

University Adjustment is Explained by Autistic Traits in the General Student Population

by

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Abstract

I examined the relationship between autistic-like personality traits and university adjustment in a sample of the general student population. Using the Broad Autism Phenotype Questionnaire (BAPQ) and the Student Adjustment to College Questionnaire (SACQ), I found that stronger autistic traits predicted poorer adjustment to university. One subscale of the BAPQ, pragmatic language difficulties, emerged as the strongest predictor of adjustment. Further, pragmatic language difficulties were higher among students in degree programs related to science, technology, engineering and mathematics (STEM), and mediated the relationship between student's major and specific measures of adjustment. These findings suggest that universities, and STEM programs in particular, should consider interventions and learning environments aimed towards improving pragmatic language skills in an effort to improve university adjustment.

Keywords: university adjustment, Broad Autism Phenotype, social communication

I dedicate this thesis to my parents who have instilled in me the values of hard work, patience and kindness – the qualities I believe essential in achieving my academic and career goals, and success in all other future life endeavours.

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Chapter 1.

Introduction

College success can be measured by two criteria: academic performance (grade point average) and retention (degree completion versus dropping out; Robbins, Lauver, Le, Langley, Davis & Carlstrom, 2004). The latter, student retention, has received considerable attention from educators and researchers since the 1960s. Historically, university students who did not complete their degrees were thought to lack the necessary abilities and motivation (Tinto, 2006). While there is evidence suggesting academic performance is an important predictor of university attrition (Daugherty & Lane, 1999; Wintre & Bowers, 2007), non-cognitive factors such as social and emotional well being may be contributing factors to university student attrition as well (Gerdes & Mallinckrodt, 1994; Pritchard & Wilson, 2003). Still, relatively little is known about risk and protective factors associated with university dropout.

Non-cognitive factors, in particular, may be crucial for ensuring successful adjustment to university life. *University adjustment* is a multi-faceted construct referring to students' success in coping with the academic, social, and emotional demands inherent to the university experience, as well as their attachment to the particular institution they attend (Baker & Siryk, 1999). In support of the role of non-cognitive factors in predicting university adjustment, in a longitudinal study Gerdes and Mallinckrodt (1994) administered surveys to high school graduates to measure expected and actual adjustment, before and after beginning university. Six years later, records were examined to compare students who earned their degree, and students who dropped out. For those who dropped out, further analyses compared students who left university in relatively good academic standing, and students who left in poor academic standing. Of the 25 items that significantly predicted group differences, 13 related to social and emotional adjustment. In addition, students who dropped out despite relatively

good academic standing were much more likely to drop out because of social and emotional adjustment difficulties, compared to students who left university in poor academic standing. Similarly, Robbins, Oh, Le and Button (2009) conducted a meta-analysis to determine the effectiveness of interventions aimed at promoting academic performance and retention, and found that while *academic skills* interventions significantly improved academic performance, these interventions did not affect retention rates. Retention was primarily predicted by *self-management* interventions (e.g., self-regulatory skills, anxiety reduction and stress management, self-control, etc.), and *socialization* interventions, (e.g., first-year student orientations). Using similar criteria for college success, Pritchard and Wilson (2003) found that academic performance and retention were primarily predicted by social and emotional factors including stress, alcohol consumption, self-esteem and fatigue.

Of great concern for universities, the National Center for Educational Statistics (2011) in the United States report data from ongoing longitudinal research indicating that between the 2003-04 and 2008-09 academic years, of all entering first-year students at post-secondary institutions, only 49.5% attained a degree, 15.0% did not receive a degree but were still enrolled at a university, and 35.5% were no longer enrolled at any university and had not attained any type of degree. Importantly, the same study found that nearly half of those who dropped out of university (15.6% of the total population) left during their first year, suggesting the possibility of adjustment difficulties.

Given that student retention affects universities' rankings, reputation, and financial well being (Delen, 2011), many institutions have taken measures to improve the social aspect of higher education by providing interventions (e.g., incoming student orientations) that have been shown to correlate with increased retention (Robbins et al., 2009). However, more initiatives would appear to be justified based on the alarmingly high attrition rates in the U.S. National attrition statistics among universities in Canada have not been reported in recent years, but there is some evidence to suggest that Canadian universities experience similar attrition rates to those in the U.S., though perhaps to a lesser extent. For example, at Simon Fraser University, where participants from the present study attend, 30.7% of students who enrolled in the Fall of 2009, dropped out before the end of 2013, and more than half of those who dropped out, did

so during their first year of enrolment (Institutional Research and Planning, 2013). A critical gap in this literature is an understanding of the individual differences in university students that are associated with social and emotional adjustment difficulties. I suggest that in order to provide the most effective interventions, it is not enough to know that students *do* experience difficulties. Rather, in order to address these difficulties head on, it is essential that we understand *why*.

1.1. A novel framework for understanding adjustment difficulties

In an effort to understand why some students experience adjustment difficulties, some researchers have examined the relationship between university adjustment and individual differences in traits that are known to impact social functioning (e.g., Kerr, Johnson, Gans, & Kumrine, 2004). One unexplored framework of individual differences in social ability is associated with the Broad Autism Phenotype (BAP). BAP is a term that has traditionally been used to describe the autistic-like behaviors of relatives of individuals with Autism Spectrum Disorder (ASD) who do not meet the diagnostic criteria for a clinical diagnosis of ASD (Hurley, Losh, Parlier, Reznick & Piven, 2007). BAP characteristics are “milder but qualitatively similar to the defining features of autism” (Hurley et al., 2007, p. 1679). In addition, a growing body of research suggests that autistic traits vary along a continuum in the general (non-clinical) population (Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001; Constantino & Todd, 2003, 2005; Wainer, Ingersoll, & Hopwood, 2011), and are associated with individual differences in social cognitive ability (Sasson, Nowlin, & Pinkham, 2012), success in friendships and intimate relationships, and loneliness (Jobe & White, 2007). Importantly, however, no work has examined how variability in autistic traits in the general population might be associated with adjustment to university. To make a case for the utility of this approach, below I discuss some of the literature describing the BAP. Then, I describe how specific facets of the BAP would be expected to predict university adjustment in the general student body, the main aim of the present study.

1.2. ASD and features of the BAP

ASD is a neurodevelopmental disorder characterized by (1) deficits and abnormalities in social communication and interaction, and by (2) the presence of restricted and repetitive patterns of interests and behavior (American Psychiatric Association, APA, 2013). The BAP, on the other hand, is a term used by researchers to refer to autistic traits in a milder form found in non-clinical populations (Bolton et al., 1994; Hurley, Losh, Parlier, Reznick & Piven, 2007; Piven and Palmer, 1999). ASD includes a wide range of symptoms and severity, so BAP can be thought of as a way of extending this spectrum to individuals who demonstrate less pronounced autistic-like traits and behaviors.

1.2.1. Pragmatic language difficulties

It is well documented that individuals with a clinical diagnosis of ASD are less adept at understanding verbal (Hudry et al., 2010) and non-verbal (Wallace, Coleman & Bailey, 2008; Baron-Cohen, Wheelwright & Jolliffe, 1997) forms of social communication compared to their neurotypical peers. For instance, individuals with ASD struggle to find the hidden meaning behind social cues (e.g., facial expressions, sarcasm, humor), often fail to understand the social conventions governing communication (e.g., turn-taking in conversation; entering a conversation) and find situations like small talk especially baffling (Müller, Schuler, & Yates, 2008). Limitations in these *pragmatic* (social) aspects of language, have cascading effects on the ability of these individuals to form friendships, intimate relationships, and to successfully navigate school and work environments (Sperry & Mesibov, 2005). Similarly (although milder), within the BAP, individuals with pragmatic language (or social communication) difficulties have difficulties with the social aspects of language including (among other aspects) verbal and non-verbal social cue recognition, inappropriate comments, tangential speaking style, monotone speech, general awkwardness in social communication such as small talk, and difficulty in matching communication style to context (Rapin & Allen, 1983). Individuals with pragmatic language impairment struggle to understand the meaning of implicit messages that are not explicitly stated, such as metaphors and humorous phrases with double meaning. Furthermore, similar to individuals with ASD, they are

more likely to violate social conventions such as turn-taking during conversation, appropriate use of gestures and other non-verbal communication (APA, 2013).

BAP is a term that has traditionally been used to characterize family members of individuals with ASD, and it has long been recognized that immediate relatives of individuals with ASD often have unusual speaking styles, even before the term “BAP” became commonplace. For example, Landa, Piven, Wzorek, Gayle, Chase and Folstein (1992) compared two samples of parents differing in whether one or more of their children had been diagnosed with ASD. While no parents in either comparison group met the criteria for an ASD diagnosis, the parents with an ASD child were more likely to display social communication irregularities including awkward expression of ideas, odd humour, atypical greeting behavior, abrupt topic change and/or topic preoccupation, confusing conveyance of information, and being overly talkative (Landa et al., 1992).

Importantly, pragmatic language difficulties should be considered independent of general language ability. Social communication difficulties are different from specific language impairments and other learning disabilities that are associated with morphological and phonological awareness, writing ability, and reading comprehension (APA, 2013). Indeed, Lam and Yeung (2012) demonstrated that children with high-functioning ASD exhibited significantly worse pragmatic language abilities compared to their typically developing peers, even when matched for verbal and non-verbal intelligence.

1.2.2. Aloof personality

A second defining feature associated with BAP is referred to as *aloof personality*. Aloof personality can be described as decreased interest or enjoyment in social interactions (Hurley et al., 2007), a feature that is a milder manifestation of the social reciprocity deficits seen in ASD (APA, 2013). It is also well established that family members of individuals with ASD have lower quantity and quality of friendships (Piven, Palmer, Landa, Santangelo, Jacobi, & Childress, 1997; Santangelo & Folstein, 1995), and recent evidence suggests that the “aloof” phenotype drives this effect (Losh & Piven, 2007). However, as is the case in ASD, an aloof personality cannot be confused with

having *no* desire for social relationships. For example, there is a commonly recognized internal conflict among adults diagnosed with ASD in that they tend to express desire for social interactions and relationships, while at the same time expressing a preference for solitude (Müller et al., 2008).

1.2.3. Rigid personality.

The third defining feature of BAP is referred to as *rigid personality*. In ASD, features of a rigid personality fall under the broader category of repetitive patterns of behavior, interests, or activities (APA, 2013). At the clinical level, this category of behaviors can range from stereotyped or repetitive motor movements (body rocking, hand flapping) and echolalia, to circumscribed or unusual interests, fascination with parts of objects to extreme resistance to changes in daily routines. Within the BAP, this feature is similar to some of the defining features of ASD but is again milder in form. In the BAP, rigid personality usually manifests itself in the form of resistance to changes in schedules, insistence on sameness and inflexible adherence to routines (Piven et al., 1997). For example, people with rigid personality may become agitated when their normal routines deviate from their expectations, and they may be hesitant to learn new ways of doing things such as altering long-held strategies (Hurley, et al., 2007).

1.3. Possible associations between BAP traits and university adjustment

Baker and Siryk (1999) describe university adjustment as a multifaceted construct, "...involving demands varying in kind and degree [that] require a variety of coping responses (or adjustments) that vary in effectiveness" (p. 1). They describe university adjustment as comprising 4 domains, including, academic, social, and personal-emotional adjustment as well as commitment or attachment to one's school. *Academic Adjustment* can be described as success in coping with various educational demands of university including motivation, enjoyment of coursework, and self-perceptions of academic performance. *Social Adjustment* refers to students' adaptation to the interpersonal and social demands of university including satisfaction with the social activities offered on campus as well as self-perceptions of success in social

functioning. *Personal-Emotional Adjustment* refers to psychological health (e.g., anxious and depressive symptoms) and possible comorbid somatic symptoms associated with psychological distress. Finally, *Goal Commitment/Institutional Attachment* (referred to henceforth as *Attachment*) refers to students' satisfaction with the institutional purpose and objectives of universities in general and of their respective institution in particular.

Baker and Siryk (1999) report a variety of studies demonstrating each domain of college adjustment is correlated to real world outcomes. Among six samples (N = 704), academic adjustment was significantly correlated with GPA (*rs* ranged from .2 to .5; Baker & Siryk, 1999). Social adjustment, was positively correlated with involvement in extracurricular activities (Baker & Siryk, 1999) and students with higher scores on this subscale were more likely to be hired for desirable on-campus jobs such as dormitory assistant positions than students who score low on social adjustment (Baker & Siryk, 1984). Students with lower scores on the Personal-emotional adjustment are more likely to be involved in university counseling services (Baker & Siryk, 1984), and longitudinal studies showed that of all the SACQ subscales, *Attachment* was most strongly correlated with attrition (Baker & Siryk, 1984; Gerdes, 1986; cited in Baker & Siryk, 1999). Taken together, the substantial number of studies validating the SACQ demonstrate that the each subscale measures distinct aspects of university adjustment that, on it's own, is predictive of divergent real-world factors that are important for succeeding and having a positive experience in university.

1.3.1. Pragmatic language and aloof personality hypotheses

Given that pragmatic language difficulties and aloof personality represent impaired social functioning, it would be logical to predict that these BAP traits will interfere with students' ability to form and maintain social and collegial relationships. The inability to form and maintain social relationships in university may also have implications for academic success. For example, having friends, acquaintances or "study-buddies" in a class may be useful for gaining help or forming group study sessions, which in turn will likely support academic adjustment. Those with pragmatic language difficulties may find it especially hard to form relationships or initiate conversations with their instructors or teaching assistants when having problems, and may avoid help seeking strategies as a

means to avoid stressful social interactions. Similarly, for some classroom activities (e.g., group projects and in-class discussions) deficits in social skill and social communication could limit success in and enjoyment of such activities. Outside of the classroom, it is also reasonable to expect that pragmatic language difficulties and aloof personality will lead to difficulties with dating and forming friendships, and success in other social activities on campus, detracting from overall social adjustment.

I also predict that pragmatic language difficulties will relate to personal-emotional adjustment. Personal-emotional adjustment refers to how students are feeling, or the psychological health and possible comorbid somatic symptoms associated with psychological distress (Baker & Siryk, 1999). It is logical to predict that the experience of social or other adjustment difficulties will result in negative affect, especially in light of previous research highlighting the relationship between social and emotional functioning in ASD populations (Mahoney & Perales, 2003; White, Ollendick & Bray, 2011). For example, having some awareness of one's social abnormalities could lead to substantial social anxiety. Furthermore, social anxiety can lead to social avoidance, which has been associated with depression (Smalley, McCracken, & Tanguay, 1995). Indeed, White et al. (2011) found significant differences in social anxiety between neurotypical university students and undiagnosed students who met the clinical threshold for ASD based on the Autism Spectrum Quotient (AQ; Baron-Cohen, Wheelwright, Skinner, Martin, & Clubley, 2001).

1.3.2. Rigid personality hypotheses

The third BAP domain, rigid personality, is also expected to detract from university adjustment in a variety of ways. Adjusting to the academic demands of university can be difficult, as students are required to quickly master new study strategies that match their new learning environment (Parker, Summerfeldt, Hogan & Majeski, 2004). It is easy to see how a resistance to change could make it difficult for students to alter their learning strategies for the increasingly complex tasks they will be expected to complete. For example, items from the rigid personality subscale include "I keep doing things the way I know, even if another way might be better" and "I am flexible about how things should be done" (reversed). In addition, university life is not a

particularly regimented lifestyle, considering the variability of daily schedules and the adaptation involved in coping with new classes, classmates and instructors each semester. For these reasons, having a rigid personality may contribute to anxious and depressive symptoms.

1.3.3. BAP, adjustment and area of study hypotheses

Another rationale for measuring BAP in a university population is that it allows us to examine the prevalence of autistic-like traits as a function of the specific areas of study in which students are majoring. Indeed, there is some evidence to suggest a negative correlation between social and emotional competence and innate understanding of the physical universe. Specifically, Baron-Cohen, Wheelwright, Spong, Scahill and Lawson (2001) hypothesized that participants with Asperger syndrome would display superior knowledge of *folk physics* (i.e., the ability to infer physical causality) and inferior knowledge of *folk psychology* (i.e., the ability to infer causality of social action). With intelligence and prior science knowledge controlled, Baron-Cohen et al., (2001) demonstrated that their sample with Asperger syndrome displayed a stronger natural sense of folk physics and a weaker understanding of folk psychology when compared to a sample of controls. This research was sparked by Baron-Cohen, Wheelwright, Skinner, et al.'s, (2001) findings that among a large sample of university students in England, those whose majors related to natural science and mathematics scored higher on autistic traits than students majoring in the humanities and social sciences. These studies seem to suggest a preference and increased aptitude for sciences (e.g., physical, natural and computer sciences but not social sciences), technology, engineering or mathematics (STEM) among ASD populations. Recently, a large-scale study from the Stanford Research Institute compared the degree program choices of university students as a function of various sub-populations. Of all university students with ASD, about 36% chose a degree program relating to STEM fields, while only 22% of the total general student body chose degree programs relating to STEM fields (Wei, Yu, Shattuck, McCracken, & Blackorby, 2012).

The present investigation seeks to extend this body of literature by examining to what degree BAP characteristics may explain the relationships between major and

adjustment. It is expected that students with STEM majors will score higher on BAP traits and lower on adjustment scores than their non-STEM major peers. This pattern by itself would not necessarily implicate BAP traits in the lower adjustment scores of STEM majors. For example, lower academic adjustment scores of STEM students could merely reflect the likelihood that STEM courses are often more difficult and demanding than non-STEM courses. Therefore, it is important to show that BAP traits mediate the relationship between major and adjustment, such that this indirect relationship explains variance in adjustment beyond what can be explained by only direct effects of major on adjustment.

Chapter 2. Method

2.1. Participants

Data were collected from 153 undergraduate students enrolled at Simon Fraser University. Excessive missing data required the removal of 19 participants from analyses. Thus, the final sample included 134 students. Participants were recruited in a variety of ways. Some participants were recruited from fliers that were posted around the university's campus. Others were recruited during class lectures in introductory psychology and education classes. The majority of participants completed the study during classes in which the instructors agreed to devote a portion of their class time to data collection. These classes included a 300-level education course ($n = 19$) as well as a 100-level criminology course ($n = 80$).

Demographic information is presented in Table 2.1. Information regarding major or intended major was requested and coded as *STEM* or *Non-STEM*. Majors related to physical, natural and computer sciences, technology, engineering and mathematics were coded as STEM, while all other majors including those relating to the social sciences were coded as non-STEM.

Table 2-1. Demographic Information of Participants

Characteristic	<i>n</i>	percentage
Sex		
Male	44	32.8
Female	89	66.4
Age (years)		
Traditional (18-24)	128	95.5
Non-Traditional (> 25)	5	3.7
Class standing		
First year	37	27.6
Second year	42	31.3
Third year	28	20.9
Fourth year (or higher)	22	16.4
Country of Origin		
Canadian	81	60.4
Non-Canadian	53	39.6
English Language Proficiency		
Speaks English as 1 st Language	76	56.7
Speaks English as additional Language	56	41.8
Major		
STEM	26	19.4
Non-STEM	99	73.9
Undeclared	9	6.7

Note. Some variables do not add up to 100% due to missing data. STEM, Sciences, Technology, Engineering and Mathematics; Non-STEM, All other majors not relating to STEM fields.

2.2. Materials and Procedure

2.2.1. Broad Autism Phenotype.

The Broad Autism Phenotype Questionnaire (BAPQ; Hurley, et al., 2007) consists of 36 questions answered on a 6-point Likert scale. The BAPQ includes three sub-scales meant to reflect the three sub-domains of ASD diagnostic criteria which are: 1) aloof personality (e.g., “I would rather talk to people to get information than to socialize”) 2) pragmatic language difficulties (e.g., “I find it hard to get my words out

smoothly”) and 3) rigid personality and a desire for sameness (e.g., “I am uncomfortable with unexpected changes in plans”) (Hurley et al., 2007). The Autism Quotient (AQ), a 50-item self-report scale that measures personality traits and behaviors associated with ASD (Baron-Cohen, Wheelwright, Skinner, Martin & Clubley, 2001) is popularly used in autism research. Sasson et al.’s (2012) observation of a high correlation ($r = .76$) between the AQ and the BAPQ suggests the BAPQ to be a valid measure of non-clinical autistic-like characteristics.

2.2.2. Adjustment to university.

University adjustment was measured with the Student Adaptation to College Questionnaire (SACQ; Baker & Siryk, 1999), a 67-item inventory that measures students’ overall university adjustment. Four subscale scores are also provided: academic adjustment, social adjustment, personal-emotional adjustment, and attachment. The SACQ measures these constructs using 9-point Likert scales (1 = *Applies Very Closely to Me* to 9 = *Doesn’t Apply to Me at All*). The 24–item academic adjustment subscale measures response to and coping with educational demands (E.g., “*I am enjoying my academic work at college.*”) The 20-item social adjustment subscale measures coping with interpersonal and social demands (E.g., “*I am very involved with social activities in college.*”) The 15-item personal-emotional subscale measures psychological and physical functioning (E.g., “*I have been getting angry too easily lately.*”) The 15-item subscale for attachment measures attitudes about university and the particular institution (E.g., “*I feel that I fit in well as a part of the college environment.*”) Extensive evidence for the reliability and validity of the SACQ is provided in the test manual (see, Baker & Siryk, 1999).

2.3. Data analysis

First, correlations were run between all BAPQ and SACQ subscales. Next, one linear regression was conducted for each of the SACQ scales (academic adjustment, social adjustment, personal-emotional adjustment and attachment) using the three BAPQ subscales as predictors. All assumptions regarding appropriate conduct of regression analysis were met. For each of the reported regression analyses, all three

BAPQ subscales were entered simultaneously as separate variables in a forced entry method. Doing so enabled determination of which subscales of the BAP were explaining variance in each SACQ subscale.

As Table 1 shows, over 40% of our sample spoke English as an additional language, which elicited concern that language fluency may influence the pragmatic language variable. For example, one item on the pragmatic language difficulties subscale of the BAPQ states, “I struggle to get my words out smoothly.” Students who speak English as an additional language may indicate a high rate of agreement with this statement if they are not yet comfortable with the English language, even if they may indicate a low rate of agreement with this item when considering their native language. To control for this potential confound, language fluency was coded dichotomously as English as an additional language (EAL), or English as first language (EFL). Utilizing best practices for controlling potentially confounding variables in multiple regressions (see, Aiken & West, 1991), for each regression equation, language fluency was entered as the sole predictor in Block 1 of a Stepwise linear regression. Next, language fluency was entered once again along with all three BAPQ subscales in Block 2 because language fluency contributed a modest but statistically significant amount of variance in Block 1. Block 3 contained mean-centered products of language fluency and each BAPQ subscale to test for interaction effects. For all four regression equations (distinct by SACQ subscale as the dependent variable), model 1 showed that language fluency made a modest and statistically detectable contribution ($R^2 = .025 - .041$). However, in model 2, one or more of the BAPQ predictors emerged as the only statistically detectable predictors and the influence of language fluency was eliminated. Model 3 showed no statistically detectable interactions. As such, I interpret only model 2 for each regression equation in the Results section, confident that language fluency of our participants was not a confounding variable.

To test the aforementioned mediation hypothesis I used an SPSS add-on called *PROCESS* (see, Preacher & Hayes, 2004; as cited in Field, 2013), designed for ease in computing and interpreting regression models with hypothesized mediating or moderating variables. For these analyses, the variable *major* was dummy-coded into *STEM* and *non-STEM* and entered into the model as the independent variable with one

or more BAPQ scale entered as the mediating variables. I conducted this analysis only for SACQ scales in which there were significant differences between STEM and non-STEM groups (see Results section).

2.4. Procedure

Participants completed the measures described above, first providing demographic information, then completing the BAPQ, and finally the SACQ. All questionnaires were completed in succession during a single meeting. Data collection took place in a laboratory or classrooms and took participants on average 25 minutes to complete.

Chapter 3. Results

Descriptive statistics are reported in Table 3.1 and correlations between all BAPQ and SACQ subscales are presented in Table 3.2. All correlations were significant at the $p < .05$ level. Most importantly, all BAPQ subscales had small to moderate negative correlations with all SACQ scales such that higher levels of BAP traits were associated with lower levels of adjustment.

Table 3-1. Descriptive Statistics of BAPQ and SACQ Subscales

	Mean	SD	Range
BAPQ_Aloof	2.68	.79	1.08 – 5.08
BAPQ_Pragm	2.74	.64	1.17 – 5.00
BAPQ_Rigid	3.05	.69	1.08 – 5.00
SACQ_Acad	5.63	1.10	2.91 – 8.21
SACQ_Social	5.73	1.11	2.47 – 7.78
SACQ_PerEmo	5.54	1.49	1.27 – 8.67
SACQ_Attach	6.57	1.22	2.73 – 8.73

Note. BAPQ, Broad Autism Phenotype Questionnaire; SACQ, Student Adaptation to College Questionnaire; BAPQ_Aloof, Aloof Personality; BAPQ_Pragm, Pragmatic Language Difficulties; BAPQ_Rigid, Rigid Personality; SACQ_Acad, Academic Adjustment, SACQ_Social, Social Adjustment; SACQ_PerEmo, Personal-Emotional Adjustment; SACQ_Attach, Institutional Attachment.

Table 3-2. Pearson's *r* Intercorrelations among BAPQ and SACQ Subscales

	1.	2.	3.	4.	5.	6.	7.
1. BAPQ_Aloof	1						
2. BAPQ_Pragm	.401**	1					
3. BAPQ_Rigid	.263**	.288**	1				
4. SACQ_Acad	-.302**	-.527**	-.199*	1			
5. SACQ_Social	-.503**	-.448**	-.249**	.547**	1		
6. SACQ_PerEmo	-.195*	-.458**	-.314**	.624**	.432**	1	
7. SACQ_Attach	-.398**	-.426**	-.178*	.677**	.791**	.460**	1

Note ** $p < 0.01$. * $p < 0.05$. BAPQ, Broad Autism Phenotype Questionnaire; SACQ, Student Adaptation to College Questionnaire; BAPQ_Aloof, Aloof Personality; BAPQ_Pragm, Pragmatic Language Difficulties; BAPQ_Rigid, Rigid Personality; SACQ_Acad, Academic Adjustment, SACQ_Social, Social Adjustment; SACQ_PerEmo, Personal-Emotional Adjustment; SACQ_Attach, Institutional Attachment

Here I report the results from all four regression equations with BAPQ subscales and language fluency as the independent variables and SACQ subscales as the dependent variables. Given the moderate correlations found between all BAPQ and SACQ subscales, regression equations were useful in delineating which BAP traits were explaining variance in each measure of adjustment. Although there were small but significant correlations between the three predictors (Table 3.2), collinearity diagnostics indicated that potential of bias was relatively low (average *variance inflation factors* ranged from 1.1 – 1.2 across each model). The raw and standardized regression coefficients of the predictors and their zero-order and partial correlations with each SACQ subscale are displayed in Tables 3.3 – 3.6.

The *Academic Adjustment* model (Table 3.3) revealed that only one of the three predictors, *pragmatic language difficulties*, independently explained variance in academic adjustment. The model was statistically significant, $F(3,127) = 113.90$, $p < .001$, and accounted for approximately 28% of the variance in academic adjustment ($R^2 = .277$, Adjusted $R^2 = .254$).

Social Adjustment (Table 3.4) was explained by two of the three predictors, *pragmatic language difficulties* and *aloof personality*. Higher levels of pragmatic language difficulties and aloof personality predicted social adjustment difficulties. This

model was statistically significant, $F(3,127) = 18.50$, $p < .001$, and accounted for 33% of the variance in social adjustment ($R^2 = .322$, Adjusted $R^2 = .300$).

Personal-Emotional Adjustment (Table 3.5) was explained by two of the three predictors, this time by *pragmatic language difficulties* and *rigid personality*. Higher levels of pragmatic language difficulties and rigid personality predicted personal-emotional adjustment difficulties. This model was statistically significant, $F(3,127) = 12.29$, $p < .001$, and accounted for approximately 25% of the variance of personal-emotional adjustment ($R^2 = .254$, Adjusted $R^2 = .233$).

Finally, *Attachment* (Table 3.6), was explained by two of the three predictors, *pragmatic language difficulties* and *aloof personality*. Higher levels of pragmatic language difficulties and aloof personality primarily predicted lower levels of attachment to one's school. This model was statistically significant, $F(3,127) = 11.41$, $p < .001$, and accounted for approximately 24% of the variance of attachment ($R^2 = .242$, Adjusted $R^2 = .218$).

Table 3-3. Linear regression results and 95% Confidence Intervals: Academic Adjustment

Model	<i>b</i>	<i>SE B</i>	β	<i>t</i>	<i>p</i>	Zero-order <i>r</i>	Partial <i>r</i>
Constant	8.14 (7.14, 9.15)	.51		16.08	<.001		
EAL/EFL	.17 (-.18, .51)	.17	.08	.95	=.343	.20	.08
BAPQ_Aloof	-.12 (-.35, .11)	.12	-.09	-1.06	=.291	-.30	-.09
BAPQ_Pragm	-.78 (-1.07, -.49)	.15	-.45	-5.31	<.001	-.51	-.43
BAPQ_Rigid	-.05 (-.30, .21)	.13	-.03	-.35	=.727	-.17	-.03

Note. EAL/EFL, English as additional language versus English as first language; BAPQ, Broad Autism Phenotype Questionnaire; SACQ, BAPQ_Aloof, Aloof Personality; BAPQ_Pragm, Pragmatic Language Difficulties; BAPQ_Rigid, Rigid Personality.

Table 3-4. Linear Regression Results and 95% Confidence Intervals: Social Adjustment

Model	<i>b</i>	<i>SE B</i>	β	<i>t</i>	<i>p</i>	Zero-order <i>r</i>	Partial <i>r</i>
Constant	8.75 (7.76, 9.73)	.50		17.52	<.001		
EAL/EFL	.01 (-.32, .35)	.17	.01	.09	=.933	.16	.01
BAPQ_Aloof	-.52 (-.75, -.30)	.12	-.38	-4.56	<.001	-.50	-.38
BAPQ_Pragm	-.47 (-.75, -.18)	.14	-.27	-3.25	=.001	-.44	-.28
BAPQ_Rigid	-.11 (-.36, .14)	.13	-.07	-.86	=.390	-.23	-.08

Note. EAL/EFL, English as additional language versus English as first language; BAPQ, Broad Autism Phenotype Questionnaire; BAPQ_Aloof, Aloof Personality; BAPQ_Pragm, Pragmatic Language Difficulties; BAPQ_Rigid, Rigid Personality.

Table 3-5. Linear regression results and 95% Confidence Intervals: Personal-Emotional Adjustment

Model	<i>b</i>	<i>SE B</i>	β	<i>t</i>	<i>p</i>	Zero-order <i>r</i>	Partial <i>r</i>
Constant	9.00 (7.61, 10.39)	.70		12.77	<.001		
EAL/EFL	.38 (-.10, .86)	.24	.13	1.59	=.115	.20	.14
BAPQ_Aloof	-.10 (-.22, .42)	.16	.05	.62	=.534	-.19	.14
BAPQ_Pragm	-.92 (-1.33, -.52)	.20	-.39	-4.54	<.001	-.45	-.37
BAPQ_Rigid	-.46 (-.81, -.11)	.18	-.21	-2.61	=.010	-.30	-.23

Note. EAL/EFL, English as additional language versus English as first language; BAPQ, Broad Autism Phenotype Questionnaire; BAPQ_Aloof, Aloof Personality; BAPQ_Pragm, Pragmatic Language Difficulties; BAPQ_Rigid, Rigid Personality.

Table 3-6. Linear regression results and 95% confidence intervals: Attachment

Model	<i>b</i>	<i>SE B</i>	β	<i>t</i>	<i>p</i>	Zero-order <i>r</i>	Partial <i>r</i>
Constant	9.23 (8.07, 10.38)	.58		15.83	<.001		
EAL/EFL	.16 (-.24, .55)	.20	.06	.79	=.431	.19	.07
BAPQ_Aloof	-.40 (-.67, -.14)	.13	-.26	-3.00	=.003	-.40	-.26
BAPQ_Pragm	-.56 (-.90, -.23)	.17	-.29	-3.35	=.001	-.42	-.29
BAPQ_Rigid	-.04 (-.33, .25)	.15	-.02	-.27	=.789	-.17	-.02

Note. EAL/EFL, English as additional language versus English as first language; BAPQ, Broad Autism Phenotype Questionnaire; BAPQ_Aloof, Aloof Personality; BAPQ_Pragm, Pragmatic Language Difficulties; BAPQ_Rigid, Rigid Personality.

3.1. Major, BAP and Adjustment

Several hypotheses tested here relate to the impact of participants' major (or intended major) on relationships between BAP and adjustment. To test these hypotheses, major was dummy coded as a dichotomous variable: *STEM* ($n = 26$) vs. *Non-STEM* ($n = 99$). Nine participants were removed from the following analyses

because they reported majors as “undeclared” and did not yet have an intended major. Two-tailed independent samples *t* tests were first run to examine differences in BAP and adjustment as a function of major. STEM majors scored higher on two out of three BAPQ subscales, aloof personality, $t(123) = 3.42, p = .001$ and pragmatic language difficulties, $t(123) = 2.55, p = .012$, but not on rigid personality ($p > .05$). STEM majors also scored higher on two out of four SACQ scales, academic adjustment, $t(123) = 3.36, p = .001$, and attachment, $t(123) = 2.04, p = .044$, but not for social or personal-emotional adjustment ($ps > .05$).

Next, two separate linear regressions were conducted for each of the SACQ scales for which there were significant differences as a function of major (academic adjustment and attachment) as demonstrated by the above *t* tests. Assumptions for mediational analyses require that three separate regression models are tested to show 1) the independent variable significantly explains variance in the hypothesized mediating variable(s), 2) the hypothesized mediating variable(s) significantly explains variance in the dependent variable, and 3) the independent variable significantly explains variance in the dependent variable. All assumptions for the following models were satisfied ($ps < .05$). For the mediation model for academic adjustment, major was entered as the only independent variable, and pragmatic language difficulties was entered as the hypothesized mediating variable because pragmatic language difficulty was the only significant predictor of academic adjustment (see Table 3.3). The mediation model revealed a significant indirect effect of major on academic adjustment through pragmatic language difficulties (see Figure 3.1). The R^2 change ($R^2 = 0.0551, CI [0.012, 0.135]$) suggests approximately 5.5% of the variance in academic adjustment can be explained by indirect effects of the mediation model beyond what can be explained by direct effects. In other words, the higher levels of pragmatic language difficulties within STEM students partially mediated the relationship between major and academic adjustment.

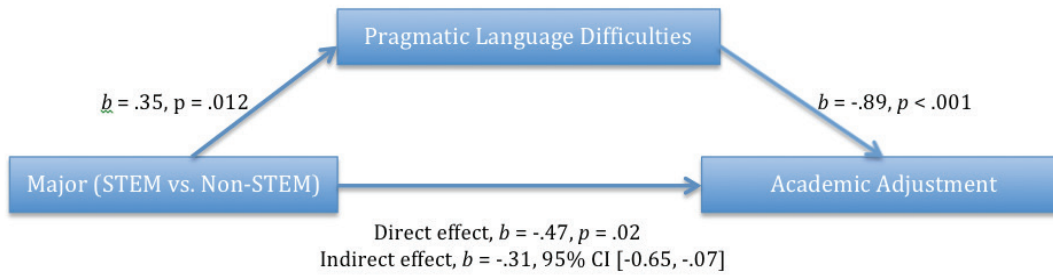


Figure 3-1. Academic Adjustment Mediation Model

For the attachment model, pragmatic language difficulties and Aloof Personality were entered as two separate hypothesized mediating variables because both these variables were significant predictors of attachment (see Table 3.6). This model also revealed significant indirect effects of major on attachment. Figure 3.2 shows that the direct effects of major on attachment dropped below the level of significance after accounting for the influence of the proposed mediating variables. This indicates that pragmatic language difficulties and aloof personality fully mediated the relationship between Major and Attachment, such that the lower levels of attachment among STEM students are entirely explained by the higher levels of BAP traits in STEM students.

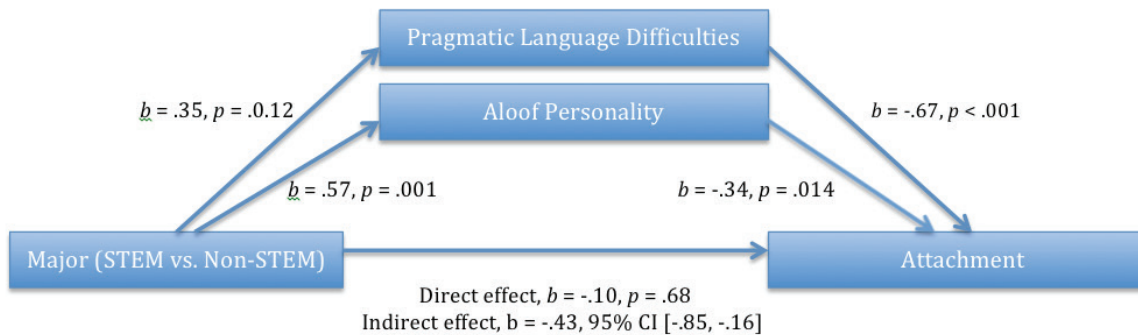


Figure 3-2. Attachment Mediation Model

Chapter 4. Discussion

Previous research has neglected to identify individual personality differences that explain why some students experience social, emotional and academic adjustment difficulties that may lead to university dropout decisions. This study utilized an autism framework to determine whether autistic-like traits in the general student body are useful in explaining variance in university adjustment. Each of the BAPQ subscales explained variance in at least one SACQ subscale, but perhaps the most notable finding from this study is that *pragmatic language*, or social communication difficulties, explained variance in all four SACQ subscales.

That pragmatic language difficulty was the only predictor of academic adjustment warrants a discussion of the different ways in which social communication might be important to academic performance in the university context. First, a difficulty with social communication could impede the formation and maintenance of relationships with peers and instructors. For example, it is likely that many undergraduates experience anxiety approaching a person of authority (such as a professor or teaching assistant) or even classmates they have never met before, and it would not be surprising if those who feel unsure about their social communication skills would be particularly unlikely to initiate social exchanges, and would be less successful in their attempts. This likely explains, in part, the negative impact of pragmatic language difficulties on both social *and* academic adjustment. Second, help-seeking avoidance may play a major role in poor academic adjustment. Many university students with ASD are reluctant or lack the communication skills to advocate for themselves and to request disability services (Janiga & Costenbader, 2002). Thus, it is reasonable to assume that social communication difficulties in the general student body could lead to reduced help-seeking.

Help-seeking has been studied extensively in K-12 populations but has received little attention in university students. The existing research examining help-seeking

behaviors in adolescent and university-aged students is often discussed in the context of *goal orientation theory* (Ryan, Pintrich & Midgley, 2001). This theory describes different goal orientations students possess that explain the various reasons students are motivated to succeed, and what strategies and behaviors are associated with these different motivations. One of the less-desired goal orientations is known as *performance-avoidance*. Students with a performance-avoidance approach often do not ask for help when they need it to avoid appearing incompetent in front of their peers (Middleton & Midgley, 1997). Although Middleton and Midgley (1997) found that help-seeking avoidance was primarily explained in terms of student desires to hide their own perceptions of cognitive incompetence, I ask: could social incompetence also play a role? Ryan and Pintrich (1997) provided some evidence that perceptions of social incompetence among seventh and eighth-graders predict help-seeking avoidance even when controlling for perceptions of cognitive incompetence.

Although not specifically examined in the present study, the adjustment difficulties among those with perceived self-reported pragmatic language difficulties might be explained in part by help-seeking avoidance. This possibility is worthy of investigation as help-seeking may be even more challenging in university than in elementary or high school, given the much larger student-instructor ratios in university classes. An additional component of help-seeking behavior in university contexts, one that has not been captured by the existing research, is help-seeking from peers. Indeed, university students are probably more likely to primarily reach out to peers for assistance with course content, assignments, etc., than they are to approach professors or teaching assistants for this information. This kind of peer interaction would be particularly difficult for a student with impairments in social communication, and thus warrants future investigation in determining the mechanisms by which autistic traits impact academic adjustment.

4.1. BAPQ Subscales Mediate the Relationship Between Major and SACQ Subscales

There is a well-known stereotype that students in departments such as engineering and computer sciences tend to be lacking in social skills. As with many

stereotypes, there appears to be a “kernel of truth” to this view. In the present study I found that students with STEM majors scored higher than non-STEM students on two of the three BAPQ subscales including aloof personality and pragmatic language difficulties. It was also found that STEM students scored lower in some measures of adjustment including academic adjustment and attachment. These results by themselves are not indicative that higher levels of BAP traits are responsible for lower levels of adjustment in STEM students. STEM students could be experiencing lower academic adjustment because their coursework is harder, and could be experiencing lower attachment as a result of lower academic adjustment. Critically, however, I found that BAP traits mediated the relationship between major and academic adjustment as well as the relationship between major and attachment such that the indirect effects of BAP explained more than 5% of variance in each of these adjustment measures beyond what was explained by the direct effects of major on adjustment.

This study is certainly not the first to show a relationship between autistic-like traits and scientific thinking. Baron-Cohen (2002) speculates that this pattern of results can be explained by similar cognitive styles of scientists and the autistic mind. He suggests that highly technically-minded people who are drawn to rule-based systems characteristic of STEM fields may find the social world somewhat baffling because social interactions do not seem to follow a logical progression or prescribed set of rules. However, this study was the first to examine how higher rates of autistic traits among STEM students impact university adjustment. The findings of this study underscore the importance for universities in general, and STEM departments in particular, to be aware of the problems students may experience with social communication, and thus, adjustment.

4.2. Strengths, Limitations and Future Research Directions

Research on pragmatic language abilities has been conducted mostly in children, and typically utilizes experimental designs comparing clinical populations with non-clinical peers. The methodology of the present study was quite different in that a) our sample consisted of an adult population, b) no participants in the sample reported having been diagnosed with a neurodevelopmental or communicative disorder such as ASD or

social communication disorder, and c) the primary quantitative analyses were correlational rather than comparative. There is a growing recognition in autism research that comparative studies do not account for within-group heterogeneity (Boucher, 2012) and others have suggested regression methods as a means to explain within-group differences (Ricketts, Jones, Happé, & Charman, 2013).

There are several methodological limitations that must be considered when drawing conclusions from this study. First, data were taken from a convenience sample from only one university. Therefore, it is not clear if the results of this study are generalizable to other university populations. Second, our measure of pragmatic language difficulties was a self-report assessment, which could be criticized for lacking authenticity. I did not actually observe participants' pragmatic language abilities in a real-world conversation. Follow-up studies should utilize more authentic measures of pragmatic language such as the Pragmatic Rating Scale (PRS; Landa, et al., 1992). The PRS uses video recordings of semi-structured conversations between participants and researchers, and has demonstrated reliable differences on pragmatic language abilities between parents with and without children with ASD (Landa, et al., 1992; Piven, et al., 1997) suggesting the PRS to be a useful measure for research on BAP in adult populations. This approach would also allow for a more detailed exploration of the specific components of pragmatic language that differentiate students who are adjusting well to university and those who are not.

A final important limitation is that in this study I did little to examine whether autistic-like traits or low adjustment relates to college success. I did request participants to self-report their current GPA. Correlational analyses showed academic adjustment, but none of the other subscales of adjustment, was positively correlated with GPA, $r = .37, p < .001$. Social adjustment, personal-emotional adjustment and attachment should theoretically be more predictive of attrition, but I did not follow participants in this study to see if they completed their degree or dropped out. As such, I relied heavily on previous research on retention to form hypothetical links between adjustment and retention. Future research should use longitudinal research designs to examine if lower rates of adjustment associated with autistic-like traits actually increase the likelihood of dropout decisions.

4.3. Implications

Despite the limitations, important implications emerge from this study. Our most notable finding is that of the dimensions comprising the BAP, pragmatic language difficulties explained the greatest amount of variance in overall adjustment. Indeed, pragmatic language difficulties explained a significant amount of variance in all four of the SACQ scales. This is an important finding considering that none of the participants in this sample reported ever being diagnosed with a developmental or communication disorder, and suggests that many students in the general student body at universities may experience difficulties in social communication, inhibiting their ability to adjust to the various demands of university. Fostering social communication skills in university students may aid their ability to adjust to the university environment, but it will likely yield benefits beyond formal education as well. Beyond technical skills, *soft skills*, (e.g., problem solving, self-motivation, leadership skills, communication skills, and interpersonal skills) are often rated as more important by employers (Johnston & McGregor, 2004; cited in Carter, 2011). Of these soft skills, communication skills in particular are frequently reported as the most sought-after skillset (National Association of Colleges and Employers, 2010). And yet, rarely are these type of skills included in university curricula. This may be in part due to findings that faculty over-estimate the importance of domain knowledge and research skills while under-estimating the importance of soft skills (Kabicher, Motschnig-Pitrik, & Figl, 2009). This brings up two outstanding questions: Are university instructors responsible for developing communication and interpersonal skills in their students? If so, how?

A growing body of research in engineering education is recognizing the need to incorporate the development of soft skills, often called *professional skills*, into curricula with the awareness that in order to excel as an engineering professional and/or advance to leadership positions, one must be able to effectively manage and motivate a team, have exceptional interpersonal skills and be able to think creatively about the unique challenges that one's team will have to overcome in practice (Kumar & Hsiao, 2007). One study asked students and faculty how they felt about a *direct instruction* approach to teaching soft skills in an engineering undergraduate class and reported unpromising results (Pulko & Parikh, 2003). The vast majority of students felt that it was a waste of

their time believing they already possessed adequate soft skills, and faculty did not enjoy teaching soft skills believing it to be a waste of their talents and area of expertise. The researchers did not appear to analyze the effectiveness of such curricula, and this remains an open question for future research.

Regardless of the effectiveness of the direct instruction of soft skills, some have proposed that a promising way to promote these skills is to provide students with ample opportunities to practice these skills using *problem-based learning* (Kumar & Hsiao, 2007). Conceptually, this model of education does not require the instructor to show students how to solve a problem, rather it involves presenting a problem to students and requiring them to work collaboratively and think creatively to figure it out themselves. In replicating the actual problems engineers will face in practice by creating problem-based scenarios in the classroom, students can begin to develop their professional skills before entering their profession. Still, it may be useful for students with severe communication difficulties to receive direct instruction on how to work effectively in groups.

In the United Kingdom (UK), researchers are displaying growing interest in what they call “employability skills,” following a 1997 report from the National Committee of Inquiry into Higher Education recommending “the development of communication, numeracy, information technology and learning how to learn at a higher level within all subjects.” (as cited in Cranmer, 2006, p. 169). Based on interviews from faculty, students and career services staff members from 34 departments in eight universities in the UK, Cranmer (2006) suggests that employment-based training and experience, and also employer involvement in courses and course design, is the most effective way to promote employability. Like problem-based learning, these methods attempt to closely match the learning environment with future work environments, or extend the learning environment outside of the classroom. Increased research is needed to evaluate the effectiveness of the limited initiatives various programs have utilized to instill professional/employability skills in their students.

In sum, the findings of this study suggest autistic-like traits in the university population contribute to a substantial amount of variance in adjustment. Given the strong relationship between social communication difficulties and university adjustment,

universities would be wise to provide interventions or design curricula in such a way to foster communication skills and other soft skills. In doing so, students will have an easier time adjusting to the university environment, and may be more likely to complete their degrees and excel in their profession following graduation. Future research should delineate how, and in what ways, pragmatic language difficulties are creating problems for students in various social and academic situations in order to provide faculty and university personnel more specific information on how to address these problems.

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