Dutifulness		S4 (*Conscientious Achievement*),	S4 (*Conscientious Achievement*),
N4 Self Consciousness		S2,	S5 (*Destructive Instability* negative),
E4 Activity		S5 (*Operational Excitement* negative),	
O4 Actions	S5 negative (*Decision Closure* negative),		
A4 Compliance	S5 negative (*Values Flexibility*),	S4 (*Personable Behaviour*),	
C4 Achievement Striving		S4 (*Conscientious Achievement*),	S4 (*Conscientious Achievement*),

N5 Impulsiveness			
E5 Excitement Seeking	S5 (*Excitement Seeking* negative),	S2 negative, S5 (*Operational Excitement* negative),	
O5 Ideas	S2, S4 (*Intellectual Openness*), S5 (*Construct Interests*),	S4 (*Intellectual Openness*),	
A5 Modesty		S4 (*Personable Behaviour*),	S5 (*Thoughtful Behaviour*),
C5 Self Discipline		S4 (*Conscientious Achievement*),	S1, S4 (*Conscientious Achievement*), S5 negative (*Destructive Instability* negative),
N6 Vulnerability			
E6 Positive Emotions			
O6 Values	S2, S4 (*Intellectual Openness*), S5 (*Values Flexibility*),	S4 (*Intellectual Openness*),	
A6 Tender Mindedness		S4 (*Personable Behaviour*),	S4 (*Thoughtful Behaviour*),
C6 Deliberation		S4 (*Conscientious Achievement*), S5 (*Perfectionism*),	S4 (*Conscientious Achievement*),
Realistic interests	S2 negative, S5 (*Construct Interests*),	S2 negative,	S3 (*Conceptual Interests* negative),
Investigative interests	S2, S5 (*Construct Interests*),	S2,	S1 negative, S3 (*Conceptual Interests* negative),
Artistic interests	S4 (*Interaction Interests* negative), S5 (*Aesthetic Flexibility* negative),		S3 (*Independent Values*), S3 (*Interaction Interests*), S4 (*Interaction Interests*),
Social interests	S4 (*Interaction Interests* negative),		S1, S3 (*Interaction Interests*), S4 (*Interaction Interests*), S5 (*Emotional Openness*),

Enterprising interests	S4 (*Interaction Interests* negative),		S3 (*Interaction Interests*), S4 (*Interaction Interests*),
Conventional interests	S3 negative (*Cognitive Flexibility* negative), S4 (*Interaction Interests* negative),		S3 (*Interaction Interests*), S4 (*Interaction Interests*),
Advanced Vocabulary II	S2, S3 (*Verbal Ability*), S4 (*Intellectual Openness*), S5 (*Literacy*),	S2, S3 (*Verbal Ability*), S4 (*Intellectual Openness*), S5 (*Literacy Generation*),	
Incomplete Words	S3 (*Verbal Ability*), S4 (*Intellectual Openness*), S5 (*Literacy*),	S3 (*Verbal Ability*), S4 (Intellectual Openness), S5 (*Literacy Generation*),	
Mental Rotation	S3 (*Cognitive Flexibility* negative), S4 (*Intellectual Openness*),	S4 (*Intellectual Openness*),	
Hidden Patterns	S3 (*Cognitive Flexibility negative*), S4 (*Intellectual Openness*), S4 (*Fluid Reasoning*), S5 (*Literacy*), S5 (*Decision Closure* negative),	S4 (*Intellectual Openness*), S4 (*Fluid Reasoning*),	S4 (*Fluid Reasoning* negative),
Subtraction & Multiplication	S4 (*Fluid Reasoning*),	S4 (*Fluid Reasoning*),	S4 (*Fluid Reasoning* negative),
Number Comparison	S4 (*Fluid Reasoning*),	S4 (*Fluid Reasoning*),	S1 negative, S4 (*Fluid Reasoning* negative),
Letter Sets	S2, S4 (*Intellectual Openness*), S4 (*Fluid Reasoning*), S5 (*Literacy*),	S2, S4 (*Intellectual Openness*), S4 (*Fluid Reasoning*), S5 (*Literacy Generation*),	S4 (*Fluid Reasoning* negative),
Nonsense Syllogisms	S2, S4 (*Intellectual Openness*),	S2, S4 (*Intellectual Openness*),	
Word Beginnings	S2, S3 (*Verbal Ability*),	S3 (*Verbal Ability*), S4 (*Intellectual Openness*),	

	S4 (*Intellectual Openness*), S5 (*Literacy*),	S5 (*Literacy Generation*),	
Elaboration		S2, S3 (*Stable Competence*),	S3 (*Stable Competence*),
Conformity	S3 (*Conforming Values* negative), S4 negative (*Intellectual Openness*),	S4 negative (*Intellectual Openness*),	
Tradition	S3 (*Conforming Values* negative), S4 negative *(Intellectual Openness*), S5 negative (*Values Flexibility*),	S4 negative (*Intellectual Openness*),	
Benevolence	S3 (*Conforming Values* negative),	S3 (*Personable Behaviour*), S4 (*Personable Behaviour*),	
Universalism			S3 (*Independent Values*),
Self Direction	S2 negative, S5 (*Aesthetic Flexibility* negative),		S3 (*Independent Values*),
Stimulation			S3 (*Sensation Seeking* negative),
Hedonism			S3 (*Sensation Seeking* negative),
Achievement	S2, S3 (*Conforming Values* negative),	S2, S4 (*Conscientious Achievement*),	S3 (*Sensation Seeking* negative), S4 (*Conscientious Achievement*),
Power	S4 negative (*Intellectual Openness*),	S3 negative (*Personable Behaviour*), S4 negative (*Intellectual Openness*), S4 negative (*Personable Behaviour*),	
Security	S3 (*Conforming Values* negative), S4 negative (*Intellectual Openness*),	S4 negative (*Intellectual Openness*),	

Study 3 Factor Scores (with personality factors) for general prediction			
Conforming Values	S3 negative,		
Verbal Ability	S3,	S3,	
Independent Values			S3,
Interaction Interests			S3,
Personable Behaviour		S3,	
Sensation Seeking			S3 negative,
Speeded Numeric Ability			
Stable Competence		S3,	S3,
Conceptual Interests			S3 negative,
Cognitive Flexibility	S3 negative,		
Study 4 Factor Scores (with personality facets) for general prediction			
Intellectual Openness	S4,	S4,	
Conscientious Achievement		S4,	S4,
Personable Behaviour		S4,	
Emotional Instability			
Sensation Seeking			
Self-Focused Values			
Interaction Interests	S4 negative,		S4,
Fluid Reasoning	S4,	S4,	S4 negative,
Study 5 Factor Scores for Psychology Grades			
Self Esteem			
Literacy	S5		
Social Pleasantness			
Aesthetic Flexibility	S5 negative,		
Values Flexibility	S5,		
Construct Interests	S5,		
Competitive Independence			

Excitement Seeking	S5 negative,		
Decision Closure	S5 negative,		
Study 5 Factor Scores for Grade Point Average			
Passive Instability			
Literacy Generation		S5,	
Decision Flexibility			
Construct Interests II			
Perfectionism		S5,	
Traditional Values			
Selflessness			
Operational Excitement		S5 negative,	
Study 5 Factor Scores for Academic Satisfaction with Psychology			
Destructive Instability			S5 negative,
Verbal Ability			
Emotional Openness			S5,
Destructive Inattentiveness			
Thoughtful Behaviour			S5,
Self-Transcendence Values			

S1 = Study 1, S2 = Study 2, S3 = Study 3, S4 = Study 4, S5 = Study 5. Direction of prediction by a variable or factor score, and direction of loadings upon a factor, are both demonstrated via leaving positive prediction/loadings unmarked, and negative = negative prediction/loadings. Format for individual variables: Study, directionality of prediction. Format for factor scores: Study, directionality of loading (*Factor Score*, directionality of prediction).

The percentages of variance accounted for by each study, for the prediction of psychology course grades, GPA and academic satisfaction are shown in Table 30. The Adjusted R^2 is displayed within brackets.

Table 30: Percentage of the variance accounted for in Studies 1-5 for all academic outcomes

Study	**Psychology Grade**	**Grade Point Average**	**Academic Satisfaction**
Study 1 factors			8% (6%)
Study 1 facets			20% (10%)
Study 1 interests			13% (10%)
Study 1 abilities			9% (5%)
Study 1 values			non sig
Study 2 factors	7% (non sig)	7% (4%)	
Study 2 facets	21% (10%)	21% (10%)	
Study 2 interests	16% (13%)	11% (8%)	
Study 2 abilities	26% (22%)	21% (17%)	
Study 2 values	14% (10%)	non sig	
Study 3 factor scores with factors	22.4% (18.4%)	18.8% (14.6%)	13.9% (10%)
Study 4 factor scores with facets	17.6% (14.1%)	17.4% (13.9%)	12.3% (9.1%)
Study 5 selected factor scores with facets	28.6% (25.2%)	20.2% (16.8%)	18.1% (15.8%)

Note: Adjusted R^2 is reported in brackets.

6.2.2 Psychology Course Grade

The percentages of variance accounted for by Studies 1-5 for psychology course grade are shown in Table 30. Study 5 was the most predictive of all the studies, explaining 25.2% of the variance in psychology course grade. Of note, it used factor scores containing personality facets rather than broader personality factors, and it was optimised by including variables which had been significant individual predictors of psychology course grade (or had accounted for unique variance) within Study 2. This approach appeared to capture the necessary specificity for prediction of psychology grades, whilst excluding irrelevant variables. Comparatively, Study 4, which included all personality facets and variables within factor scores, predicted only 14.1% of the variance, the least predictive of the studies that utilised factor scores. Study 2 demonstrated the lowest level of predictive ability overall when using personality factors alone – they were not able to predict course grade beyond

that accounted for by age and gender. These results suggest that narrow variables and inclusion of facets over factors are useful for predicting psychology grade performance, but that not all facets are relevant to psychology. Such findings demonstrate the importance of specificity for predicting academic performance in different areas of study (Vedel et al., 2015).

Interestingly, the studies demonstrated that personality facets are of greater importance to the prediction of psychology-specific course grades than personality factors, which were not relevant to psychology course grade in any of the studies. The research within this thesis supports the findings in the research to date that personality facets are important beyond their broader factors for the prediction of academic performance (O'Connor & Paunonen, 2007; Paunonen & Ashton, 2001a, 2013) and are capable of predicting academic performance when the personality factors themselves are not relevant (Trapmann et al., 2007). Further, of the personality facets, the studies displayed a marked focus on Openness to Experience and Agreeableness facets as (positive) predictors of psychology grade, and it appears that Neuroticism, Conscientiousness and to a great degree, Extraversion facets, are not very relevant to academic performance within psychology courses. Vocational interests, cognitive abilities and personal values were all uniformly relevant to the prediction of psychology course grades, but without a strong orientation towards any specific grouping of interests, abilities or values.

The significant predictive factor scores of Psychology course grade shared similarities between the studies, but their expression within various factors differed. The predictive factors all demonstrated some overlap with the four well-known trait complexes found within the literature – namely, the Social trait complex, Clerical-Conventional trait complex, Science-Math trait complex, and Intellectual-Cultural trait complex (Ackerman, 2003; Ackerman & Heggestad, 1997). When the factor scores which predicted increased psychology grade were examined, their relationships to each other and the trait complexes became evident. In Study 3, which did not include personality facets, increased psychology course grade was predicted by *Verbal Ability*, a factor score containing reasoning aspects of the Science-Math trait complex but also literary aspects of the Intellectual-Cultural trait complex. Conversely, lower psychology grade performance was predicted by increases

in the factor scores *Conforming Values* and *Cognitive Flexibility*. Whilst *Conforming Values* appears close to the Clerical-Conventional trait complex, *Cognitive Flexibility* is rather curious, involving aspects of both Science-Math and Intellectual-Cultural trait complexes, with loadings on *Gv* abilities of rotation and flexibility of closure, but also a negative loading of Conventional interests (suggesting a focus on creative, Artistic interests in contrast). Such a factor score seems incongruent in terms of the literature, until one considers that firstly, the focus is upon prediction of psychology grades rather than overall GPA, and secondly, *Gv* abilities and creative interests, while factorially close to *Gf* abilities and scientific interests, are not identical. This supports the idea that specificity of variables is of greater importance to predicting course-specific academic performance than previously thought.

In Study 4 which included personality facets and all potential variables, increased psychology course grade was predicted by *Fluid Reasoning* and *Intellectual Openness*, which correspond closely to the Science-Math and Intellectual-Cultural trait complexes. Decreased psychology course grade was predicted by *Interaction Interests*, which seems to demonstrate a shared area between the Social and Intellectual-Cultural trait complexes and focuses on the interactive nature of social and creative tasks.

In Study 5 which included facets, but only variables shown to be significant within Study 2, psychology course grade was predicted by *Construct Interests*, *Literacy and Values Flexibility*. *Construct Interests* comprises loadings on Realistic and Investigative vocational interests, in addition to O5 Openness to Ideas, and as such, appears to inhabit the area of overlap displayed between the Science-Math and Intellectual-Cultural trait complexes, whilst *Literacy* and *Values Flexibility* are distinctly closer to the Intellectual-Cultural trait complex. Conversely, *Decision Closure*, *Excitement Seeking* and *Aesthetic Flexibility* predicted decreased psychology grades, and respectively, seemed similar to the Clerical-Conventional, Social, and Intellectual-Cultural trait complexes. *Excitement Seeking* expresses a straightforward, negative effect of the need for stimulation upon grades, possibly due to a lack of novelty involved in studying, and potentially demonstrating that individuals who seek excitement are less suited to psychology's ideas-focused tasks, and better suited to areas

of study which involve a variety of active and social tasks. One might speculate that this facet reveals discrepancies in vocational interests alignment between a student and psychology as a course of study. *Decision Closure* appears to express an element of closemindedness which is interestingly inverse to the factor scores of *Intellectual Openness* and *Values Flexibility* and negatively predicts psychology grade. However, *Aesthetic Flexibility*, much like *Cognitive Flexibility*, involves creative traits that once again predict lowered psychology course grades, highlighting the small but distinct differences between flexible, open-minded behaviour and creative, aesthetic choice driven behaviour. This further supports the idea of specificity of variables for predicting academic performance, particularly prediction for different academic disciplines; a narrow distinction arising between similar characteristics may suggest that this level of specificity is theoretically important for predicting academic performance in psychology. Further, in comparison to the literature, these studies demonstrate a progression of factor scores. Study 3, which only utilises personality factors, clumps Science-Math and Intellectual-Cultural related factor scores together, suggesting that personality facets are necessary to the differentiation of these groupings. In Study 4, the inclusion of facets and further selection refinement seems to separate the factor scores into specific groups.

6.2.3 Grade Point Average

The percentages of variance accounted for by Studies 1-5 for GPA are shown in Table 30. Study 2 demonstrated that abilities were able to explain 17% of the variance in GPA. These results are very slightly greater than any of the factor score predictions. The second greatest predictor of GPA, Study 5, significantly predicted 16.8% of the variance with optimised factor scores. The utility of factor scores lies in their ability to condense and combine information, and in terms of practical value, the three significant factor scores accounted for more unique variance in the regression (15%) than the four significant facet variables of Study 2 (10% unique variance). Interestingly, the least predictive of the factor scores was again Study 4, which used personality facets within factor scores to predict 13.9% of the variance, and the least predictive overall was Study 2's prediction

using personal values for regression which found a non-significant result. The results suggest that whilst personal values held by an individual appear to have no bearing upon university grades received, cognitive abilities and personality facets are important to the prediction of general academic performance in university, presumably via behaviours enacted that encourage learning, and abilities which enable both learning and demonstration of acquired knowledge. While the relationship between performance and cognitive abilities is long acknowledged, this finding supports previous research on facets, both the utility of using narrow independent variables to predict a narrow dependent variable (Vedel et al., 2015; Wittmann & Süβ, 1999), and the specific utility of facets for predicting academic performance (Armstrong & Anthoney, 2009; McAbee, Oswald, & Connelly, 2014; O'Connor & Paunonen, 2007).

GPA had noticeably fewer negative predictors, in comparison to psychology course grade. Further, personality factors were relevant to its prediction, lending additional support to the idea that generalised academic performance can be predicted by more general variables, but that course-specific academic performance requires greater specificity (Vedel et al., 2015; Wittmann & Süβ, 1999). Although all personality factors of the Big Five were represented, there was a strong emphasis upon Conscientiousness and Agreeableness facets predicting GPA, which supports the idea that these traits are important to generalised academic success. Further, in alignment with previous findings in the literature that facets within a factor can contain differing predictive ability (Rikoon et al., 2016), the results demonstrated that different facets within the same personality factor were dispersed within different predictive factor scores. For example, Extraversion facets were found within both *Personable Behaviour* and *Conscientious Achievement* in Study 4, whilst Extraversion itself was not predictive of GPA. For vocational interests, the studies displayed few predictive variables, with a focus towards the Things and Ideas orientations of the RIASEC hexagon. As expected for general academic performance, all cognitive abilities were relevant to the prediction of GPA. For values, there was a focus on negative prediction from the Conservation orientation, and positive prediction from the Self Enhancement and Self-Transcendence orientations, with an interesting absence of Openness to Change values. That Conservation values

appear important as negative predictors of academic performance, whilst Openness to Change values do not appear as positive predictors, suggests that the circumplex structure and dichotomy between these value orientations is not directly mirrored when predicting academic performance. If viewed in terms of the literature, it seems baffling that variables within a supposedly intellectual/openminded orientation are not relevant to GPA. However, from a practical viewpoint this could be expected; valuing independence of choice and novel experiences is not relevant to academic performance. Indeed, in terms of general academic performance, one could expect a situation in which conformity and appreciation of repetition is relevant to grades, and in fact, this can be seen in the positive prediction from factors such as *Conscientious Achievement*.

When the factor scores which predicted increased GPA were compared to trait complexes found within the literature (Ackerman, 2003; Ackerman & Heggestad, 1997), similarities were once again observed. Study 3, which did not include personality facets, showed that increased GPA was predicted by *Verbal Ability*, *Personable Behaviour* and *Stable Competence. Verbal Ability*, previously shown to be predictive of psychology course grade, contains aspects of both the Science-Math and Intellectual-Cultural trait complexes due to the combination of fluid and crystallised cognitive abilities. *Personable Behaviour*, which focuses upon Agreeableness and the Benevolence value, seems most related to the Social trait complex, whilst *Stable Competence* seems to resemble the Clerical-Conventional trait complex, perhaps leaning towards the Social trait complex, with its inclusion of Conscientiousness, and emotional stability inherent in the negative loading for Neuroticism.

As previously discussed, *Fluid Reasoning* and *Intellectual Openness* have a clear resemblance to the Science-Math and Intellectual-Cultural trait complexes, and these factor scores were also predictive of GPA for Study 4, which included all possible variables. Other predictive factors of GPA were *Personable Behaviour* (effectively identical to the *Personable Behaviour* featured in Study 3, but involving Agreeableness facets rather than the factor), and *Conscientious Achievement*. Once again, *Personable Behaviour* could be considered similar to the Social trait complex, and *Conscientious Achievement* resembles the Clerical-Conventional trait complex. Further, there is much shared

between this factor and its predecessor *Stable Competence* in Study 3, but they differ in secondary focus; where *Stable Competence* emphasises emotional stability in addition to dutiful, organised behaviours, *Conscientious Achievement* emphasises success. This difference may illuminate a subtle variation in necessary characteristics between overall GPA and psychology-specific grades. It is speculated that increased emotional stability may be necessary for engagement with the course content of psychology and subsequently increased academic performance. It is further speculated that an increased GPA, which is comprised of high grades received for multiple courses over time, is less closely tied to course content engagement, and relies upon a strong motivation to achieve and possibly placing a higher value upon academic success.

Study 5, with its factor scores customised for each dependent variable, showed that *Literacy Generation*, *Perfectionism*, and *Operational Excitement* predicted increased GPA. *Operational Excitement* as a negative predictor of academic performance shared much with both the Social trait complex and *Excitement Seeking* from Study 3. *Perfectionism* appears to be a refined version of *Conscientious Achievement*, focusing on deliberate action towards successful outcomes, and likewise sharing overlap with the Clerical-Conventional trait complex. Curiously, whilst Study 3 includes a combined Science-Math and Intellectual-Cultural factor, and Study 4 separates it into two distinct factors that parallel the literature, in Study 5, only *Literacy Generation* is found to be predictive, and this honed factor involving aspects of the Intellectual-Cultural trait complex focuses on the semantics and morphology of *Gc*. When compared to Study 3, and Study 4, which provided factor scores for the prediction of all academic outcomes, it seems that reasoning and fluid abilities are perhaps more relevant to other academic outcomes, or potentially produce an improved prediction when accounting for academic success in general, and that when factor scores are generated specifically for the prediction of GPA alone – or perhaps for the prediction of GPA in a sample of psychology students (an area of study largely explored and assessed via written expression) – increased grades are demonstrated by students with greater language mastery. Such possibilities are supported by recent research which demonstrates the importance of reading ability in the prediction of GPA (Pluck, 2018). This suggests that the ability to understand, produce and

communicate language successfully is even more important to high academic performance than the ability to provide well-reasoned arguments and solutions, due to its basic nature; good reasoning requires communication to be acknowledged, but communication does not rely upon reasoning in the same manner.

Another study within the literature has utilised personality factors and facets for the prediction of GPA in a sample comprising students from a variety of courses, including psychology (Vedel et al., 2015). To compare as directly as possible, prediction of GPA for psychology students and prediction of GPA for students overall were examined as the closest comparisons to the current research's prediction of GPA using a sample of psychology students. When compared, the current research mostly supported the findings for personality facet prediction within the literature; Study 2 demonstrated that N4 Self Consciousness and C1 Competence were significant individual facet predictors of GPA, whilst a relevant factor score in Study 3 was *Stable Competence* (includes Conscientiousness) and from Study 4, relevant factor scores were *Personable Behaviour* (includes A1 Trust, N2 Angry Hostility (negative loading), A2 Straightforwardness, A6 Tender Mindedness), *Conscientious Achievement* (includes C1 Competence, E3 Assertiveness, C5 Self Discipline) and *Intellectual Openness* (includes O5 Ideas, O6 Values). Study 5 interestingly only provided one predictive factor score which could be directly compared, and this was *Perfectionism* (C1 Competence). Contrary to the literature, *Conscientious Achievement* additionally included a positive loading upon C4 Achievement Striving, whilst this was found to be a negative predictor of GPA for students overall. Further, when the results of the current research are examined in comparison to the literature, there was no distinction made between comparative findings for psychology students and comparative findings for students overall. Such results lend support to the idea that not only do the predictors of course-specific grades differ from those of GPA, but that GPA itself can be discipline-specific (De Fruyt & Mervielde, 1996; Vedel, 2014; Vedel et al., 2015), thus giving a possible explanation for why the comparison unearths similarities between GPA prediction for psychology students and overall GPA, but not for psychology course grades. To clarify, discipline-specific GPA occurs when the majority of a student's courses are within the same academic

discipline, thus forming a liminal area between specific success in course content, and generic success in a tertiary academic setting.

Finally, the most direct methodology comparison can be made with a study in the literature which utilises factor scores for the prediction of GPA, and explained 51.3% of the variance (Kanfer et al., 2010). They found that the predictive factor scores were Verbal Ability, Numerical Ability, Learning/Mastery Orientation (Intellectual-Cultural type trait complex), and Self Management, which involved Conscientiousness and decision making (Clerical-Conventional type trait complex), and the overlap between these and the significant predictors found within Studies 3-5 is evident. Whilst the previous research separated factor scores for cognitive abilities and other traits, used students drawn from engineering and computer science majors, and did not investigate facets, the current findings of this thesis support the literature in that both ability and non-ability factor scores were found to be significantly predictive of GPA, and that factor scores can successfully be applied for the prediction of academic performance. Furthermore, with an additional 22.7% of the variance explained by their research (when comparing R^2), it seems prudent for future research to include measures of motivation.

6.2.4 Academic Satisfaction with Psychology

The percentages of variance accounted for by Studies 1-5 for academic satisfaction with psychology are shown in Table 30. Study 5 demonstrated that optimised factor scores were the greatest predictor of academic satisfaction with psychology, explaining 15.8% of the variance with three factor scores. In contrast, the use of personal values in Study 1 demonstrated the least predictive ability, finding a non-significant result.

Of note, it seems relevant that the dependent variable involved is Academic Satisfaction *with Psychology*, and psychology is linked closely with specific narrow traits, but this situation may differ if satisfaction with other areas of study were examined. However, the current research, with its emphasis on the differences found between significant predictors of the three academic outcomes (but also in terms of unused low sampling of other academic disciplines during the collection of

studies 1-5) supports the literature, which found that different courses of study are predicted by different personality facets (Vedel et al., 2015).

The prediction of academic satisfaction with psychology differed from the prediction of GPA and psychology grades by a focus upon Conscientiousness facets, values within close proximity to the Openness to Change value orientation and negative prediction from *Gf* abilities; the lack of prediction by *Gc* abilities or Conservation values was notable, demonstrating that verbal ability and traditional values are not related to satisfaction with psychology course content. Vocational interests demonstrated a uniform prediction without any particular focus; that is, all six vocational interests were of equal relevance to the prediction of academic satisfaction within psychology.

Overall, the predictors of academic satisfaction with psychology were either distinct from the predictors for psychology grades or demonstrated an inverse relationship to them. For example, Investigative interests positively predicts Psychology grade, but negatively predicts academic satisfaction with psychology.

The potential implication of this finding is that some characteristics which pertain to increased satisfaction with studying psychology are detrimental or of little importance to high academic performance within psychology; conversely, characteristics involved in receiving increased psychology grades are detrimental or of little importance to experiencing high levels of satisfaction with psychology course content. This appears to highlight potential incongruity between students who enjoy psychology and those who display high academic performance within psychology, and may present unique challenges for provision of career guidance; useful career counselling must consider both. Such a situation is potentially due to high performing students experiencing a lack of challenge in the content, or greater interest in another academic course, or two groups defined by different characteristics – perhaps one group more interested in the practical, helping aspect of psychology and another group more interested in the academic, research aspect of psychology – which enter the area of study due to differing motivations and differing abilities. Further, some overlap was shared between the predictors of GPA and satisfaction with psychology, suggesting

that in part, the academic satisfaction with psychology measure used within this study contained broader elements of general academic satisfaction, in addition to psychology-specific satisfaction.

The results of this research supported the finding in the literature that Neuroticism negatively predicts academic satisfaction (Trapmann et al., 2007) and whilst one study found that vocational interests did not predict academic satisfaction (Pozzebon et al., 2014), others used samples that could be expected to differ from psychology students – technicians and industrial clerks (Volodina et al., 2015), and business students (Logue et al., 2007), but found that vocational interests were indeed relevant to the prediction of course-specific academic satisfaction. For cognitive abilities, there was a focus upon *Gf* abilities as negative predictors of satisfaction, and upon the Openness to Change and Self-Enhancement value orientations as positive predictors of satisfaction. Potentially students with high *Gf* abilities are best engaged in areas of study with greater emphasis on pure reasoning ability (mathematics, for example). However, it is striking that whilst Openness to Change values are irrelevant to the prediction of GPA, they are important to the prediction of satisfaction within psychology, suggesting that independent thought and flexible thinking are perquisites for enjoyment of psychology course content. This contrast between the academic outcome predictors further highlights the importance of specificity in prediction; as found in Study 5, there is increased predictive ability and understanding to be gained from doing so. Whilst there is parsimony in a single set of predictors for academic success, this method may overlook useful independent variables that are only relevant for one specific academic outcome or those which involve diverse relationships with different aspects of academic success.

The predictive factor scores for academic satisfaction with psychology were again compared to the trait complexes found in the literature (Ackerman, 2003; Ackerman & Heggestad, 1997) and whilst there is less direct application to the literature in regards to trait complexes, which have largely focused upon academic success, understanding of where these factor scores fit in relation to psychology course grade and GPA, and of the meaning inherent in their prediction of academic satisfaction, is of relevance. In Study 3, *Independent Values*, *Interaction Interests* and *Stable Competence* significantly predicted satisfaction with psychology, with *Sensation Seeking* and

Conceptual Interests as negative predictors of satisfaction. Curiously, prediction using the broader personality factors provided the greatest number of narrow, predictive factor scores, whilst both Study 4 and 5 involve facets and appear to streamline the factors involved. *Independent Values* fits well with the Intellectual-Cultural trait complex, containing Openness to Experience, Artistic interests, and the values of Self Direction and Universalism, suggesting an overall open mindedness towards ideas. *Interaction Interests* involves a heavy focus upon social behaviour and aligns with the Social trait complex, making it subtly different from its similarly named factor score in Study 4. As previously discussed, *Stable Competence* aligns most closely with the Clerical-Conventional trait complex. When examining the negative predictors, *Conceptual Interests*, with its vocational interest orientation between Things and Ideas, aligns closely to the Science-Math trait complex, whilst *Sensation Seeking* seems closest to the Social trait complex due to its focus on Extraversion and valuing stimulating experiences, whether exciting, hedonistic, or achievement-focused.

In Study 4, all relevant factor scores were those found to be additionally predictive of the other dependent variables. *Conscientious Achievement*, previously discussed as a predictor of GPA, appears close to the Clerical-Conventional trait complex. However, *Interaction Interests*, previously discussed as fitting between the Intellectual-Cultural and Social trait complexes (due to greater equity between numbers of creative and social traits, in comparison with its identically named predecessor in Study 3) was featured as a negative predictor of psychology grades, but as a positive predictor of satisfaction with psychology, whilst *Fluid Reasoning*, previously discussed as aligned with the Science-Math trait complex, predicted increased psychology grades and GPA, but acted as a negative predictor of academic satisfaction with psychology. As discussed elsewhere, such a dichotomy may point to the dual nature of psychology as an academic discipline; that is, some students may be drawn to the theoretical, ideas-focused aspects and perform well academically, whilst other students may be drawn to the social, interactive aspects of certain topics in the discipline, but their skills are more practical than demonstrable academically.

As for Study 5, the three predictive factor scores appear to be streamlined versions of factors found in previous studies; *Destructive Instability* which negatively predicts satisfaction with psychology

resembles a negatively scored, honed form of *Stable Competence* which focuses on a lack of emotional stability and discipline, and as such, is closest to the Clerical-Conventional trait complex, albeit in an inverse format. *Emotional Openness*, with its joint aspects of open mindedness and emotional, social behaviour resembles *Interaction Interests* and fits between the Intellectual-Cultural and Social trait complexes. *Thoughtful Behaviour* closely resembles *Personable Behaviour* and aligns well with the Social trait complex but is honed around consideration, without any aspects of social interaction. When examined together, the predictive factors of this study lend support to the idea of a scientific/social dichotomy of psychology as an academic discipline, suggesting that while emotional stability is inherent in baseline academic success, the socially inclined psychology student who feels most satisfied undertaking psychology could be characterised as an individual that shows consideration for others, and is both interested in, and openminded about, the expression of emotions. Further, if the prediction of psychology course grade is re-examined in light of this potential dichotomy, it would suggest that the scientifically inclined psychology student who receives high grades in psychology could be characterised as an individual with an interest in abstract ideas and making them tangible, high levels of verbal ability, openminded about ideas and possibilities, but not necessarily artistically creative, and with a reduced need to seek out novelty. One might speculate that this dichotomy in motivation and respective strengths can be seen within the division of postgraduate courses, with more socially inclined students drawn towards applied, professional masters programs such as a Clinical or Organisational Masters and more scientifically inclined students undertaking a PhD in psychology.

6.2.5 Correspondence and differences between Psychology Grade, GPA and Academic Satisfaction with Psychology

Study 3 and Study 4 both used uniform sets of independent variables for the prediction of academic performance and academic satisfaction, which allowed for similarities and differences to be better examined. Study 3 demonstrated that there was no overlap of the predictive factor scores for psychology course grade and academic satisfaction with psychology, with psychology course grades significantly predicted by *Conforming Values* (negative), *Verbal Ability* and *Cognitive Flexibility*

(negative), whilst academic satisfaction with psychology was predicted by *Independent Values*, *Interaction Interests*, *Sensation Seeking* (negative), *Stable Competence* and *Conceptual Interests* (negative).

However, both psychology course grade and academic satisfaction with psychology shared predictive factor scores with GPA. As could be expected, *Verbal Ability* was relevant to the prediction of both overall GPA and psychology-specific grades. Further, *Stable Competence* was a predictive factor score for overall GPA and academic satisfaction with psychology; this result suggests that emotional and behavioural stability predicts positive academic outcomes in university. Both factor scores which overlap in their predictive ability appear to be expressing commonalities of successful behaviour.

With the inclusion of personality facets, Study 4 displayed a greater overlap between the predictive factor scores for psychology course grades and academic satisfaction with psychology. However, the overlap suggested an opposing relevance of the factor scores; *Interaction Interests* was a negative predictor of psychology grade, but positively predicted satisfaction with psychology. Similarly, *Fluid Reasoning* significantly predicted psychology grade, but was a negative predictor of satisfaction with psychology. These results suggest a separation between academic performance and academic satisfaction in terms of psychology as a course of study, but when viewed in the context of each other, suggest a discrepancy; those who perform the best in psychology courses are not necessarily those who are most invested in the course content. As previously discussed in section 6.2.4, it seems possible that this is highlighting dichotomous student motivations, where vocational interests and abilities intersect, with some students attracted to the social, helping aspects but not invested academically, and others attracted to the research-based aspects of psychology, but not invested in the social aspects.

As in Study 3, Study 4 demonstrated that significant predictors of psychology grade and academic satisfaction were shared with GPA. The two measures of academic performance showed an alignment, with increased *Intellectual Openness* and increased *Fluid Ability* predicting both higher

psychology grades and higher GPA overall. As previously discussed, the findings were contrary to those of academic satisfaction, with *Fluid Ability* acting as a negative predictor. However, academic satisfaction with psychology and GPA were both significantly predicted by increased *Conscientious Achievement*. When significant factor scores of both studies are examined, it appears that shared predictors of GPA and academic satisfaction with psychology are due to a shared general academic success. Academic satisfaction with psychology, as a dependent variable, seems to capture both psychology course-specific satisfaction, but additionally, general academic satisfaction.

Upon examining the personality factors and facets, it was notable that only the facets predicted psychology grades, whilst a variety of personality factors and facets predicted GPA and academic satisfaction with psychology. The factor scores containing such personality factors further tended to be of a more general nature regarding successful academic outcomes; the inclusion of personality factors within factor scores, such as Stable Competence – broad but necessary for performing well and feeling satisfied academically – and the exclusion of these from psychology course grade, demonstrates that psychology course grade prediction involves a narrower level of prediction. This in turn supports the need to match specificity of dependent and independent variables in order to increase predictive validity (Vedel et al., 2015; Wittmann & Süβ, 1999).

Overall, whilst personality facets contributed strongly to the prediction of psychology grades, both in terms of variables and those subsumed within factor scores, psychology grades involved far more usage of Openness and Agreeableness facets, and less usage of Neuroticism, Conscientiousness and Extraversion facets – which demonstrated greater utility as predictors of GPA. These results align well with the separation of general academic success and psychology-specific success; in particular, elevated levels of Conscientiousness and decreased amounts of Neuroticism have often been found as general predictors of academic success, job success, and a variety of positive outcomes, and as such, are more enmeshed within general academic performance than psychology specific performance. In contrast, due to task content and enjoyment, the studies demonstrated that psychology grade and academic satisfaction with psychology had much stronger ties to vocational interests than GPA. As expected, both academic performance outcomes demonstrated stronger

prediction by cognitive abilities than academic satisfaction with psychology. There were a few interesting cognitive ability findings in the studies. Firstly, as would be expected, both academic performance outcome variables demonstrated a similar pattern of cognitive ability prediction, showing that in part, psychology grade performance involves similar abilities to the generic academic performance expressed through GPA. However, psychology grade's predictive difference lies in flexibility of thought and how that is expressed behaviourally via Openness to Experience facets. Thus, psychology grade prediction does involve some specific cognitive abilities that are not as relevant to overall academic performance. In a similar manner to the shared ability predictors of academic performance, GPA and academic satisfaction with psychology expressed shared ability predictors of academic success. Elaboration, within the *Stable Competence* factor score, ostensibly measures figural fluency. However, it appears to additionally capture an amount of emotional stability and resultant academic success under testing conditions; individuals that had higher levels of Elaboration and Stable Competence received higher GPAs and were more satisfied with psychology. If this measure were indicating a greater expression of figural fluency, then it most likely would have demonstrated an impact upon psychology course grade, which had strong relationships with traits related to Openness and fluency. Academic satisfaction with psychology additionally displayed a clear grouping of negative prediction by fluid reasoning abilities in the studies. This was related to the inverse findings for academic performance for this factor score and for Interaction Interests. As such, it seems that students that do not feel satisfied with undergraduate psychology have less interest in socially interactive tasks and also abilities which support this (such as greater emotional stability), possibly being better suited to theoretical and academic tasks involved in postgraduate study of psychology, or in other fields of study entirely.

6.2.6 Utility of the Current Research and Comparisons with the Literature

Upon examining the optimised trait complexes, and their resultant factor scores used for the prediction of academic outcomes within Study 5, it can be seen that there is merit to exploring this

approach. Psychology course grades and academic satisfaction with psychology were most strongly predicted by the factor scores derived from the optimised trait complexes of Study 5, and the result for GPA was only slightly less predictive than using cognitive abilities in Study 2 (0.2% less), with reduced testing time taken overall. When compared with key studies from the literature, the current research demonstrates that optimised factor scores are able to successfully explain a modest amount of the variance in academic outcomes. For direct comparison, R^2 will be discussed instead of Adjusted R^2.

The current research found that factor scores derived from optimised trait complexes predicted 28.6% of the variance in psychology course grades and 20.2% of the variance in GPA. In comparison, Pozzebon et al. (2014) used personality factors, vocational interest congruence and cognitive abilities to predict 19% of the variance in major-specific GPA for various majors examined as a singular group, and 22% of the variance in overall GPA. These results are similar to those of the available research, whilst studies involving facets and factor scores demonstrated greater predictive ability. Vedel et al. (2015) used personality facets to predict both overall GPA, and a range of major-specific GPAs. Only 11% of the variance in overall GPA was explained by their study, but major-specific GPA ranged from 16% of the variance in Humanities-specific GPA to the considerable finding of 57% of the variance accounted for in Psychology-specific GPA. Similarly, Kanfer et al. (2010) utilised factor scores for prediction comprising personality, vocational interests, cognitive abilities and motivation to explain 51.3% of the variance in overall GPA. For academic satisfaction, the current research was able to predict 18.1% of the variance in psychology-specific academic satisfaction, which is somewhat larger than the only relevant study; Pozzebon et al. (2014) predicted 7% of the variance in major-specific academic satisfaction. Overall, these comparisons demonstrate that the optimised factor scores of the current research are modest yet promising predictors of academic outcomes, and with future modification, may have even greater utility.

6.3 Strengths of the Research

The research had four main strengths. Firstly, the study had breadth in terms of its independent variables. It explored a wider variety of individual differences variables than most studies. For the cognitive abilities domain, ten measures from a range of varied abilities were selected. Further, it demonstrated breadth in terms of criterion variables, examining both the prediction of academic satisfaction and academic performance.

Secondly, the study had depth expressed via its independent and criterion variables. It examined the comparative differences in prediction between personality factors and personality facets, and whether facets were improved predictors of academic outcomes, and it included narrow cognitive abilities for increased specificity of prediction rather than broad, general ability measures.

The third strength of the research was that academic performance was investigated using both overall GPA and psychology course grades, in order to separately examine the prediction of general academic performance and course specific academic performance. Further, the combined investigation involved examining the prediction of academic satisfaction and academic performance using each individual differences domain separately, the factor analysis derived factor scores, and the factor analysis derived factor scores that included all personality facets.

The fourth strength of the research was its originality. Although research findings, have suggested that the inclusion of these individual differences domains is relevant and important, to date no other research has included in the one study measures of personality, vocational interests, cognitive abilities and values, nor have studies included the specific measures of the NEO-PI-R, SDS-R, the ETS kit of Factor Referenced Cognitive Tests, and the SVS. Further, no research has included these four domains of individual differences for the prediction of both academic performance and academic satisfaction. Very few studies have included measures of ability and values within the same study, and to date, none have utilised these for the prediction of both academic performance and satisfaction, or even for GPA and course specific grades within academic performance. Moreover, very few studies have used factor scores derived from factor analysis for the prediction of criterion

variables, and none to date have utilised factor scores from measures of personality, vocational interests, cognitive abilities and values, or factor scores for the prediction of both academic satisfaction and academic performance.

6.4 Implications of the Research

By showing which variables are predictive of performance in psychology courses, overall GPA, and satisfaction within psychology courses the results of this project have practical implications for career counselling. Primarily, by identifying which specific variables within the test battery are actually predictive of academic achievement and increased satisfaction, it enables progress to be made with identifying streamlined and personalised testing for career counselling. In particular, specific personality facets and reduced factors derived from specific narrow combinations of variables were shown to be more predictive than broad personality factors, particularly for the identification of academic outcomes within specific academic disciplines. Completion of the full test battery would take 2 hours 30 minutes; as such these improvements, which would reduce the time taken, have potential to lower both test-taker fatigue, and overall cost. For example, in Study 5, 15.8% of the variance in satisfaction with psychology could be predicted by three factor scores, which themselves contained only 7 out of 30 facets, and 1 out of 6 vocational interests, which translates to a considerable, 96% reduction in testing time (approximately 6 minutes in total; 1 minute for relevant personality facet items, 5 min for relevant vocational interest items). Conversely, by identifying the specific variables within the test battery which were predictive of lowered academic performance and reduced academic satisfaction, this project has the potential to facilitate not just high performance and increased satisfaction, but also how to avoid areas of academic weakness and lowered satisfaction – thus reducing the likelihood of course withdrawal and drop out, increasing successful degree completion rates, and maintaining the well-being of students – all of which are areas of significant concern for universities. It should be noted that different variables are important for predicting the presence versus lack of academic performance and academic satisfaction, even within the same academic discipline or major. As such, career

counsellors should select measures for providing advice with care. There is still much unexplained variance and advice would need to be appropriately tentative.

6.5 Limitations of the Research

Possible limitations of this project included recruitment and test battery administration. Although psychology students were required to take part in research participation to earn 5% of their course grade, the lengthiness of the current project, with an administration time of 2 hours and 30 minutes, may have been off-putting to some students, and it was difficult to gather enough participants to perform the necessary statistics. However, the test administration time had been reduced to the minimum possible while still including the full NEO-PI-R, SDS-R, SVS, and ten individual measures of cognitive abilities. Further, with such a lengthy administration time, the students that self-selected to participate may have been significantly different from those who did not (potentially increased Openness to Experience and Intellectual interests motivating a personal interest in the study's content), and those that participated may have been affected by fatigue or lack of concentration, which would have implications for the timed tests of ability. A larger sample would have allowed for cross validation of the factors, and improved validation of the AcSat measure. A secondary limitation of administration was the self-reporting of course grades that contributed to the variables of psychology course grade and GPA. Of the 358 participants, 26.82% (96 participants) did not report their grades, which weakened the power of the analyses that were undertaken.

Another possible limitation of these studies was the usage of the AcSat measure of academic satisfaction. This measure was developed to fulfil a need within the project, yet due to sampling and test administration issues, it left some flaws unaddressed. Despite having good reliability with a Cronbach's alpha of .81, the validity of this measure was not further tested. This was due to issues with administration; at a testing length of 2 hours and 30 minutes it was not practical to increase the time further with additional items, nor to include additional measures for validation. The measure only shows weak criterion related validity when correlated with N3 Depression (negative)

and C4 Achievement Striving, and did not correlate with GPA and psychology grades, but it is unknown whether it would demonstrate relationships with more salient measures such as career decisions efficacy or life satisfaction, for example. Prior to development, a search of the literature was performed and few suitable measures were available for use. For example, Nauta's Academic Major Satisfaction Scale (Nauta, 2007) would have been very appropriate for use in this project, but was published after the literature search for academic satisfaction measures had been undertaken and accordingly, an academic satisfaction measure had to be developed to fill the gap.

6.6 Future Research

To address the above limitations, future research should replicate studies of this kind with additional participants and streamline administration length by focusing on relevant variables with predictive power, to prevent participant fatigue and decrease the effects of participant self-selection. Additional incentives to the grade participation points obtained in the present studies could also be provided to all students to increase recruitment. Participants could be drawn from different universities to increase the generalisability of results, and course grades could be collected directly from the universities, which would decrease issues with self-reporting.

With an increased sample size, the AcSat measure could be refined with confirmatory factor analysis to test the significance of the measure in another sample. In addition, the validity issues of this measure could be addressed with the inclusion of contemporary academic satisfaction measures, such as the Academic Major Satisfaction Scale (Nauta, 2007), and measures of life satisfaction and other related outcome variables. Moreover, most of these issues (difficulty with recruitment, administration length, test fatigue, self-selection, necessary refinement of the AcSat and testing its validity with the inclusion of new measures) could be addressed by changing the medium of administration from paper and pencil to an online study, which could be completed by participants at a convenient time and rewarded with incentives upon completion, and that, combined with university course grade data, would improve upon most of this project's limitations.

In terms of future research that would provide interesting and informative avenues, different variables, such as motivation, and in particular, different academic disciplines could be utilized. A replication of this study which instead utilised tertiary students from other academic disciplines than psychology would be very informative. Firstly, an investigative test battery followed by the use of factor scores to predict both positive and negative academic outcomes for other disciplines would add to both the literature and inform career counselling for those disciplines, as they are likely to differ from the variables relevant to psychology students. Secondly, the results of a replication for predicting GPA would also help determine whether the current research has unearthed generic, all-encompassing predictors of tertiary academic performance via GPA, or whether these predictors of GPA, found in a sample of psychology students, still pertain to the discipline itself. In turn, such knowledge would have implications for developing models of academic performance. Future research could involve path analysis to determine the structure of these variables' prediction of academic outcomes for different disciplines, or machine learning neural networks could be trained for prediction. Additional criterion variables could include persistence within a major, persistence within university, and graduate employment after leaving university, whilst additional independent variables could include the concept of motivation, and the integration of leisure interests, learning styles and work values. Future samples could examine populations in need of greater career counselling advice, such as 3rd year students, or postgraduate students, whose traits may have become more crystallised over time (Costa & McCrae, 1992b; Holland, 1997). Finally, future research with the ultimate aim of improving career counselling within universities could focus on either: a) the streamlining of relevant narrow aspects of existing measures such as the NEO-PI-R, SDS-R, SVS, MRT and ETS Kit abilities into a reduced and refined test battery to reduce time and cost for predicting academic outcomes in different academic disciplines or b) the development and creation of an entirely new measure to predict academic outcomes in a range of different academic disciplines, involving personality facets, vocational interests, cognitive abilities and values integrated into a single test structure.

6.7 Final Conclusions

This thesis has demonstrated that complexity can be harnessed to provide parsimony. A number of insights were revealed by the findings of this research.

Firstly, breadth of independent variable types was shown to be important. The use of a wide range of variables from four separate individual differences domains allowed for greater understanding and comparison of how these variables interact with and predict different academic outcomes. Investigation of how the domains interacted in combination led to some further theoretical insights. It was apparent from the consistent but low relationships between personality, cognitive abilities, vocational interests and values that they overlap but can be considered as sufficiently distinct domains. It was additionally apparent that specific domains have closer relationships with and predictive power of specific academic outcomes than others; for example, vocational interests were most important to the prediction of psychology grades and satisfaction with psychology, but were not important to GPA, whilst cognitive abilities were important to psychology grades and GPA but not to satisfaction with psychology. Although such findings seem intuitive, few studies have had the breadth of individual differences necessary in order to explore these relationships. Further, latent factors involving two or more of the individual differences domains appear to exist, linking these variables, which was demonstrated by the consistent pairings and separations unearthed via exploratory factor analysis, and displayed in Table 28. For example, *Intellectual Openness* involves personality facets, cognitive abilities, and values, and its discovery within Study 4 supports previous research on the study of Intellect as a dimension between Openness to Experience and cognitive ability (DeYoung, 2015). However, whilst such a latent structure provided theoretical insights in Study 4, the latent factors did not provide the best model for useful prediction of academic outcomes; Study 5's greater specificity and refinement, with factors optimised for the prediction of one of three academic outcomes, considerably improved upon previous models. For example, *Aesthetic Flexibility* (Study 5, optimised for prediction of Psychology course grade) involved the integration of personality facets, vocational interests and values, and was a significant, negative

predictor of Psychology course grade whilst *Decision Closure* (Study 5, optimised for psychology course grade), another negative predictor of Psychology course grade, involves cognitive abilities and personality facets in a way that suggests an intriguing liminal area between them, via the process of decision making.

Secondly, depth was shown to be important for increased prediction of academic outcomes and greater understanding of why the variables were predictive. The use of narrow, specific independent variables appeared to increase both prediction via matching the level of specificity between dependent and independent variables and provided increased meaningful content. This was moderately evident with the use of narrow, Stratum I cognitive abilities, but markedly so with the use of personality facets. For example, in Study 3, the narrow cognitive ability of Elaboration was unique to the factor score *Stable Competence*, and in combination with Conscientiousness and negatively loaded Neuroticism, appeared to capture a combined element of fluency of thought hampered by Neuroticism, adding to the understanding of this factor. However, the use of facets significantly increased both prediction and understanding, with different facets within a personality factor belonging to different factor scores; this occurred in Study 5, for example, with the Openness to Experience facets split between the significant factor scores of *Aesthetic Flexibility*, *Values Flexibility*, *Construct Interests*, and *Decision Closure*. *Aesthetic Flexibility* (+ O1 Fantasy and + O2 Aesthetics) and *Decision Closure* (- O4 Actions, negatively loaded) predicted a reduction in psychology grade, whilst *Values Flexibility* (+ O6 Values) and *Construct Interests* (+ O5 Ideas) predicted an increased psychology grade. These findings demonstrate a clear division between openminded, flexible thinking and creative thinking that would not have been expressed by the use of broader personality factors; further, they illuminate the difference between flexible and creative thought in terms of how such areas might relate to and predict grades in different academic courses. Facets were additionally shown to be important to the prediction of all three dependent variables, but strongly related to prediction of psychology course grade. Specificity was additionally expressed in the division of academic performance between course-specific grades and overall GPA, which allowed a clearer understanding of what leads to high academic performance in general, and

what leads to high academic performance in psychology. Finally, the relevance of specificity was demonstrated by factor scores. In general, factor scores were found to be useful for the prediction of academic outcomes, but their predictive ability increased sharply with specificity; the strongest predictive factor scores were demonstrated by Study 5, in which factors were optimised for the prediction of one of the three academic outcomes, and only included variables which had been found to add unique variance to the prediction of that academic outcome independently in Studies 1-2.

Whilst these findings have illuminated the importance of breadth and depth for theoretical understanding and increased predictive ability, they further have relevance for practical career counselling. So, what predicts psychology course grade, GPA and satisfaction with psychology? For psychology course grade, students with increased literacy related abilities (reasoning, perception, and knowledge), open mindedness towards values, and an interest in tasks involving ideas received higher grades in psychology, whilst students with increased open mindedness towards artistic creativity, a greater need to seek out stimulation, and who tend to make decisive, quick judgements received lower psychology grades.

For general academic performance demonstrated via GPA, students with increased *Gc* abilities, particularly lexical semantics and morphology, along with deliberate action towards successful outcomes received higher GPAs, whilst students with an increased need for excitement and activity received lower GPAs.

Students with increased open-mindedness towards expressing feelings and social interaction, and with increased consideration for other people, experienced greater academic satisfaction with undertaking psychology, whilst students with increased emotional fragility and self-indulgence experienced less academic satisfaction with undertaking psychology.

Such variation in the findings for the three academic outcomes highlights the need to distinguish between them and build up a database of course specific performance and satisfaction. In general, the findings of this thesis suggest that career counsellors could utilise factor scores, combining a

small set of specific predictors and excluding irrelevant sections, in order to assist in determining whether a student is best suited to an academic discipline. It further suggests that brief, honed measures comprising these variables could be created to streamline and systematise this process for students in different academic disciplines.

In conclusion, this thesis demonstrates the importance of considering both breadth and depth for exploring individual differences in academic performance and satisfaction; it illuminates the utility of employing a wide range of specific, narrow individual differences in combination to predict specific academic outcomes in different academic disciplines. Consequently, these findings have the potential to enhance applied career counselling for tertiary education to the benefit of both students and tertiary education institutions.

6.8 Appendix 1: AcSat Scale

Rate each of the subjects that you undertook in Semester 1 using the following options:

Subject 1 name:

A.	Boring	1	2	3	4	5	Interesting
B.	Not Fun	1	2	3	4	5	Enjoyable
C.	Useless	1	2	3	4	5	Worth Learning

Subject 2 name:

A.	Boring	1	2	3	4	5	Interesting
B.	Not Fun	1	2	3	4	5	Enjoyable
C.	Useless	1	2	3	4	5	Worth Learning

Subject 3 name:

A.	Boring	1	2	3	4	5	Interesting
B.	Not Fun	1	2	3	4	5	Enjoyable
C.	Useless	1	2	3	4	5	Worth Learning

Subject 4 name:

A.	Boring	1	2	3	4	5	Interesting
B.	Not Fun	1	2	3	4	5	Enjoyable
C.	Useless	1	2	3	4	5	Worth Learning

6.9 Appendix 2: Extended tables predicting AcSat scale items

6.9.1 Extended Tables: Personality Factors

6.9.1.1 Personality Factors predicting Boring-Interesting

Table 31: Hierarchical regression for age, gender and personality factors predicting AcSat item Boring-Interesting

	Boring-Interesting			
Step and predictor variable	R^2	ΔR^2	β	sr^2
Step 1 (Method: Enter)	.01	.01		
Age			.04	.00
Gender			.02	.00
Step 2 (Method: Enter)	.05*	.03*		
Neuroticism			-.10	.01
Extraversion			-.02	.00
Openness			.03	.00
Agreeableness			.09	.01
Conscientiousness			.12	.01

*p <.05. **p <.01. ***p <.001.

6.9.1.2 Personality Factors predicting Not Fun-Enjoyable

Table 32: Hierarchical regression for age, gender and personality factors predicting AcSat item Not Fun-Enjoyable

	Not Fun-Enjoyable			
Step and predictor variable	R^2	ΔR^2	β	sr^2
Step 1 (Method: Enter)	.05***	.05***		
Age			.14*	.02
Gender			.11	.01
Step 2 (Method: Enter)	.11***	.06**		
Neuroticism			-.10	.01
Extraversion			-.06	.00
Openness			.02	.00
Agreeableness			.04	.00
Conscientiousness			.19**	.03

*p <.05. **p <.01. ***p <.001.

6.9.1.3 Personality Factors predicting Worthless-Worth Learning

Table 33: Hierarchical regression for age, gender and personality factors predicting AcSat item Worthless-Worth Learning

	Worthless-Worth Learning			
Step and predictor variable	R^2	ΔR^2	β	sr^2
Step 1 (Method: Enter)	.03*	.03*		
Age			.09	.01
Gender			.12	.01
Step 2 (Method: Enter)	.05*	.03		
Neuroticism			-.09	.01
Extraversion			.02	.00
Openness			.08	.01
Agreeableness			.04	.00
Conscientiousness			.06	.00

*p <.05. **p <.01. ***p <.001.

6.9.2 Extended Tables: Personality Facets

6.9.2.1 Personality Facets predicting Boring-Interesting

Table 34: Hierarchical regression for age, gender and personality facets predicting AcSat item Boring-Interesting

Boring-Interesting				
Step and predictor variable	R^2	ΔR^2	β	sr^2
Step 1 (Method: Enter)	.01	.01		
Age			.08	.00
Gender			.03	.00
Step 2 (Method: Enter)	.20**	.19**		
N1 Anxiety			-.02	.00
E1 Warmth			-.05	.00
O1 Fantasy			-.20**	.02
A1 Trust			.04	.00
C1 Competence			.03	.00
N2 Angry Hostility			-.08	.00
E2 Gregariousness			.00	.00
O2 Aesthetics			.11	.01
A2 Straightforwardness			-.20*	.02
C2 Order			.04	.00
N3 Depression			-.14	.01
E3 Assertiveness			-.07	.00
O3 Feelings			.19**	.02
A3 Altruism			.01	.00
C3 Dutifulness			-.01	.00
N4 Self Consciousness			-.14	.01
E4 Activity			-.11	.01

O4 Actions	-.04	.00
A4 Compliance	-.00	.00
C4 Achievement Striving	-.06	.00
N5 Impulsiveness	.16*	.01
E5 Excitement Seeking	.06	.00
O5 Ideas	.05	.00
A5 Modesty	.22**	.03
C5 Self Discipline	.13	.00
N6 Vulnerability	.02	.00
E6 Positive Emotions	.05	.00
O6 Values	-.12	.01
A6 Tender Mindedness	.06	.00
C6 Deliberation	.11	.01

*p <.05. **p <.01. ***p <.001.

6.9.2.2 Personality Facets predicting Not Fun-Enjoyable

Table 35: Hierarchical regression for age, gender and personality facets predicting AcSat items Not Fun-Enjoyable

Not Fun-Enjoyable				
Step and predictor variable	R^2	ΔR^2	β	sr^2
Step 1 (Method: Enter)	.05***	.05***		
Age			.16*	.02
Gender			.10	.01
Step 2 (Method: Enter)	.22***	.17**		
N1 Anxiety			-.07	.00
E1 Warmth			.03	.00
O1 Fantasy			-.12	.01
A1 Trust			-.12	.01
C1 Competence			-.04	.00
N2 Angry Hostility			-.02	.00
E2 Gregariousness			-.09	.00
O2 Aesthetics			.14*	.01
A2 Straightforwardness			.03	.00
C2 Order			.10	.00
N3 Depression			-.18*	.01
E3 Assertiveness			-.13	.01
O3 Feelings			.03	.00
A3 Altruism			.03	.00
C3 Dutifulness			-.03	.00
N4 Self Consciousness			-.07	.00
E4 Activity			.01	.00
O4 Actions			-.07	.00

A4 Compliance	-.01	.00
C4 Achievement Striving	-.05	.00
N5 Impulsiveness	.14	.01
E5 Excitement Seeking	-.02	.00
O5 Ideas	.07	.00
A5 Modesty	-.04	.00
C5 Self Discipline	.27**	.02
N6 Vulnerability	.04	.00
E6 Positive Emotions	.01	.00
O6 Values	-.06	.00
A6 Tender Mindedness	.15*	.01
C6 Deliberation	-.00	.00

*p <.05. **p <.01. ***p <.001.

6.9.2.3 Personality Facets predicting Worthless-Worth Learning

Table 36: Hierarchical regression for age, gender and personality facets predicting AcSat item Worthless-Worth Learning

Worthless-Worth Learning				
Step and predictor variable	R^2	ΔR^2	β	sr^2
Step 1 (Method: Enter)	.03*	.03*		
Age			.10	.01
Gender			.06	.00
Step 2 (Method: Enter)	.15	.12		
N1 Anxiety			-.06	.00
E1 Warmth			-.03	.00
O1 Fantasy			-.08	.00
A1 Trust			-.08	.00
C1 Competence			.07	.00
N2 Angry Hostility			.11	.00
E2 Gregariousness			.10	.00
O2 Aesthetics			.16*	.02
A2 Straightforwardness			-.08	.00
C2 Order			-.03	.00
N3 Depression			-.19*	.01
E3 Assertiveness			.00	.00
O3 Feelings			.07	.00
A3 Altruism			-.03	.00
C3 Dutifulness			-.08	.00

N4 Self Consciousness	-.11	.00
E4 Activity	-.10	.01
O4 Actions	-.02	.00
A4 Compliance	.09	.00
C4 Achievement Striving	.04	.00
N5 Impulsiveness	.05	.00
E5 Excitement Seeking	-.04	.00
O5 Ideas	-.02	.00
A5 Modesty	.15*	.01
C5 Self Discipline	.12	.00
N6 Vulnerability	.11	.00
E6 Positive Emotions	.05	.00
O6 Values	.01	.00
A6 Tender Mindedness	.11	.01
C6 Deliberation	.08	.00

*p <.05. **p <.01. ***p <.001.

6.9.3 Extended Tables: Cognitive Abilities

6.9.3.1 Cognitive Abilities predicting Boring-Interesting

Table 37: Hierarchical regression for age, gender and cognitive abilities predicting AcSat item Boring-Interesting

Boring-Interesting				
Step and predictor variable	R^2	ΔR^2	β	sr^2
Step 1 (Method: Enter)	.01	.01		
Age			.07	.00
Gender			.03	.00
Step 2 (Method: Enter)	.05	.04		
Advanced Vocabulary			-.10	.01
Incomplete Words			.09	.01
Mental Rotation			-.03	.00
			-.04	.00
Hidden Patterns				
Subtraction & Multiplication			.01	.00
Number Comparison			-.16*	.02
Letter Sets			.00	.00
Nonsense Syllogisms			-.02	.00
Word Beginnings			-.02	.00
Elaboration			.07	.00

*p <.05. **p <.01. ***p <.001.

6.9.3.2 Cognitive Abilities predicting Not Fun-Enjoyable

Table 38: Hierarchical regression for age, gender and cognitive abilities predicting AcSat item Not Fun-Enjoyable

Not Fun-Enjoyable				
Step and predictor variable	R^2	ΔR^2	β	sr^2
Step 1 (Method: Enter)	.05***	.05***		
Age			.20***	.04
Gender			.09	.01
Step 2 (Method: Enter)	.12***	.07*		
Advanced Vocabulary			-.12	.01
Incomplete Words			.10	.01
Mental Rotation			-.05	.00
Hidden Patterns			-.05	.00
Subtraction & Multiplication			.07	.00
Number Comparison			-.11	.01
Letter Sets			-.04	.00
Nonsense Syllogisms			-.02	.00
Word Beginnings			-.14*	.01
Elaboration			.10	.01

*p <.05. **p <.01. ***p <.001.

6.9.3.3 Cognitive Abilities predicting Worthless-Worth Learning

Table 39: Hierarchical regression for age, gender and cognitive abilities predicting AcSat item Worthless-Worth Learning

Worthless-Worth Learning				
Step and predictor variable	R^2	ΔR^2	β	sr^2
Step 1 (Method: Enter)	.03*	.03*		
Age			.11	.01
Gender			.11	.01
Step 2 (Method: Enter)	.07	.04		
Advanced Vocabulary			-.03	.00
Incomplete Words			.12	.01
Mental Rotation			.00	.00
Hidden Patterns			-.06	.00
Subtraction & Multiplication			.03	.00
Number Comparison			-.14*	.01
Letter Sets			-.04	.00
Nonsense Syllogisms			-.01	.00
Word Beginnings			-.11	.01
Elaboration			.01	.00

*p <.05. **p <.01. ***p <.001.

6.9.4 Extended Tables: Vocational Interests

6.9.4.1 Vocational Interests predicting Boring-Interesting

Table 40: Hierarchical regression for age, gender and vocational interests predicting AcSat item Boring-Interesting

Boring-Interesting				
Step and predictor variable	R^2	ΔR^2	β	sr^2
Step 1 (Method: Enter)	.01	.01		
Age			.06	.00
Gender			-.08	.00
Step 2 (Method: Enter)	.08**	.07**		
Realistic			-.03	.00
Investigative			-.14*	.02
Artistic			-.01	.00
Social			.27***	.05
Enterprising			-.05	.00
Conventional			-.00	.00

*p <.05. **p <.01. ***p <.001.

6.9.4.2 Vocational Interests predicting Not Fun-Enjoyable

Table 41: Hierarchical regression for age, gender and vocational interests predicting AcSat item Not Fun-Enjoyable

Not Fun-Enjoyable				
Step and predictor variable	R^2	ΔR^2	β	sr^2
Step 1 (Method: Enter)	.05***	.05***		
Age			.20***	.04
Gender			.07	.00
Step 2 (Method: Enter)	.09***	.04*		
Realistic			.01	.00
Investigative			-.09	.01
Artistic			.02	.00
Social			.15*	.01
Enterprising			.07	.00
Conventional			-.09	.01

*p <.05. **p <.01. ***p <.001.

6.9.4.3 Vocational Interests predicting Worthless-Worth Learning

Table 42: Hierarchical regression for age, gender and vocational interests predicting AcSat item Worthless-Worth Learning

Worthless-Worth Learning				
Step and predictor variable	R^2	ΔR^2	β	sr^2
Step 1 (Method: Enter)	.03*	.03*		
Age			.13*	.01
Gender			-.07	.00
Step 2 (Method: Enter)	.15***	.12***		
Realistic			-.15*	.02
Investigative			-.17**	.02
Artistic			.06	.00
Social			.27***	.05
Enterprising			.06	.00
Conventional			-.07	.00

*p <.05. **p <.01. ***p <.001.

6.9.5 Extended Tables: Values

6.9.5.1 Values predicting Boring-Interesting

Table 43: Hierarchical regression for age, gender and values predicting AcSat item Boring-Interesting

Boring-Interesting				
Step and predictor variable	R^2	ΔR^2	β	sr^2
Step 1 (Method: Enter)	.01	.01		
Age			.07	.00
Gender			.04	.00
Step 2 (Method: Enter)	.03	.02		
Conformity			.07	.00
Tradition			.00	.00
Benevolence			-.01	.00
Universalism			.09	.00
Self Direction			-.13	.01
Stimulation			.05	.00
Hedonism			.02	.00
Achievement			-.06	.00
Power			-.07	.00
Security			-.02	.00

*p <.05. **p <.01. ***p <.001.

6.9.5.2 Values predicting Not Fun-Enjoyable

Table 44: Hierarchical regression for age, gender and values predicting AcSat item Not Fun-Enjoyable

Not Fun-Enjoyable				
Step and predictor variable	R^2	ΔR^2	β	sr^2
Step 1 (Method: Enter)	.05***	.05***		
Age			.18**	.03
Gender			.13*	.01
Step 2 (Method: Enter)	.09**	.04		
Conformity			.08	.00
Tradition			.08	.00
Benevolence			-.14	.01
Universalism			.10	.01
Self Direction			.05	.00
Stimulation			-.09	.01
Hedonism			.07	.00
Achievement			.02	.00
Power			-.04	.00
Security			-.00	.00

*p <.05. **p <.01. ***p <.001.

6.9.5.3 Values predicting Worthless-Worth Learning

Table 45: Hierarchical regression for age, gender and values predicting AcSat item Worthless-Worth Learning

Worthless-Worth Learning				
Step and predictor variable	R^2	ΔR^2	β	sr^2
Step 1 (Method: Enter)	.03*	.03*		
Age			.10	.01
Gender			.12*	.01
Step 2 (Method: Enter)	.06	.04		
Conformity			.08	.00
Tradition			-.02	.00
Benevolence			.07	.00
Universalism			.12	.01
Self Direction			.03	.00
Stimulation			-.03	.00
Hedonism			.07	.00
Achievement			-.13	.01
Power			.00	.00
Security			-.05	.00

*p <.05. **p <.01. ***p <.001.

6.10 References

Ackerman, P. L. (1996). A theory of adult intellectual development: Process, personality, interests, and knowledge. *Intelligence, 22*(2), 227-257.

Ackerman, P. L. (2003). Aptitude complexes and trait complexes. *Educational Psychologist, 38*(2), 85-93.

Ackerman, P. L., Chamorro-Premuzic, T., & Furnham, A. (2011). Trait complexes and academic achievement: Old and new ways of examining personality in educational contexts. *British Journal of Educational Psychology, 81*(1), 27-40.

Ackerman, P. L., & Heggestad, E. D. (1997). Intelligence, personality, and interests: evidence for overlapping traits. *Psychological Bulletin, 121*(2), 219.

Ackerman, P. L., Kanfer, R., & Beier, M. E. (2013). Trait complex, cognitive ability, and domain knowledge predictors of baccalaureate success, STEM persistence, and gender differences. *Journal of Educational Psychology, 105*(3), 911.

Allen, J., Robbins, S. B., Casillas, A., & Oh, I. S. (2008). Third-year college retention and transfer: Effects of academic performance, motivation, and social connectedness. *Research in Higher Education, 49*(7), 647-664. doi:10.1007/s11162-008-9098-3

Andrieu, B. (2011). Binet's archive of the Experimental Study of Intelligence 1899-1902. *L'Annee Psychologique, 111*(3), 509-532. doi:http://dx.doi.org/10.4074/S0003503311003046

Anglim, J., & Grant, S. (2016). Predicting psychological and subjective well-being from personality: Incremental prediction from 30 facets over the Big 5. *Journal of Happiness studies, 17*(1), 59-80.

Anglim, J., Knowles, E. R. V., Dunlop, P. D., & Marty, A. (2017). HEXACO personality and Schwartz's personal values: A facet-level analysis. *Journal of Research in Personality, 68*, 23-31.

Anglim, J., & O'Connor, P. (2019). Measurement and research using the Big Five, HEXACO, and narrow traits: A primer for researchers and practitioners. *Australian Journal of Psychology, 71*(1), 16-25.

Armstrong, P. I., & Anthoney, S. F. (2009). Personality facets and RIASEC interests: An integrated model. *Journal of Vocational Behavior, 75*(3), 346-359. doi:https://doi.org/10.1016/j.jvb.2009.05.004

Armstrong, P. I., Day, S. X., McVay, J. P., & Rounds, J. B. (2008). Holland's RIASEC model as an integrative framework for individual differences. *Journal of Counseling Psychology, 55*(1), 1.

Armstrong, P. I., & Rounds, J. B. (2010). Integrating individual differences in career assessment: The atlas model of individual differences and the strong ring. *The Career Development Quarterly, 59*(2), 143-153.

Barchard, K. A. (2003). Does emotional intelligence assist in the prediction of academic success? *Educational and Psychological Measurement, 63*(5), 840-858.

Bergold, S., & Steinmayr, R. (2018). Personality and intelligence interact in the prediction of academic achievement. *Journal of Intelligence, 6*(2), 27.

Bowles, T. V., & Brindle, K. A. (2017). Identifying facilitating factors and barriers to improving student retention rates in tertiary teaching courses: a systematic review. *Higher Education Research & Development*, 1-17. doi:10.1080/07294360.2016.1264927

Brandt, N. D., Lechner, C. M., Tetzner, J., & Rammstedt, B. (2019). Personality, cognitive ability, and academic performance: Differential associations across school subjects and school tracks. *Journal of personality*.

Brown, N. W. (1994). Cognitive, interest, and personality variables predicting first-semester GPA. *Psychological Reports, 74*(2), 605-606.

Busato, V. V., Prins, F. J., Elshout, J. J., & Hamaker, C. (1999). The relation between learning styles, the Big Five personality traits and achievement motivation in higher education. *Personality and Individual Differences, 26*(1), 129-140. doi:http://dx.doi.org/10.1016/S0191-8869%2898%2900112-3

Busato, V. V., Prins, F. J., Elshout, J. J., & Hamaker, C. (2000). Intellectual ability, learning style, personality, achievement motivation and academic success of psychology students in higher

education. *Personality and Individual Differences, 29*(6), 1057-1068. doi:http://dx.doi.org/10.1016/S0191-8869%2899%2900253-6
Carless, S. A. (1999). Career Assessment: Holland's Vocational Interests, Personality Characteristics, and Abilities. *Journal of Career Assessment, 7*(2), 125-144. doi:10.1177/106907279900700203
Carroll, J. B. (1993). *Human cognitive abilities: A survey of factor-analytic studies*: Cambridge University Press.
Cattell, R. B. (1941). Some theoretical issues in adult intelligence testing. *Psychological Bulletin, 38*(592), 10.
Cattell, R. B. (1963). Theory of fluid and crystallized intelligence: A critical experiment. *Journal of Educational Psychology, 54*(1), 1.
Chamorro-Premuzic, T., & Furnham, A. (2008). Personality, intelligence and approaches to learning as predictors of academic performance. *Personality and Individual Differences, 44*(7), 1596-1603.
Chowdhury, M. S., & Amin, M. N. (2006). PERSONALITY AND STUDENTS' ACADEMIC ACHIEVEMENT: INTERACTIVE EFFECTS OF CONSCIENTIOUSNESS AND AGREEABLENESS ON STUDENTS' PERFORMANCE IN PRINCIPLES OF ECONOMICS. *Social Behavior & Personality: an international journal, 34*(4), 381-388.
Corulla, W. J., & Coghill, K. R. (1991). Can Educational Streaming Be Linked to Personality - a Possible Link between Extroversion, Neuroticism, Psychoticism and Choice of Subjects. *Personality and Individual Differences, 12*(5), 367-374. doi:Doi 10.1016/0191-8869(91)90052-D
Costa, P. T., & McCrae, R. R. (1980). Influence of Extraversion and Neuroticism on Subjective Well-Being - Happy and Unhappy People. *Journal of Personality and Social Psychology, 38*(4), 668-678. doi:Doi 10.1037/0022-3514.38.4.668
Costa, P. T., & McCrae, R. R. (1992a). Four ways five factors are basic. *Personality and Individual Differences, 13*(6), 653-665. doi:http://dx.doi.org/10.1016/0191-8869%2892%2990236-I
Costa, P. T., & McCrae, R. R. (1992b). *Neo PI-R professional manual* (Vol. 396). Odessa, FL: Psychological Assessment Resources.
Cox, D. W., Bjornsen, A. L., Krieshok, T. S., & Liu, Y. (2016). Occupational Engagement and Academic Major Satisfaction: Vocational Identity's Mediating Role. *The Career Development Quarterly, 64*(2), 169-180. doi:10.1002/cdq.12049
Coyle, T. R., Snyder, A. C., Richmond, M. C., & Little, M. (2015). SAT non-g residuals predict course specific GPAs: Support for investment theory. *Intelligence, 51*, 57-66.
Cromley, J. G., Booth, J. L., Wills, T. W., Chang, B. L., Tran, N., Madeja, M., . . . Zahner, W. (2017). Relation of Spatial Skills to Calculus Proficiency: A Brief Report. *Mathematical Thinking and Learning, 19*(1), 55-68.
De Fruyt, F., & Mervielde, I. (1996). Personality and interests as predictors of educational streaming and achievement. *European Journal of Personality, 10*(5), 405-425. doi:http://dx.doi.org/10.1002/%28SICI%291099-0984%28199612%2910:5%3C405::AID-PER255%3E3.0.CO;2-M
Deary, I. J., Strand, S., Smith, P., & Fernandes, C. (2007). Intelligence and educational achievement. *Intelligence, 35*(1), 13-21.
Deary, I. J., Whalley, L. J., Lemmon, H., Crawford, J. R., & Starr, J. M. (2000). The Stability of Individual Differences in Mental Ability from Childhood to Old Age: Follow-up of the 1932 Scottish Mental Survey. *Intelligence, 28*(1), 49-55. doi:https://doi.org/10.1016/S0160-2896(99)00031-8
DeYoung, C. G. (2015). Openness/intellect: A dimension of personality reflecting cognitive exploration. In *APA handbook of personality and social psychology, Volume 4: Personality processes and individual differences.* (pp. 369-399): American Psychological Association.
DeYoung, C. G., Quilty, L. C., & Peterson, J. B. (2007). Between facets and domains: 10 aspects of the Big Five. *Journal of Personality and Social Psychology, 93*(5), 880.
DeYoung, C. G., Quilty, L. C., Peterson, J. B., & Gray, J. R. (2014). Openness to experience, intellect, and cognitive ability. *Journal of personality assessment, 96*(1), 46-52.

Dollinger, S. J., Leong, F. T. L., & Ulicni, S. K. (1996). On Traits and Values: With Special Reference to Openness to Experience. *Journal of Research in Personality, 30*(1), 23-41. doi:https://doi.org/10.1006/jrpe.1996.0002

Douglas, H. E., Bore, M., & Munro, D. (2016). Openness and Intellect: An analysis of the motivational constructs underlying two aspects of personality. *Personality and Individual Differences, 99*, 242-253.

Dudley, N. M., Orvis, K. A., Lebiecki, J. E., & Cortina, J. M. (2006). A meta-analytic investigation of conscientiousness in the prediction of job performance: Examining the intercorrelations and the incremental validity of narrow traits. *Journal of Applied Psychology, 91*(1), 40.

Edwards, J. E., & Waters, L. K. (1982). Involvement, ability, performance, and satisfaction as predictors of college attrition. *Educational and Psychological Measurement, 42*(4), 1149-1152. doi:http://dx.doi.org/10.1177/001316448204200421

Edwards, J. E., & Waters, L. K. (1983). Predicting university attrition: A replication and extension. *Educational and Psychological Measurement, 43*(1), 233-236.

Edwards, J. R. (1993). Problems With The Use Of Profile Similarity Indices In The Study Of Congruence In Organizational Research. *Personnel psychology, 46*(3), 641-665.

Ekstrom, R. B., French, J. W., & Harman, H. H. (1979). Cognitive factors: Their identification and replication. *Multivariate Behavioral Research Monographs*.

Ekstrom, R. B., French, J. W., Harman, H. H., & Dermen, D. (1976). *Manual for kit of factor-referenced cognitive tests*. Princeton, NJ:: Educational testing service.

Etzel, J. M., & Nagy, G. (2016). Students' Perceptions of Person–Environment Fit:Do Fit Perceptions Predict Academic Success Beyond Personality Traits? *Journal of Career Assessment, 24*(2), 270-288. doi:10.1177/1069072715580325

Farsides, T., & Woodfield, R. (2003). Individual differences and undergraduate academic success: the roles of personality, intelligence, and application. *Personality and Individual Differences, 34*(7), 1225-1243. doi:Pii S0191-8869(02)00111-3

Feldman, K. A., & Newcomb, T. M. (1969). *The impact of college on students*. Piscataway, NJ: Transaction Publishers; US.

Flanagan, D. P. (2000). Wechsler-based CHC cross-battery assessment and reading achievement: Strengthening the validity of interpretations drawn from Wechsler test scores. *School Psychology Quarterly, 15*(3), 295-329. doi:10.1037/h0088789

Flanagan, D. P., Alfonso, V. C., & Reynolds, M. R. (2013). Broad and Narrow CHC Abilities Measured and Not Measured by the Wechsler Scales:Moving Beyond Within-Battery Factor Analysis. *Journal of Psychoeducational Assessment, 31*(2), 202-223. doi:10.1177/0734282913478047

Fonteyne, L., Duyck, W., & De Fruyt, F. (2017). Program-specific prediction of academic achievement on the basis of cognitive and non-cognitive factors. *Learning and Individual Differences, 56*, 34-48.

Fritzsche, B. A., McIntire, S. A., & Yost, A. P. (2002). Holland Type as a Moderator of Personality–Performance Predictions. *Journal of Vocational Behavior, 60*(3), 422-436. doi:https://doi.org/10.1006/jvbe.2001.1841

Furnham, A., & Chamorro-Premuzic, T. (2004). Personality and intelligence as predictors of statistics examination grades. *Personality and Individual Differences, 37*(5), 943-955.

Gandal, N., Roccas, S., Sagiv, L., & Wrzesniewski, A. (2005). Personal value priorities of economists. *Human Relations, 58*(10), 1227-1252.

Gosling, S. D., Rentfrow, P. J., & Swann Jr, W. B. (2003). A very brief measure of the Big-Five personality domains. *Journal of Research in Personality, 37*(6), 504-528.

Gough, H., & Heilbrun, A. L. (1983). The revised adjective checklist manual. In: Palo Alto, CA: Consulting Psychologists Press.

Graham, E. K., & Lachman, M. E. (2012). Personality stability is associated with better cognitive performance in adulthood: Are the stable more able? *The Journals of Gerontology: Series B: Psychological Sciences and Social Sciences, 5*(5), 545-554. doi:http://dx.doi.org/10.1093/geronb/gbr149

Gregory, R. J. (1996). *Psychological testing*. Boston: Allyn & Bacon.

Guan, G., Shiye, M., Liu, J., & Yum, G. (2006). *Relationship between satisfaction with major, academic performance, and congruence.*

Guindon, A. (2008). *Individual Difference Correlates of Human Values as Measured by a Novel Revision of the Schwartz Values Survey.* ProQuest,

Gustafsson, J. E., & Balke, G. (1993). General and specific abilities as predictors of school achievement. *Multivariate Behavioral Research, 28*(4), 407-434.

Hansen, J.-I. C., & Wiernik, B. M. (2016). Work preferences: vocational interests and values. In *The SAGE Handbook of Industrial, Work & Organizational Psychology: V1: Personnel Psychology and Employee Performance* (pp. 408).

Hansen, J. I. C., & Tan, R. N. (1992). Concurrent Validity of the 1985 Strong Interest Inventory for College Major Selection. *Measurement and Evaluation in Counseling and Development, 25*(2), 53-57.

Harrington, R., & Loffredo, D. A. (2001). The relationship between life satisfaction, self-consciousness, and the Myers-Briggs Type Inventory dimensions. *The Journal of Psychology: Interdisciplinary and Applied, 135*(4), 439-450. doi:http://dx.doi.org/10.1080/00223980109603710

Harris, D. (1940). Factors affecting college grades: a review of the literature, 1930-1937. *Psychological Bulletin, 37*(3), 125-166. doi:http://dx.doi.org/10.1037/h0055365

Harris, J. A., Vernon, P. A., Johnson, A. M., & Jang, K. L. (2006). Phenotypic and genetic relationships between vocational interests and personality. *Personality and Individual Differences, 40*(8), 1531-1541. doi:https://doi.org/10.1016/j.paid.2005.11.024

Heaven, P. C. L., & Ciarrochi, J. (2012). When IQ is not everything: Intelligence, personality and academic performance at school. *Personality and Individual Differences, 53*(4), 518-522. doi:https://doi.org/10.1016/j.paid.2012.04.024

Holland, J. L. (1980). The Influence of Vocational-Interest Inventories - Some Implications for Psychological-Testing. *Counseling Psychologist, 9*(1), 83-86.

Holland, J. L. (1997). *Making vocational choices: A theory of vocational personalities and work environments, 3rd ed*. Odessa, FL, US: Psychological Assessment Resources.

Holland, J. L., & Gottfredson, G. D. (1976). Using a Typology of Persons and Environments to Explain Careers - Some Extensions and Clarifications. *Counseling Psychologist, 6*(3), 20-29. doi:Doi 10.1177/001100007600600306

Holland, J. L., Gottfredson, G. D., & Baker, H. G. (1990). Validity of Vocational Aspirations and Interest Inventories - Extended, Replicated, and Reinterpreted. *Journal of Counseling Psychology, 37*(3), 337-342. doi:Doi 10.1037//0022-0167.37.3.337

Holland, J. L., Powell, A. B., & Fritzsche, B. A. (1985). *The self-directed search (SDS). The career interest inventory for today...: a guide to educational and vocational planning*: Psychological Assessment Resources.

Holland, J. L., Shears, M., & Harvey-Beavis, A. (2001). *Self-Directed Search* (Australian ed.). Camberwell, Victoria: Australian Council for Educational Research.

Horn, J. L. (1968). Organization of abilities and the development of intelligence. *Psychological review, 75*(3), 242.

Horn, J. L. (1991). Measurement of intellectual capabilities: A review of theory. In K. S. McGrew, J. K. Werder, & R. W. Woodcock (Eds.), *Woodcock-Johnson technical manual* (pp. 197-232). Chicago, IL: Riverside.

Horn, J. L., & Noll, J. (1997). Human cognitive capabilities: Gf-Gc theory. In *Contemporary intellectual assessment: Theories, tests, and issues.* (pp. 53-91). New York, NY, US: Guilford Press.

Johnson, W. (2018). A Tempest in A Ladle: The Debate about the Roles of General and Specific Abilities in Predicting Important Outcomes. *Journal of Intelligence, 6*(2), 24.

Kahn, J. H., Nauta, M. M., Gailbreath, R., Tipps, J., & Chartrand, J. M. (2002). The utility of career and personality assessment in predicting academic progress. *Journal of Career Assessment, 10*(1), 3-23.

Kanfer, R., Wolf, M. B., Kantrowitz, T. M., & Ackerman, P. L. (2010). Ability and trait complex predictors of academic and job performance: A person–situation approach. *Applied Psychology, 59*(1), 40-69.

Kaufman, J. C., Kaufman, S. B., & Plucker, J. A. (2013). Contemporary theories of intelligence. In D. Reisberg (Ed.), *The oxford handbook of cognitive psychology* (pp. 811-822). New York: Oxford University Press.

Kausel, E. E., & Slaughter, J. E. (2011). Narrow personality traits and organizational attraction: Evidence for the complementary hypothesis. *Organizational Behavior and Human Decision Processes, 114*(1), 3-14.

Kell, H., & Lang, J. (2017). Specific Abilities in the Workplace: More Important Than g? *Journal of Intelligence, 5*(2), 13.

Kelso, G. i. (1986). An orientation to Holland's theory. In J. J. Lokan & K. F. Taylor (Eds.), *Holland in Australia. A vocational choice theory in research and practice* (pp. xv-xxii). Melbourne: ACER.

Klimstra, T. A., Bleidorn, W., Asendorpf, J. B., van Aken, M. A., & Denissen, J. J. (2013). Correlated change of Big Five personality traits across the lifespan: A search for determinants. *Journal of Research in Personality, 47*(6), 768-777. doi:http://dx.doi.org/10.1016/j.jrp.2013.08.004

Knafo, A., & Sagiv, L. (2004). Values and work environment: Mapping 32 occupations. *European Journal of Psychology of Education, 19*(3), 255-273.

Krapić, N., & Kuljanić, P. (2017). Intelligence, Personality Traits and Vocational Interests as Predictors of School Achievement. *Psihologijske teme, 26*(2), 431-450.

Krishnan, V. R. (2008). Impact of MBA Education on Students' Values: Two Longitudinal Studies. *Journal of Business Ethics, 83*(2), 233-246. doi:DOI 10.1007/s10551-007-9614-y

Kusurkar, R., & Croiset, G. (2015). Critical synthesis package: Schwartz value survey (SVS). . *MedEdPORTAL, 11*(10002). doi:http://doi.org/10.15766/mep_2374-8265.10002

Laidra, K., Pullmann, H., & Allik, J. (2007). Personality and intelligence as predictors of academic achievement: A cross-sectional study from elementary to secondary school. *Personality and Individual Differences, 42*(3), 441-451. doi:DOI 10.1016/j.paid.2006.08.001

Larsen, L., Hartmann, P., & Nyborg, H. (2008). The stability of general intelligence from early adulthood to middle-age. *Intelligence, 36*(1), 29-34. doi:https://doi.org/10.1016/j.intell.2007.01.001

Larson, L. M., Rottinghaus, P. J., & Borgen, F. H. (2002). Meta-analyses of Big Six interests and Big Five personality factors. *Journal of Vocational Behavior, 61*(2), 217-239.

Lechner, C., Danner, D., & Rammstedt, B. (2017). How is personality related to intelligence and achievement? A replication and extension of Borghans et al. and Salkever. *Personality and Individual Differences, 111*, 86-91.

Lent, R. W., Singley, D., Sheu, H., Schmidt, J. A., & Schmidt, L. C. (2007). Relation of Social-Cognitive Factors to Academic Satisfaction in Engineering Students. *Journal of Career Assessment, 15*(1), 87-97. doi:doi:10.1177/1069072706294518

Liem, G. A. D., Martin, A. J., Porter, A. L., & Colmar, S. (2012). Sociocultural antecedents of academic motivation and achievement: Role of values and achievement motives in achievement goals and academic performance. *Asian Journal of Social Psychology, 15*(1), 1-13. doi:doi:10.1111/j.1467-839X.2011.01351.x

Lietz, P., & Matthews, B. (2006). Are values more important than learning approaches? Factors influencing student performance at an international university. *Australian Association for Research in Education*.

Logue, C. T., Lounsbury, J. W., Gupta, A., & Leong, F. T. L. (2007). Vocational interest themes and personality traits in relation to college major satisfaction of business students. *Journal of Career Development, 33*(3), 269-295. doi:10.1177/0894845306297348

Lounsbury, J. W., Saudargas, R. A., Gibson, L. W., & Leong, F. T. (2005a). An investigation of broad and narrow personality traits in relation to general and domain-specific life satisfaction of college students. *Research in Higher Education, 46*(6), 707-729. doi:Doi 10.1007/11162-004-4140-6

Lounsbury, J. W., Sundstrom, E., Loveland, J. M., & Gibson, L. W. (2003). Intelligence, "Big Five" personality traits, and work drive as predictors of course grade. *Personality and Individual Differences, 35*(6), 1231-1239. doi:http://dx.doi.org/10.1016/S0191-8869%2802%2900330-6

Lounsbury, J. W., Welsh, D. P., Gibson, L. W., & Sundstrom, E. (2005b). Broad and narrow personality traits in relation to cognitive ability in adolescents. *Personality and Individual Differences, 38*(5), 1009-1019.

Luk, C. L., & Bond, M. H. (1993). Personality Variation and Values Endorsement in Chinese University-Students. *Personality and Individual Differences, 14*(3), 429-437. doi:Doi 10.1016/0191-8869(93)90312-Q

McAbee, S. T., & Oswald, F. L. (2013). The criterion-related validity of personality measures for predicting GPA: A meta-analytic validity competition. *Psychological Assessment, 25*(2), 532-544. doi:http://dx.doi.org/10.1037/a0031748

McAbee, S. T., Oswald, F. L., & Connelly, B. S. (2014). Bifactor models of personality and college student performance: A broad versus narrow view. *European Journal of Personality, 28*(6), 604-619.

McDaniel, M. A., & Banks, G. C. (2010). General cognitive ability. In J. C. Scott & R. D. H. (Eds.), *Handbook of Workplace Assessment* (Vol. 32, pp. 61): John Wiley & Sons.

McGrew, K. S. (2005). The Cattell-Horn-Carroll Theory of Cognitive Abilities: Past, Present, and Future. In D. P. Flanagan & P. L. Harrison (Eds.), *Contemporary intellectual assessment:Theories, tests,and issues* (2nd ed., pp. 136−181). New York: GuilfordPress.

McGrew, K. S. (2009). CHC theory and the human cognitive abilities project: Standing on the shoulders of the giants of psychometric intelligence research. *Intelligence, 37*(1), 1-10. doi:https://doi.org/10.1016/j.intell.2008.08.004

McGrew, K. S., & Wendling, B. J. (2010). Cattell–Horn–Carroll cognitive-achievement relations: What we have learned from the past 20 years of research. *Psychology in the Schools, 47*(7), 651-675. doi:doi:10.1002/pits.20497

McKay, D. A., & Tokar, D. M. (2012). The HEXACO and five-factor models of personality in relation to RIASEC vocational interests. *Journal of Vocational Behavior, 81*(2), 138-149.

McLarnon, M. J. W., Goffin, R. D., & Rothstein, M. G. (2018). Differentiation of cognitive abilities and the Medical College Admission Test. *Personality and Individual Differences, 123*, 50-55. doi:https://doi.org/10.1016/j.paid.2017.11.005

Milsom, A., & Coughlin, J. (2017). Examining Person–Environment Fit and Academic Major Satisfaction. *Journal of College Counseling, 20*(3), 250-262. doi:10.1002/jocc.12073

Morrow, J. M. (1971). *Satisfaction with choice of college major: A test of Holland's theory of vocational choice.* Morrow, James M : U North Carolina, Chapel Hill, Retrieved from http://ovidsp.ovid.com/ovidweb.cgi?T=JS&CSC=Y&NEWS=N&PAGE=fulltext&D=psyc2&AN=1971-29681-001

Moutafi, J., Furnham, A., & Tsaousis, I. (2006). Is the relationship between intelligence and trait Neuroticism mediated by test anxiety? *Personality and Individual Differences, 40*(3), 587-597.

Nafziger, D. H., Holland, J. L., & Gottfredson, G. D. (1975). Student-College Congruency as a Predictor of Satisfaction. *Journal of Counseling Psychology, 22*(2), 132-139. doi:Doi 10.1037/H0076340

Napoli, A. R. (1996). *Psychosocial factors related to retention and early departure of two-year community college students.* Napoli, Anthony R : State U New York at Stony Brook, US, Retrieved from http://ovidsp.ovid.com/ovidweb.cgi?T=JS&CSC=Y&NEWS=N&PAGE=fulltext&D=psyc3&AN=1996-95023-288

Nauta, M. M. (2007). Assessing college students' satisfaction with their academic majors. *Journal of Career Assessment, 15*(4), 446-462.

Nauta, M. M. (2010). The development, evolution, and status of Holland's theory of vocational personalities: Reflections and future directions for counseling psychology. *Journal of Counseling Psychology, 57*(1), 11.

Ng, T. K., & Ye, S. (2016). Human values and university life satisfaction among Hong Kong Chinese university students: A cross-lagged panel analysis. *The Asia-Pacific Education Researcher, 25*(3), 453-461.

Nye, C. D., Perlus, J. G., & Rounds, J. (2018a). Do ornithologists flock together? Examining the homogeneity of interests in occupations. *Journal of Vocational Behavior, 107*, 195-208. doi:https://doi.org/10.1016/j.jvb.2018.04.004

Nye, C. D., Prasad, J., Bradburn, J., & Elizondo, F. (2018b). Improving the operationalization of interest congruence using polynomial regression. *Journal of Vocational Behavior, 104*, 154-169.

Nye, C. D., Su, R., Rounds, J. B., & Drasgow, F. (2012). Vocational interests and performance: A quantitative summary of over 60 years of research. *Perspectives on Psychological Science, 7*(4), 384-403.

Nye, C. D., Su, R., Rounds, J. B., & Drasgow, F. (2017). Interest congruence and performance: Revisiting recent meta-analytic findings. *Journal of Vocational Behavior, 98*, 138-151.

O'Connor, M. C., & Paunonen, S. V. (2007). Big Five personality predictors of post-secondary academic performance. *Personality and Individual Differences, 43*(5), 971-990. doi:http://dx.doi.org/10.1016/j.paid.2007.03.017

Olver, J. M., & Mooradian, T. A. (2003). Personality traits and personal values: a conceptual and empirical integration. *Personality and Individual Differences, 35*(1), 109-125. doi:Pii S0191-8869(02)00145-9

Parks-Leduc, L., Feldman, G., & Bardi, A. (2015). Personality traits and personal values: A meta-analysis. *Personality and Social Psychology Review, 19*(1), 3-29.

Parks, L. (2007). *Personality and values: A meta-analysis.* Paper presented at the annual conference for the society of industrial and organizational psychology, New York.

Parks, L., & Guay, R. P. (2009). Personality, values, and motivation. *Personality and Individual Differences, 47*(7), 675-684.

Parks, L., & Guay, R. P. (2012). Can personal values predict performance? Evidence in an academic setting. *Applied Psychology, 61*(1), 149-173.

Pascarella, E. T. (2006). How College Affects Students: Ten Directions for Future Research. *Journal of College Student Development, 47*(5), 508-520. doi:http://dx.doi.org/10.1353/csd.2006.0060

Päßler, K., & Hell, B. (2012). Do interests and cognitive abilities help explain college major choice equally well for women and men? *Journal of Career Assessment, 20*(4), 479-496.

Paunonen, S. V., & Ashton, M. C. (2001a). Big Five predictors of academic achievement. *Journal of Research in Personality, 35*(1), 78-90.

Paunonen, S. V., & Ashton, M. C. (2001b). Big five factors and facets and the prediction of behavior. *Journal of Personality and Social Psychology, 81*(3), 524.

Paunonen, S. V., & Ashton, M. C. (2013). On the prediction of academic performance with personality traits: A replication study. *Journal of Research in Personality, 47*(6), 778-781.

Paunonen, S. V., Rothstein, M. G., & Jackson, D. N. (1999). Narrow reasoning about the use of broad personality measures for personnel selection. *Journal of Organizational Behavior: The International Journal of Industrial, Occupational and Organizational Psychology and Behavior, 20*(3), 389-405.

Pluck, G. (2018). Lexical reading ability predicts academic achievement at university level. *Cognition, Brain, Behavior, 22*(3), 175-196.

Poropat, A. E. (2009). A meta-analysis of the five-factor model of personality and academic performance. *Psychological Bulletin, 135*(2), 322-338. doi:http://dx.doi.org/10.1037/a0014996

Pozzebon, J. A., & Ashton, M. C. (2009a). Personality and Values as Predictors of Self- and Peer-Reported Behavior. *Journal of Individual Differences, 30*(3), 122-129. doi:Doi 10.1027/1614-0001.30.3.122

Pozzebon, J. A., & Ashton, M. C. (2009b). Personality and values as predictors of self-and peer-reported behavior. *Journal of Individual Differences, 30*(3), 122-129.
Pozzebon, J. A., Ashton, M. C., & Visser, B. A. (2014). Major changes: Personality, ability, and congruence in the prediction of academic outcomes. *Journal of Career Assessment, 22*(1), 75-88.
Pullmann, H., & Allik, J. (2008). Relations of academic and general self-esteem to school achievement. *Personality and Individual Differences, 45*(6), 559-564. doi:http://dx.doi.org/10.1016/j.paid.2008.06.017
Rammstedt, B., Danner, D., & Martin, S. (2016). The association between personality and cognitive ability: Going beyond simple effects. *Journal of Research in Personality, 62*, 39-44.
Rammstedt, B., Lechner, C., & Danner, D. (2018). Relationships between Personality and Cognitive Ability: A Facet-Level Analysis. *Journal of Intelligence, 6*(2), 28.
Randahl, G. J. (1991). A typological analysis of the relations between measured vocational interests and abilities. *Journal of Vocational Behavior, 38*(3), 333-350. doi:https://doi.org/10.1016/0001-8791(91)90034-J
Rikoon, S. H., Brenneman, M., Kim, L. E., Khorramdel, L., MacCann, C., Burrus, J., & Roberts, R. D. (2016). Facets of conscientiousness and their differential relationships with cognitive ability factors. *Journal of Research in Personality, 61*, 22-34.
Roccas, S., Sagiv, L., Schwartz, S. H., & Knafo, A. (2002). The Big Five Personality Factors and Personal Values. *Personality and Social Psychology Bulletin, 28*(6), 789-801. doi:10.1177/0146167202289008
Rohde, T. E., & Thompson, L. A. (2007). Predicting academic achievement with cognitive ability. *Intelligence, 35*(1), 83-92. doi:https://doi.org/10.1016/j.intell.2006.05.004
Rokeach, M. (1973). *The nature of human values*: Free press.
Roth, B., Becker, N., Romeyke, S., Schäfer, S., Domnick, F., & Spinath, F. M. (2015). Intelligence and school grades: A meta-analysis. *Intelligence, 53*, 118-137. doi:https://doi.org/10.1016/j.intell.2015.09.002
Rounds, J. B., & Tracey, T. J. (1990). From trait-and-factor to person-environment fit counseling: Theory and process. In W. B. Walsh & S. J. Osipow (Eds.), *Career Counseling: Contemporary Topics in Vocational Psychology* (pp. 1-44). Hillsdale, NJ: Erlbaum.
Sackett, P. R., Lievens, F., Van Iddekinge, C. H., & Kuncel, N. R. (2017). Individual differences and their measurement: A review of 100 years of research. *Journal of Applied Psychology, 102*(3), 254.
Sagiv, L. (2002). Vocational interests and basic values. *Journal of Career Assessment, 10*(2), 233-257.
Sagiv, L., Roccas, S., Cieciuch, J., & Schwartz, S. H. (2017). Personal values in human life. *Nature Human Behaviour, 1*(9), 630-639. doi:10.1038/s41562-017-0185-3
Sagiv, L., & Schwartz, S. H. (2000). Value priorities and subjective well-being: Direct relations and congruity effects. *European journal of social psychology, 30*(2), 177-198.
Sagiv, L., & Schwartz, S. H. (2004). Values, intelligence and client behavior in career counseling: A field study. *European Journal of Psychology of Education, 19*(3), 237-254.
Saß, S., Kampa, N., & Köller, O. (2017). The interplay of g and mathematical abilities in large-scale assessments across grades. *Intelligence, 63*, 33-44. doi:https://doi.org/10.1016/j.intell.2017.05.001
Schaie, K. W., Willis, S. L., & Caskie, G. I. L. (2004). The Seattle Longitudinal Study: Relationship Between Personality and Cognition. *Neuropsychology, development, and cognition. Section B, Aging, neuropsychology and cognition, 11*(2-3), 304-324. doi:10.1080/13825580490511134
Schmitt, N., Oswald, F. L., Friede, A., Imus, A., & Merritt, S. (2008). Perceived fit with an academic environment: Attitudinal and behavioral outcomes. *Journal of Vocational Behavior, 72*(3), 317-335. doi:https://doi.org/10.1016/j.jvb.2007.10.007
Schneider, B. (1987). The people make the place. *Personnel psychology, 40*(3), 437-453.
Schneider, W. J., & McGrew, K. S. (2012). The Cattell-Horn-Carroll model of intelligence. In D. P. Flanagan & P. L. Harrison (Eds.), *Contemporary intellectual assessment: Theories, tests, and issues* (pp. 99-144). New York: Guilford Press.

Schult, J., & Sparfeldt, J. R. (2016). Do non-g factors of cognitive ability tests align with specific academic achievements? A combined bifactor modeling approach. *Intelligence, 59*, 96-102. doi:https://doi.org/10.1016/j.intell.2016.08.004

Schwartz, S. H. (1992a). Universals in the content and structure of values: Theoretical advances and empirical tests in 20 countries. In *Advances in experimental social psychology, Vol 25* (pp. 1-65). San Diego, CA: Academic Press; US.

Schwartz, S. H. (1992b). Universals in the content and structure of values: Theoretical advances and empirical tests in 20 countries. *Advances in experimental social psychology, 25*, 1-65.

Schwartz, S. H. (1994). Are There Universal Aspects in the Structure and Contents of Human-Values. *Journal of Social Issues, 50*(4), 19-45.

Schwartz, S. H. (2006). Basic human values : theory, measurement, and applications. *Revue Francaise De Sociologie, 47*(4), 929-+.

Schwartz, S. H. (2012). An overview of the Schwartz theory of basic values. *Online readings in Psychology and Culture, 2*(1), 11.

Schwartz, S. H., & Bardi, A. (2001). Value hierarchies across cultures: Taking a similarities perspective. *Journal of Cross-Cultural Psychology, 32*(3), 268-290.

Schwartz, S. H., Melech, G., Lehmann, A., Burgess, S., Harris, M., & Owens, V. (2001). Extending the cross-cultural validity of the theory of basic human values with a different method of measurement. *Journal of Cross-Cultural Psychology, 32*(5), 519-542. doi:Doi 10.1177/0022022101032005001

Schwartz, S. H., & Sortheix, F. M. (2018). Values and subjective well-being. In E. Diener, S. Oishi, & L. Tay (Eds.), *Handbook of well-being.* . Salt Lake City, UT: DEF Publishers. .

Smith, P. B., Peterson, M. F., Schwartz, S. H., Ahmad, A. H., Akande, D., Andersen, J. A., . . . Yanchuk, V. (2002). Cultural values, sources of guidance, and their relevance to managerial behavior - A 47-nation study. *Journal of Cross-Cultural Psychology, 33*(2), 188-208. doi:Doi 10.1177/0022022102033002005

Snow, R. E. (1989). Aptitude-treatment interaction as a framework for research on individual differences in learning. In *Learning and individual differences: Advances in theory and research.* (pp. 13-59). New York, NY, US: W H Freeman/Times Books/ Henry Holt & Co.

Snow, R. E. (2014). *Cogmtive-Conative Aptitude Interactions in Learning.* Paper presented at the Abilities, motivation and methodology: The Minnesota symposium on learning and individual differences.

Sortheix, F. M., & Lönnqvist, J. E. (2015). Person-group value congruence and subjective well-being in students from Argentina, Bulgaria and Finland: The role of interpersonal relationships. *Journal of Community & Applied Social Psychology, 25*(1), 34-48.

Soubelet, A., & Salthouse, T. A. (2011). Personality–cognition relations across adulthood. *Developmental psychology, 47*(2), 303.

Spearman, C. (1904). " General Intelligence," Objectively Determined and Measured. *The American Journal of Psychology, 15*(2), 201-292.

Spearman, C. (1927). *The abilities of man*. London: Macmillan.

Spokane, A. R., & Derby, D. P. (1979). Congruence, Personality Pattern, and Satisfaction in College-Women. *Journal of Vocational Behavior, 15*(1), 36-42. doi:Doi 10.1016/0001-8791(79)90016-2

Stankov, L. (2009). Conservatism and cognitive ability. *Intelligence, 37*(3), 294-304.

Stoll, G., Rieger, S., Lüdtke, O., Nagengast, B., Trautwein, U., & Roberts, B. W. (2017). Vocational interests assessed at the end of high school predict life outcomes assessed 10 years later over and above IQ and Big Five personality traits. *Journal of Personality and Social Psychology, 113*(1), 167.

Strahan, S., & Credé, M. (2015). Satisfaction With College Re-Examining Its Structure and Its Relationships with The Intent to Remain in College and Academic Performance. *Journal of College Student Retention: Research, Theory & Practice, 16*(4), 537-561.

Su, R., Murdock, C. D., & Rounds, J. B. (2015). Person-environment fit. *APA handbook of career intervention, 1*, 81-98.

Taub, G. E., Keith, T. Z., Floyd, R. G., & McGrew, K. S. (2008). Effects of general and broad cognitive abilities on mathematics achievement. *School Psychology Quarterly, 23*(2), 187.

Tinsley, H. E. (2000). The congruence myth: An analysis of the efficacy of the person–environment fit model. *Journal of Vocational Behavior, 56*(2), 147-179.

Toker, Y., & Ackerman, P. L. (2012). Utilizing occupational complexity levels in vocational interest assessments: Assessing interests for STEM areas. *Journal of Vocational Behavior, 80*(2), 524-544. doi:http://dx.doi.org/10.1016/j.jvb.2011.09.001

Torelli, C. J., & Kaikati, A. M. (2009). Values as Predictors of Judgments and Behaviors: The Role of Abstract and Concrete Mindsets. *Journal of Personality and Social Psychology, 96*(1), 231-247. doi:Doi 10.1037/A0013836

Trapmann, S., Hell, B., Hirn, J. W., & Schuler, H. (2007). Meta-analysis of the relationship between the Big Five and academic success at university. *Zeitschrift fur Psychologie/Journal of Psychology, 215*(2), 132-151. doi:http://dx.doi.org/10.1027/0044-3409.215.2.132

Trógolo, M., & Medrano, L. A. (2012). Personality traits, difficulties in emotion regulation and academic satisfaction in a sample of argentine college students. *Personalidad, dificultades en la regulación emocional y satisfacción académica en una muestra de estudiantes universitarios argentinos., 5*(2), 30-39.

Tyler, D., & Small, J. M. (1990). Persistence of College Transfer Students. *Alberta Journal of Educational Research, 36*(2), 181-188.

Van Iddekinge, C. H., Roth, P. L., Putka, D. J., & Lanivich, S. E. (2011a). Are you interested? A meta-analysis of relations between vocational interests and employee performance and turnover. *Journal of Applied Psychology, 96*(6), 1167.

Vandenberg, S. G., & Kuse, A. R. (1978). Mental rotations, a group test of three-dimensional spatial visualization. *Perceptual and motor skills, 47*(2), 599-604.

Vedel, A. (2014). The Big Five and tertiary academic performance: A systematic review and meta-analysis. *Personality and Individual Differences, 71*, 66-76. doi:10.1016/j.paid.2014.07.011

Vedel, A., Thomsen, D. K., & Larsen, L. (2015). Personality, academic majors and performance: Revealing complex patterns. *Personality and Individual Differences, 85*, 69-76. doi:10.1016/j.paid.2015.04.030

Vitulic, H. S., & Prosen, S. (2012). PERSONALITY AND COGNITIVE ABILITIES AS PREDICTORS OF UNIVERSITY STUDENTS' ACADEMIC ACHIEVEMENT. *Drustvena Istrazivanja, 21*(3), 715-732. doi:10.5559/di.21.3.06

Vitulic, H. S., & Zupancic, M. (2010). Robust and mid-level personality traits as predictors of adolescents' academic achievement in secondary school. *Suvremena Psihologija, 13*(2), 203-219.

Volodina, A., Nagy, G., & Köller, O. (2015). Success in the first phase of the vocational career: The role of cognitive and scholastic abilities, personality factors, and vocational interests. *Journal of Vocational Behavior, 91*, 11-22.

Westermann, R., Elke, H., Spies, K., & Trautwein, U. (1996). Identifikation und Erfassung von Komponenten der Studienzufriedenheit. [Identifying and assessing components of student satisfaction.]. *Psychologie in Erziehung und Unterricht, 43*(1), 1-22.

Wiernik, B. M. (2016). Intraindividual personality profiles associated with Realistic interests. *Journal of Career Assessment, 24*(3), 460-480.

Wittmann, W. W., & Süβ, H. M. (1999). Investigating the path between working memory, intelligence, knowledge, and complex problem-solving performances via Brunswik symmetry. In P. L. Ackerman, P. C. Kyllonen, & R. D. Roberts (Eds.), *Learning and individual differences: Process, trait, and content determinants* (pp. 77–104). Washington, DC: American Psychological Association.

Wolfradt, U., & Dalbert, C. (2003). Personality, values and belief in a just world. *Personality and Individual Differences, 35*(8), 1911-1918. doi:https://doi.org/10.1016/S0191-8869(03)00040-0

Wolniak, G. C., & Pascarella, E. T. (2005). The effects of college major and job field congruence on job satisfaction. *Journal of Vocational Behavior, 67*(2), 233-251. doi:10.1016/j.jvb.2004.08.010

Yik, M. S. M., & Tang, C. S. (1996). Linking personality and values: The importance of a culturally relevant personality scale. *Personality and Individual Differences, 21*(5), 767-774. doi:https://doi.org/10.1016/0191-8869(96)00114-6