The Gender Conflict on Academic Performance and the Raven's Progressive Matrices

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Abstract

The Raven's Progressive Matrices (RPM) is a ubiquitous general intelligence measure, and many studies have found that on average males perform better than females on the RPM. Some have interpreted this as suggesting males have higher general intelligence. Since measured intelligence is the best predictor of academic performance (AP), the implication is that males will achieve better academically. However, many researches show the opposite: females perform better academically in general. Therefore, this study examined gender differences in intelligence and academic performances from 688 third-year psychology students (530 females and 158 males), with their ages ranging from 18-to-63 years old (M=23.9, SD=6.66 yrs), to explore this paradox. Moreover, we also studied other variables that are related to academic performance such as prior academic performances, emotional intelligence, verbal intelligence, and personality (Openness and Conscientiousness, in particular) in an attempt to resolve this conflict. Results showed that Conscientiousness influenced AP more in females whereas general intelligence affected AP more in males, which could be the two crucial factors in explaining the conflict. However, this is not the only explanation, so future studies are still required to identify other possible variables or reasons to resolve the conflict comprehensively.

Declaration

This thesis contains no material which has been accepted for the award of any other degree of diploma in any University, and, to the best of my knowledge, this thesis contains no material previously published except where due reference is made. I give permission for the digital version of this thesis to be made available on the web, via the University of Adelaide's digital thesis repository, the Library Search and through web search engines, unless permission has been granted by the School to restrict access for a period of time.

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Contribution Statement

In writing this thesis, my supervisor and I collaborated to generate research questions of interest and design the appropriate methodology. My supervisor provided the data, details of the participants, and advice on the R-code used in this thesis. I conducted the literature search, and I was responsible for all data analysis and thesis write-up.

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I want to thank my supervisor for patiently leading me step-by-step toward the end of this thesis. I could not finish this without my supervisor. Also, I appreciate all the help from my friends and family. They supported me when I faced adversity.

CHAPTER 1

Introduction

1.1 Rationale

The Raven's Progressive Matrices (RPM) has been used extensively to measure human intelligence, and an average result of males outperforming females is commonly found. Some researches interpreted this as males having higher general intelligence. Due to measured intelligence being the best predictor of academic performance, the implication is that males will achieve better academically. However, the results from many studies contradicted this implication, with females generally better in academic performance. Hence, this study attempted to resolve this conflict by examining some other variables related to academic performance.

1.2 Overview of Raven's Progressive Matrices

The Raven's Progressive Matrices (RPM) is a popular measure for general intelligence. It was invented by John C. Raven in 1936 (Raven, 1936), and some adjustments and extensions had been made afterward. The RPM was developed to measure Spearman's *g*, that is, general intelligence. More specifically, Spearman claimed that the RPM tested the "eductive" ability, referring to a kind of general cognitive ability that organizes meanings from complex contexts (Raven, 2008). On the other hand, the RPM was also found as being able to examine fluid intelligence (Bilker et al., 2012). Fluid intelligence was proposed by Cattell (1963) and it is an ability of reasoning, analyzing, and solving problems from confusion without referring to prior experiences.

In regard to the versions of the RPM, there are three of them: Standard Progressive Matrices, Coloured Progressive Matrices, and Advanced Progressive Matrices. The Standard Progressive Matrices is a general version which was designed for as many people as possible,

including children above 6 years old and people at all education levels. On the contrary, the Coloured Progressive Matrices is a simpler version for 5-12 years old children and seniors. It was named the Coloured version because the questions have colours to aid examinees, and the other two matrices are only in black and white. Finally, the Advanced Progressive Matrices is the most challenging version for adults with higher ability. Undergraduate students were our participants, and hence a concise version of the Advanced Progressive Matrices (APM) was selected as our measure in present study.

1.2.1 Raven's Progressive Matrices and Gender. Gender differences in the RPM have been studied throughout many decades, and the finding is that adult males perform on average better than females. Although no gender differences were reported in studies from Jensen (1998) and Mackintosh (1998), a more recent meta-analytic study which examined data from numerous countries indicated that males performed better than females after the age of 14 years old (Lynn & Irwing, 2004). More precisely, they collected data from 57 studies to examine gender differences and compare them in each age group. The effect size was measured by Cohen's *d*. At the age of 6-9 years old, boy's mean score was slightly higher than girls whereas girls performed slightly better at 10-13 years old; yet, they were not statistically significant. Boys performed better again at 14 years old with the effect size of $d = 0.08$. This male advantage then grew larger and became significant, with $d = 0.10$ at 15 years old, $d = 0.17$ at 19 years old and $d = 0.33$ at 20-29 years old. The magnitude remained the same until 80-89 years old. Overall, adult males performed better than females.

Moreover, higher general intelligence in adult males has not only been found in the RPM. For example, Pezzuti, Tommasi, Saggino, Dawe, and Lauriola (2020) found out that in Italy, adult males perform better in many of the core subtests in WAIS-IV, such as Block Design,

Matrix Reasoning, Visual Puzzles, and so on, leading to higher IQ scores than females, albeit with a small-medium effect size. Therefore, the assumption by some researchers is that adult males have higher general intelligence than females.

However, apart from males having higher general intelligence, an alternative explanation regarding males outperforming females in the RPM has been proposed. Waschl, Nettelbeck and Burns (2017) reported that the RPM not only examines general intelligence but also visuospatial ability, and the variance accounted by visuospatial ability is substantial. Visuospatial ability is an ability to solve problems through visual images, including identifying the length between objects, rotating items mentally, and so on. Since evidence shows that males are better in visuospatial ability (Voyer, Voyer, & Bryden, 1995), this might be the reason for the male advantage on the RPM. This explanation was partially supported by Gignac's (2015) research which stated that the RPM was not a pure general intelligence measure, but general intelligence only accounted for 50% of the variance in the RPM score and fluid intelligence accounted for 10% of it. The other 25% of the variance is from test specificity and 15% from error. Moreover, Waschl and Burns' (2020) meta-analytic study including 96,957 adults from 98 different studies and different intelligence measures reported that there is no consistent gender difference in inductive reasoning. Inductive reasoning is the most representative and commonly used narrow ability for general intelligence and fluid intelligence, and hence the result indicates that there is no gender difference in general intelligence. In addition, they further examined the content of different intelligence measures, including figural, verbal, and numerical stimuli, and the results showed significant male advantage on figural stimuli, which the RPM uses. Figural stimuli are considered a kind of visuospatial ability. With the evidence presented, the conclusion is that the male advantage on the RPM could be caused by visuospatial ability rather than general

intelligence. Hence, more studies were conducted. Colom, Rebollo, Palacios, Juan-Espinosa, and Kyllonen's (2004) study reported that after controlling the differences in visuospatial ability, the male advantage on the RPM became nonsignificant. Lim's (1994) result also indicated that when doing the RPM, females were found being more challenged by visuospatial factors. Nevertheless, Abad, Colom, Rebollo, and Escorial (2004) stated that although the magnitude of male advantage on the RPM decreased after visuospatial ability had been controlled, the male advantage was still significant. These inconsistent results suggest that visuospatial ability explains some extent of the male advantage on the RPM but cannot prove that visuospatial ability is the only factor that causes gender difference, and further studies are required to identify any other factors.

1.2.2 Raven's Progressive Matrices and Academic Performance. Since the RPM is a measure of general intelligence, and general intelligence was found one of the strongest predictors for academic performance (Kuncel, Hezlett, & Ones, 2004; Higgins, Peterson, Pihl, & Lee, 2007), the relationship between the RPM and academic performance should be substantial. Laidra, Pullmann, and Allik (2007) examined elementary and secondary school students and agreed with the inference, as well as many other studies that tested undergraduate students (Raven, Court, & Raven, 1996; Day, Hanson, Maltby, Proctor, & Wood, 2010; Higgins et al., 2007). To be more exact, Laidra, Pullmann, and Allik's (2007) research examined children from grade 2-12, and the average Pearson's correlation was approximately r =.5. In Day and her colleagues' (2010) study, she reported the RPM significantly predicts undergraduate students' academic performance with the standardized regression coefficient (β) of 0.32.

Considering that the RPM is closely related to academic performance, and adult males perform better than adult females in the RPM, the implication is that adult males would achieve

better in academic performance. However, we often hear the opposite, with females performing better than males academically. Hence, further exploration of this issue is presented in the following paragraphs.

1.3 Gender and Academic Performance

Typically, females are believed to show better academic performance than males. It is true, to a certain extent. A meta-analysis by Richardson, Abraham and Bond (2012), encompassing 217 papers across Europe and North America, reported that female students obtained significantly higher grades. The magnitude of sample-weighted average correlation (r^+) is 0.09, which is small according to Cohen's conventions. The same result was found in many other studies (Voyer & Voyer, 2014; Castagnetti & Rosti, 2009; Woodfield, Jessop, & McMillan, 2006). To be more specific, the stereotype is that male students would perform better in mathematics while females in reading and languages. In addition, even male students themselves are more motivated and expect themselves to perform better in mathematics, but female students exhibit higher level of anxiety; yet, both genders overall show negative feelings toward mathematics (Todor, 2014; Rodriguez, Regueiro, Pineiro, Estevez, & Valle, 2020). Surprisingly, O'Connell (2018) and Voyer and Voyer (2014) found females achieving higher grades in mathematics, reading, and language courses, and the scores in language courses were found to have the largest gender differences while the smallest gender differences were in mathematics. Apart from these, there are still many other studies showing no gender difference in academic performance (Icekson, Kaplan, & Slobodin, 2020; Rosander & Bäckström, 2012; Budrina, 2017). Although in Rosander and Bäckström's (2012) study, the result is almost statistically significant with an effect size of $d = 0.16$; similarly, $d = 0.28$ is calculated from Icekson, Kaplan and Slobodin's (2020) study, and the females' mean grades are slightly higher

in both studies. In a nutshell, researches nowadays seem to suggest that females obtain higher scores than males in schools; yet, some contrasting results might have been found in different countries or age ranges. Hence, to understand the correlation between gender and academic performance comprehensively, more specific studies should be carried out.

1.4 Other Variables related to Academic Performance

After inspecting the relationships between the RPM, gender, and academic performance, the disparities become apparent. Therefore, this present study also examined some factors that are related to academic performance in an attempt to resolve the conflict. These factors include prior academic performance, verbal intelligence, emotional intelligence, and personality.

1.4.1 Prior Academic Performance and Academic Performance. The first variable is prior academic performance. Universities establishing entrance requirements based upon students' prior academic performance is a ubiquitous idea, and numerous studies support this. To elaborate, common criteria tertiary institutions might examine are the American College Testing (ACT), Scholastic Assessment Test (SAT), and high school grade point average (GPA). Westrick, Le, Robbins, Radunzel, & Schmidt (2015) reported that the ACT and GPA scores successfully predict first and second year academic performance in universities. Another meta-analysis study found out that the ACT, GPA and SAT are all significantly related to university student academic performance (Richardson et al., 2012). Interestingly, academic performance in universities is better predicted by the combination of high school scores and the ACT and SAT (Kobrin, Patterson, Shaw, Mattern, & Barbuti, 2008). For example, in Kobrin and his colleagues' (2008) study, a correlation of $r = .36$ was found for high school GPA, $r = .35$ for SAT scores, and a combination of both correlated to a medium level of $r = .46$, meaning high school GPA and SAT encompass different elements that predict academic performance in colleges. With incorporating

them into universities' criteria of assessment, a more accurate prediction could be made. Prior academic performance is, therefore, a strong predictor for university students' academic performance, and hence we incorporated this factor in our study.

Prior academic performance might not be able to explain the conflict mentioned above but including and comparing prior academic performance to academic performance can provide evidence for the fact that although general intelligence is a strong predictor for academic performance, some other variables also play essential roles. Lynn and Irwing (2004) stated that after 14 years old, the male advantage on general intelligence starts to become significant, and hence, even if females are better in prior academic performance, this gap between gender should narrow or disappear since males obtain higher general intelligence. Accordingly, if the magnitude of the gap remains the same, general intelligence could not be the key factor which causes gender difference in academic performance.

1.4.2 Verbal Intelligence and Academic Performance. Verbal intelligence also plays an important role in predicting academic performance. Unlike fluid intelligence which many intelligence scales measure, verbal intelligence is classified as a crystalized intelligence (Horn, 1988). Cattell (1971) defined crystallized intelligence as a type of knowledge that people learn and understand from past experiences. Crystallized intelligence was also found a successful predictor in high school and college students' academic performance (Postlethwaite, 2011). Hence, verbal intelligence, as expected, is a significant predictor for college students' academic performance in both GPA and exam grades (Berkowitz & Stern, 2018; Dollinger, Matyja, & Huber, 2008; Kornilova, Kornilov & Chumakova, 2009). Dollinger and his colleagues (2008) even ascertained that verbal intelligence held the greatest magnitude of correlation with academic performance comparing to many factors such as GPA or personality traits. With respect

to majors, Berkowitz and Stern (2018) reported that verbal intelligence uniquely predicted the performance on math and physics courses. To sum up, the relationship between verbal intelligence and university students' academic performance is strong, so this study included it to examine the influence verbal intelligence exerted on student grades.

1.4.3 Emotional Intelligence and Academic Performance. In addition to intelligence quotient (IQ), emotional intelligence (EI) can also predict academic performance. Overall, some meta-analyses presented that there is a positive association between EI and academic performance (Van Rooy & Viswesvaran, 2004; Richardson et al., 2012; MacCann et al., 2020). However, EI is a relatively broad and new idea; hence, researchers propose different theories and measurement perspectives every day. In general, ability scales and rating scales are the two main kinds of measuring models, and they were found examining different structures of EI by noticing only a weak correlation between each other (Brackett & Mayer, 2003; Brackett, Rivers, Shiffman, Lerner, & Salovey, 2006). According to Mayer, Caruso and Salovey (2000), ability scales require subjects to respond to given situations and evaluations will be made upon the responses. In contrast, rating scales require participants answering emotion-related questions by themselves. Both ability and rating scales were reported successfully related to academic performance, but the effect of ability scales is significantly larger (MacCann et al., 2020).

There is another division of EI named trait EI, which according to Siegling, Furnham, and Petrides (2015) can be explained as "a constellation of emotional self-perceptions located at the lower levels of personality hierarchies and integrates the affective aspects of personality" (p. 57), showing positive relation to academic performances (Richardson et al., 2012; MacCann, Double, & Minbashian, 2019). However, Petrides, Frederickson and Furnham (2004) reported that the effect of trait EI varies in different subjects; for example, trait EI can affect English substantially,

yet only a small effect can be observed in mathematics and science. Another appealing finding they discovered is that although trait EI is associated with academic performances, the power is different between different IQ groups. Even though the difference is not significant, the low IQ group required higher level of trait EI to perform better academically, but the high IQ group was not affected by the variation of trait EI. In conclusion, no matter which aspect of EI is considered, all of them are related to academic performance in general, thus EI was also included in this study and we examine the rating scales of EI in particular.

1.4.4 Personality and Academic Performance. With regard to predictors of academic performance, personality is also a pivotal factor (Poropat, 2009), but some studies manifested that the overall personality is not significantly related to academic performance (Heaven & Ciarrochi, 2012; O'Connell, 2018). Hence, after narrowing personality down to five traits based on the Big Five theory, researchers discovered that Conscientiousness and Openness are the two factors best predicting academic performance (Chamorro-Premuzic & Furnham, 2008; Morales-Vives, Camps, & Dueñas, 2020), so this present study included these two traits in particular.

Among the two personality traits, numerous studies reported that Conscientiousness is the best predictor (Noftle & Robins, 2007; Icekson et al., 2020; Richardson et al., 2012), and the effect of such relationship even equals or exceeds that of general intelligence in predicting academic performance (Brandt, Lechner, Tetzner, & Rammstedt, 2020); yet, this only happened in highly selected samples. Moreover, Noftle & Robins (2007) and Poropat (2009) indicated that Conscientiousness is a very stable predictor across different levels of education, and few studies have reported no correlation occurs. Interestingly, Di Domenico & Fournier (2015) studied the relationship between academic performance and Conscientiousness deeper and realized that there is a significant interaction; thus, they divided both variables into high- and low-level groups.

Eventually, the group with high level of general intelligence and Conscientiousness best predicted academic performance.

On the contrary, Openness seems to be a controversial factor. Richardson, Abraham and Bond (2012) showed no significant correlation between Openness and academic performance along with O'Connor and Paunonen (2007) reporting only minor correlation. However, general intelligence has been found significantly correlated to Openness, and with the help of general intelligence, good grades can be expected in many subjects (Heaven & Ciarrochi, 2012). In addition, numerous studies showed that with the combination of general intelligence, Conscientiousness, and Openness, they predict a considerable amount of variance in academic performance (Chamorro-Premuzic & Furnham, 2008; Di Domenico & Fournier, 2015). Therefore, Openness and Conscientiousness were included in this study.

1.5 Gender Differences in Variables Related to Academic Performance

In an attempt to explain the conflict described above, it is necessary to also inspect the gender differences in the variables that are related to academic performance. Accordingly, we could compare the gender differences and figure out the reasons for the occurrence of the disparity.

1.5.1 Prior Academic Performance and Gender. Overall, consensus of which gender performs better academically has not yet been reached, so we specify the population to secondary school grades and college admission scores, which are immediately the performances before students entering University. Female students score higher in high school GPAs (Mau & Lynn, 2001; French, Homer, Popovici, & Robins, 2015). Surprisingly, males achieve better in college admission scores such as ACT and SAT (Burton, Lewis, & Robertson, 1988; Mau & Lynn, 2001). One possible explanation for this inconsistency might be females are more

responsible and Conscientious than males (Mau & Lynn, 2001). Because criteria of high school grades could include submitting deadlines or in-class behaviours, this could lead to deduction of grades but irrelevant to their knowledge. Another explanation is that females are better in skills such as spelling or writing essays (Hyde & Linn, 1988), yet they are not included in the ACT or the SAT, so they score lower than males. Therefore, it remains unclear which gender is better at academic performance from different perspective; thus, this present study included Tertiary Entrance Rank (TER), which is similar with GPA.

1.5.2 Verbal Intelligence and Gender. In general, females are believed to perform better in verbal intelligence, and many reviews support this idea (Maccoby, 1966; Maccoby & Jacklin, 1978; Halpern, 2013). In a more specific review, Denno (1982) revealed that the difference is minor until the age of 10, and it becomes noticeable afterwards. However, there is also a meta-analytic study which found no difference, with the effect size of $d = 0.11$ (Hyde & Linn, 1988). Therefore, the consensus of gender difference in verbal intelligence has not yet been reached, and further studies are required to identify this.

1.5.3 Emotional Intelligence and Gender. Females are thought to obtain higher emotional intelligence probably because they express more emotions and show greater empathy toward one another. Many studies support this idea in different emotional intelligence measures (Day & Carroll, 2004; Mayer, Caruso, & Salovey, 1999; Van Rooy & Viswesvaran, 2003). However, Goleman (2017) and Bar-On (1997) disagree. They suggested that although males and females perform differently among the subareas of emotional intelligence, no difference is found in general. Finally, emotional intelligence is a relatively new area. Numerous new theories or definitions are being proposed all over the world. Thus, assertion about which gender obtains higher emotional intelligence level cannot be made until further studies have been produced.

1.5.4 Personality and Gender. Conscientiousness and Openness are the only two traits we examined in this section, because they are the two of the Big Five personality traits related to academic performance. Schmitt, Realo, Voracek, and Allik (2008) collected data from 55 cultures and reported that women obtain higher level of Conscientiousness in most of the nations, and this is also supported by Rosander and Bäckström (2012). However, some disagreements had been found. Some studies claimed that although females display higher degree of Conscientiousness in some facets, no difference is found overall (Woodfield et al., 2006; Costa Jr, Terracciano, & McCrae, 2001; Weisberg, DeYoung, & Hirsh, 2011).

Openness is a relatively ambigiuous personality construct in regard to gender differences. Men were found scoring higher in 37 cultures, but 18 cultures reported the opposite (Schmitt et al., 2008). On the contrary, Weisberg, DeYoung and Hirsh (2011) found no gender difference. To be more precise, men and women show salient traits in different facets of Openness, so there is no gender difference on average (Costa Jr et al., 2001).

Overall, we acknowledged that males perform better on the RPM; some have therefore inferred that male general intelligence is higher. Because general intelligence is a strong predictor for academic performance, a conflict arises because males fail to outperform females academically. Therefore, this study included five other variables which are also related to academic performance in an attempt to explain the conflict.

1.6 The Present Study

This current study aims to examine the conflict whereby female students perform better academically while male students score higher in the RPM. In order to do so, we included prior academic performance, verbal intelligence, emotional intelligence, and personality

(Conscientiousness and Openness in particular). Based on prior studies, these research questions were developed:

(a) Do males perform better in the RPM than females?

(b) Do females perform better academically than males?

(c) Do prior academic performance, verbal intelligence, emotional intelligence, Conscientiousness, and Openness significantly relate to academic performance?

(d) Is there any sex difference in any of these factors?

(e) To what extent can the conflict be explained by these factors individually?

(f) What combination of these factors most effectively explains the conflict?

CHAPTER 2

Method

2.1 Participants

Participants were all third-year psychology students from the University of Adelaide who participated in the practical *Emotional intelligence: More than personality and cognitive ability?* in the course PSYCHOL 3022: Individual Differences Personality and Assessment, in the years 2010-2013. There was a total of N=688 participants, with 530 females and 158 males, and their ages ranged from 18-to-67 years old (M=23.9, SD = 6.66 yrs). Students were required to complete four psychometric scales: the Assessing Emotions Scale (AES; Schutte et al., 1998), Spot-the-Word (Baddeley, Emslie, & Nimmo-Smith, 1993), Raven's Advanced Progressive Matrices Short Form (APM–SF; Raven, Court, & Raven, 1993; Bors & Stokes, 1998), and The Openness Conscientiousness Extraversion Agreeableness Neuroticism Index Condensed (OCEANIC; Schulze & Roberts, 2006). They also provided demographic information, their Tertiary Entrance Rank (TER) scores, where available, and were asked to grant permission to access their final grades for Level III Psychology courses completed in the year they participated in the practical for potential future research purposes.

2.2 Materials

All data were collected via the course site on MyUni, the University's Learning Management System (BlackBoard). The questionnaires and psychometric scales were administered as individual quizzes on MyUni and were completed by students in their own time over a period of about a week.

2.2.1 Intelligence. To examine the level of intelligence, we selected the Raven's Advanced Progressive Matrices Short Form (APM–SF; Raven, Court, & Raven, 1993). This short form consists of 12 items, which were derived from the original Raven's Advanced Progressive Matrices. The validation of this short form was confirmed by Bors and Stokes (1998), and the internal consistency was .73.

2.2.2 Academic performance. Academic performances were collected as the average of final grades for Level III Psychology courses completed in the year they participated in. A higher grade indicates overall a better academic performance in Psychology courses.

2.2.3 Prior academic performance. Prior academic performance was assessed via self-reported Tertiary Entrance Ranks (TER). The TER was a score given to students who had finished secondary schooling in Australia. The scores were a percentile rank based upon an aggregated scaling procedure, that compares academic performance with peers in the same year. A higher score indicates a better academic performance, and it is used to determine admission to tertiary education. The highest possible score is 99.95 and, in this sample, the lowest score is 46.2**.**

2.2.4 Verbal intelligence. The Spot-The-Word (Baddeley et al., 1993) was chosen to examine verbal intelligence. A pair of words, one actual word and one invented word, was presented to the participants, and they have to choose the real word. The internal reliability and validity level to the Mill Hill Vocabulary Scale (Raven, 1958) were $r = .78$ and $r = .69$, respectively. There were 30 items and those who identify more correct words earn higher scores, indicating higher verbal intelligence.

2.2.5 Emotional intelligence. Emotional intelligence was measured by the Assessing Emotions Scale (AES; Schutte et al., 1998); this scale is also sometimes called the Emotional Intelligence Scale, Self-Report Emotional Intelligence Test, or Schutte Emotional Intelligence Scale. It is a 33-item self-report measure of emotional intelligence developed upon the model proposed by Salovey and Mayer in 1990. A 5-point Likert scale is used on each item to test the level of agreement from strongly disagree to strongly agree. A Cronbach's alpha of .90 was found in the AES. A higher score suggests higher emotional intelligence.

2.2.6 Personality (Openness and Conscientiousness). Personality was tested by The Openness Conscientiousness Extraversion Agreeableness Neuroticism Index Condensed (OCEANIC; Schulze & Roberts, 2006). This scale assesses the Five Factor Model personality constructs. In a total of 45 items, participants were asked to rate the frequency with which they engaged in each of the behaviours on a 6-point Likert scale, with a response of (1) indicating that they never engage in the specified behaviours and (6) indicating that they always engage in the specified behaviours. The Cronbach's alpha for the five factors ranged from .77 (Openness) to .91 (Conscientiousness and Neuroticism). A higher score in a particular area manifests a more salient trait in that person. However, Openness and Conscientiousness were the only two features we used in this study.

2.3 Data Analysis

R and SPSS were used to conduct statistical analyses.

2.4 Study Design and Analyses

Three stages were required for this study. First, the Mann-Whitney U test was used to examine the gender differences among all variables (including academic performance,

intelligence, prior academic performance, verbal intelligence, emotional intelligence, Openness, and Conscientiousness). Next, we tested the correlations between those variables and academic performance via multiple linear regression in the overall, female, and male data. Finally, relative importance regression was used on the overall, male, and female groups separately in order to inspect the variance each variable explained in each gender group, suggesting the importance of each variable, and to further interpret the conflict discussed above in third-year psychology students' academic performances.

CHAPTER 3

Results

This section presents the results of this study. The main aim is to explore the potential reasons for females outperforming males academically when males score on average higher in the Raven's Progressive Matrices (RPM). Before resolving this, the relationships between each variable to academic performance were first examined, and then further interpretations could be made by comparing those relationships.

3.1 Data Description

Table 1 displays the descriptive statistics for every variable from the whole sample, including the number of observations, mean, standard deviation, median, maximum, and minimum. The variables include age, prior academic performance, Openness, Conscientiousness, emotional intelligence, general intelligence, verbal intelligence, and academic performance. The number of prior academic performance scores (TER) is noticeably small because some of the participants failed to provide them. Since the focus of this study is the difference between genders, descriptive statistics for females and males are separately presented in Table 2. Participants were mainly from psychology programs, and typically the number of females is more than males in this area, so female participants were more numerous than males in these data.

Table 1.

Descriptive Analysis of Each Variable

	n	mean	sd	min	max	median
Age	688	23.9	6.66	18.3	67.0	21.4
APM	688	7.9	2.39	3.0	12.0	8.0
AveGrade	688	70.3	10.3	41.0	93.0	71.2
TER	549	86.3	9.90	46.2	100.0	88.3
STW	688	24.7	3.13	15.0	30.0	25.0
AES	683	122.3	11.3	80.0	161.0	122.0
C	686	38.1	7.31	14.0	54.0	38.0
O	686	32.7	7.12	14.0	53.0	33.0

Note: APM is Advanced progressive Matrices a measure of general intelligence, AveGrade is the average grade for all Level III Psychology subjects a measure of academic performance, TER is Tertiary Entrance Rank a measure of prior academic performance, STW is Spot-the-Word a measure of verbal intelligence, AES is Assessing Emotions Scale a measure of emotional intelligence, C is Conscientiousness, and O is Openness.

Table 2.

Descriptive Analysis of Each Variable for Males and Females separately

Male						
	n	mean	sd	min	max	median
APM	158	8.29	2.46	3.00	12.0	9.0
AveGrade	158	68.4	10.5	41.0	93.0	68.7
TER	121	83.1	10.7	47.5	99.9	85.0
STW	158	25.8	2.85	16.0	30.0	26.0
AES	158	123.7	11.5	88.0	156.0	124.0
C	158	37.2	6.93	19.0	54.0	37.0
O	158	35.2	7.14	15.0	51.0	35.0
Female						
	n	mean	sd	min	max	median
APM	530	7.8	2.36	3.0	12.0	8.0
AveGrade	530	70.9	10.2	42.0	92.5	71.8
TER	428	87.2	9.49	46.2	100.0	89.1
STW	530	24.4	3.14	15.0	30.0	25.0
AES	525	121.8	11.2	80.0	161.0	122.0
C	528	38.4	7.41	14.0	54.0	39.0
O	528	32.0	6.95	14.0	53.0	32.0

Note: APM is Advanced progressive Matrices a measure of general intelligence, AveGrade is the average grade for all Level III Psychology subjects a measure of academic performance, TER is Tertiary Entrance Rank a measure of prior academic performance, STW is Spot-the-Word a measure of verbal intelligence, AES is Assessing Emotions Scale a measure of emotional intelligence, C is Conscientiousness, and O is Openness.

3.2 Assumptions Checking

3.2.1 Mann-Whitney U test. Gender differences were tested through the Mann-Whitney U test and effect sizes are shown as Cohen's *d*. The reasons for this study to use the Mann-Whitney U test are, first, our dependent variables are continuous such as academic performance or intelligence scores, and gender as an independent variable is categorical. Next, every participant is independent. No relationship can be found between participants. In addition, the distribution for each variable is not normal and the group sizes for males and females differ greatly, which shows non-parametric tests are preferable, and when comparing the shapes of distributions of males and females, they are similar. Finally, with the current sample size, the lesser power of the Mann-Whitney U test compared to parametric testing is not important. Mann-Whitney U test compares groups with medians (*Mdn*), so medians were also included in the descriptive analysis tables. Regarding the effect sizes, interpretation by convention indicates that 0.2 of Cohen's *d* suggests a small effect, $d = 0.5$ suggests a medium effect, and $d = 0.8$ suggests a large effect.

3.2.2 Multiple Linear Regression. Multiple linear regression was chosen to examine the relationships between each variable and academic performance, and relative importance regression (Gromping, 2006) was further used to test the proportion each variable accounted for in the explained variance. Assumptions were checked before conducting the analyses. Outliers were inspected by the analysis of standardised residuals. Five outliers were found in the data; yet, they were reasonable after inspection so were not excluded. Durbin-Watson value of 1.93 indicates that the data meet the assumption of independent errors. Multicollinearity is also not a concern (APM, Tolerance = .95; TER, Tolerance = .95; STW, Tolerance = .90; AES, Tolerance = .75; C, Tolerance = .83; O, Tolerance = .80). Multivariate normality, linearity, and homoscedasticity are checked through viewing the Q-Q plot, histogram, and scatterplot. Finally,

the assumption of non-zero variance is also met (APM, Variance = 5.7; AveGrade, Variance = 105.8; TER, Variance = 98.0; STW, Variance = 9.8; AES, Variance = 127.8; C, Variance = 53.5; O, Variance = 50.7). After all the assumptions are scrutinized, the data is appropriate for multiple linear regression analysis. Relative importance regression analysis is conducted for the purpose of decomposing the variance. By doing so, we could identify which variable is the most important predictor for academic performance and compare the variables in the male and female groups to explain the conflict mentioned previously.

3.3 Data Analysis

3.3.1 Gender Difference. Table 3 shows the sex differences within each variable and the effect sizes. Mann-Whitney U tests indicated that emotional intelligence (AES) was the only factor with no significant difference between males (*Mdn*=124) and females (*Mdn*=122), *U*=37669, *p*=0.08, with only a small effect size (*d*=.16). Similarly, factors with small effect sizes included general intelligence (APM, *d*=.20), academic performance (AveGrade, *d*=.24), and Conscientiousness (C, *d*=.16). Prior academic performance (TER, *d*=.42), Openness (O, *d*=.47), and verbal intelligence (STW, *d*=.48) exhibited medium effect sizes. In terms of gender advantages, females outperformed males in three areas—academic performance, prior academic performance and, Conscientiousness, and males scored slightly higher in the rest of the variables.

Table 3.

Sex Difference and effect size of Each Variable

	U	p-value	Cohen's *d*[a]
APM	36842	0.021	0.20
AveGrade	47962	0.005	-0.24
TER	31898	0.000	-0.42
STW	30512	0.000	0.48
AES	37669	0.080	0.16
C	46332	0.034	-0.16
O	31134	0.000	0.47

Note: APM is Advanced progressive Matrices a measure of general intelligence, AveGrade is the average grade for all Level III Psychology subjects a measure of academic performance, TER is Tertiary Entrance Rank a measure of prior academic performance, STW is Spot-the-Word a measure of verbal intelligence, AES is Assessing Emotions Scale a measure of emotional intelligence, C is Conscientiousness, and O is Openness. [a] negative sign for Cohen's *d* indicates females score higher than males (See Table 2)

3.3.2 Overall Relationships of Each Variable and Academic Performance. Table 4 shows the regression analysis of whether Conscientiousness, general intelligence, prior academic performance, Openness, emotional intelligence, and verbal intelligence predict academic performance in the overall data. 146 observations were deleted because of the missingness of data, mainly for TER. The results indicated that the combination of these variables significantly predicted academic performance, $F(6, 535)=20.6$, $p<.001$, and explained 18.8% of the variance. After further exploration, the regression analysis revealed only emotional intelligence and verbal intelligence did not significantly predict academic performance (APM, $b = .58$, $p=.001$; TER, *b*

= .29, p<.001; STW, b = .19, p=.15; AES, b = .04, p=.32; C, b = .34, p<.001; O, b = .127, p=.038). The positive and negative signs indicate the influence of direction from each variable. Openness and emotional intelligence were the two variables with negative signs, meaning one unit increase in Openness and emotional intelligence will lead to .13 and .04 decrease in academic performance, respectively, after controlling for the other variables. When comparing the standardized β values to detect the importance among those variables, we found that prior academic performance and Conscientiousness were the two most important predictors, followed by general intelligence. Although Openness was a significant predictor, its influence was relatively small. According to the relative importance regression analysis (Table 5), prior academic performance accounted for 52.5% of the explained variance, followed by Conscientiousness at 29.1% and general intelligence at 10.9%, while emotional intelligence contributed the smallest at 1%.

Table 4.

Overall Regression Analysis for Variables Correlating to Academic Performance

	Estimate	Std. Error	Beta value	t value	Pr(>|t|)
(Intercept)	70.9	0.38		184.4	<.001 ***
APM	0.58	0.17	.14	3.49	.001 ***
TER	0.29	0.04	.30	7.44	<.001 ***
STW	0.19	0.13	.06	1.44	.15
AES	-0.04	0.04	-.05	-1.00	.32
C	0.34	0.06	.25	5.90	<.001 ***
O	-0.13	0.06	-.09	-2.08	.038 *

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

Table 5.

Relative Importance Regression for All Population

	APM	TER	STW	AES	C	O
lmg	0.109	0.525	0.046	0.010	0.291	0.020

Note: The number shows the percentage each variable accounted for in the explained variance.

3.3.3 Relationships of Each Variable and Academic Performance for Males. The multiple linear regression analysis for males is shown in Table 6. A total of 121 participants were included in this analysis. The result revealed that these six variables significantly predicted academic performance, F(6, 114)=3.29, p=.005. 14.8% of the variance had been explained, which is slightly smaller than the overall data. Unlike the overall result, only the prior academic performance significantly predicted academic performance (APM, b = .68, p=.061; TER, b = .21, p=.017; STW, b = .35, p=.29; AES, b = .06, p=.56; C, b = .17, p=.23; O, b = .05, p=.73). Interestingly, general intelligence, Conscientiousness, and Openness became nonsignificant predictors in the male group, yet general intelligence was almost significant with a p value of .06. When we compared the standardised β values, prior academic performance remained the strongest predictor, consistent with the overall model. However, the second strongest predictor became general intelligence as opposed to Conscientiousness. Regarding the 14.8% variance being explained (Table 8), prior academic performance still contributed the most at 41.4%, followed by general intelligence at 26.3%. Comparing to the overall data, the importance of general intelligence increased, whereas Conscientiousness dropped to the fourth place, even lower than verbal intelligence. Openness and emotional intelligence remained the same with merely little contribution.

Table 6.

Regression Analysis for Variables Correlating to Academic Performance for Males

	Estimate	Std. Error	Beta value	t value	Pr(>|t|)
(Intercept)	69.2	1.06		65.3	.010 ***
APM	0.68	0.36	.17	1.89	.061
TER	0.20	0.08	.22	2.43	.017 *
STW	0.35	0.33	.10	1.06	.29
AES	-0.05	0.09	-.06	-0.58	.56
C	0.17	0.14	.12	1.20	.23
O	0.05	0.14	.04	0.35	.73

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

3.3.4 Relationships of Each Variable and Academic Performance for Females. Table 7 shows the multiple linear regression results for the female group. 421 female students were included in this model. The six variables also significantly predicted academic performance, $F(6, 414)=17.2$, $p<.001$, and 20.0% of the variance had been accounted for. When considering the variables individually, we can see that prior academic performance, Openness, Conscientiousness, and general intelligence were significant predictors (APM, $b = .60$, $p=.002$; TER, $b = .31$, $p<.001$; STW, $b = .18$, $p=.23$; AES, $b = .04$, $p=.41$; C, $b = .37$, $p<.001$; O, $b = .15$, $p=.026$). The standardized β values indicated that prior academic performance was the most influential factor for academic performance, and then Conscientiousness. General intelligence was ranked in the third position. With respect to the contribution of each variable for the 20.0% variance, Table 8 reveals that the prior academic performance remained the highest contributor at 50.2%, followed by Conscientiousness at 31.9%. Emotional intelligence explaining 1.2% was still the smallest contributor.

Table 7.

Regression Analysis for Variables Correlating to Academic Performance for Females

	Estimate	Std. Error	Beta value	t value	Pr(>|t|)
(Intercept)	71.1	0.44		159.9	<.001 ***
APM	0.60	0.19	.14	3.11	.002 **
TER	0.31	0.05	.30	6.71	<.001 ***
STW	0.18	0.15	.06	1.21	.23
AES	-0.04	0.04	-.04	-0.82	.41
C	0.37	0.06	.28	5.75	<.001 ***
O	-0.15	0.07	-.11	-2.23	.026 *

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

Table 8.

Separate Relative Importance Regression for Male and Female

	male	female
APM	0.263	0.096
TER	0.414	0.502
STW	0.174	0.045
AES	0.016	0.012
C	0.104	0.319
O	0.029	0.026

With these analyses, some answers for the research questions become clear. Consistent with previous researches, males did score higher in the RPM, but the effect size is small (Research Question a). Next, although the effect size is also small, females performed significantly better in academic performance than males (Research Question b). The answer to

Research Question c is that prior academic performance, Openness, Conscientiousness, and general intelligence are related to academic performance. Table 3 indicates that among all variables, only emotional intelligence has no significant gender difference (Research Question d).

3.4 Comparison of Males and Females

In an attempt to answer Research Question e and f, comparing males' and females' data is necessary. The comparison of these three models revealed that the combination of the six variables predicted more variance for academic performance in the female group (20.0%) than the male group (14.8%). More specifically, when we compared the variables individually, prior academic performance and general intelligence were important predictors in both groups, whereas Openness and Conscientiousness were only significant in the female group, and verbal intelligence and emotional intelligence were not significant in both groups. Regarding the importance of each variable, Table 8 shows that both groups agreed with prior academic performance being the most important factor; however, the second most influential factor differs— the factor was general intelligence in the male group but Conscientiousness in the female group. The third position was verbal intelligence for males and general intelligence for females. Conscientiousness dropped to fourth place for males, while the fourth place for females was verbal intelligence. Finally, the contribution of Openness and emotional intelligence was only minor in both groups. Therefore, the results showed that prior academic performance, Openness, and emotional intelligence were consistent variables across both gender groups (prior academic performance being the strongest and emotional intelligence and Openness being the least significant variables), so the deduction was that general intelligence, verbal intelligence and Conscientiousness were the main variables causing sex difference in academic performance,

which with the combination of these three factors could explain the conflict the most (Research Question e). With regards to the extent explained by these variables individually (Research Question f), the disparity Conscientiousness caused was substantial. Conscientiousness's influence on the female group was great, while this influence was small in the male group. The influence of general intelligence also differs. At first, we assumed that general intelligence would be a profound predictor; however, this only happened in the male group. Conscientiousness was an exceptionally more important predictor than general intelligence in the female group. It was also worthwhile to mention that verbal intelligence influenced academic performance greater in males than females.

3.5 Exclusion of Prior Academic Performance

With the analyses above, we confirmed that prior academic performance is a strong predictor for academic performance; hence, to avoid the probable obscuring effect from prior academic performance, the analysis was conducted again without this variable.

3.5.1 Overall Data. Table 9 shows when the prior academic performance was excluded, the rest of the five variables still significantly predicted academic performance, $F(5, 674)=16.7$, $p<.001$. A total of 680 participants were in this model. 11.1% of the variance had been explained. Conscientiousness and general intelligence remained significant predictors and emotional intelligence stayed not significant. However, Openness became not significant and verbal intelligence became significant (APM, $b = .77$, $p<.001$; STW, $b = .34$, $p=.007$; AES, $b = .06$, $p=.15$; C, $b = .39$, $p<.001$; O, $b = .11$, $p=.067$), suggesting these two variables are unstable and could be influenced by prior academic performance. Table 12 of relative importance regression result indicated that the importance of each variable is consistent with the previous model, with

Conscientiousness contributing the most, followed by general intelligence. Verbal intelligence accounted for 12.7%, ranking the third.

Table 9.

Overall Regression Analysis for Variables Correlating to Academic Performance without Prior Academic Performance

	Estimate	Std. Error	Beta value	t value	Pr(>|t|)
(Intercept)	51.0	4.81		10.6	<.001 ***
APM	0.77	0.16	.178	4.74	<.001 ***
STW	0.34	0.12	.103	2.71	.007 **
AES	-0.05	0.04	-.060	-1.43	.15
C	0.39	0.06	.28	7.02	<.001 ***
O	-0.11	0.06	-.075	-1.84	.067

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

3.5.2 Male Data. Table 10 reveals that the five variables also significantly predicted academic performance in the male group, $F(5, 152)=4.51$, $p<.001$. A total of 158 participants were in this model. This model explained 12.9% of the variance. When we inspected the variables individually, general intelligence was the only significant predictor (APM, $b = 1.06$, $p=.002$; STW, $b = .41$, $p=.17$; AES, $b = .14$, $p=.096$; C, $b = .20$, $p=.14$; O, $b = .16$, $p=.22$;), which is also consistent with the previous model. In Table 12, general intelligence explained more than half of the variance at 56.3%. Verbal intelligence was the second most important variable at 16%, followed by Conscientiousness at 10.8%.

3.5.3 Female Data. The multiple regression excluding prior academic performance for females is shown in Table 11. This model included 522 participants, and the five variables also

significantly predicted academic performance F(5, 516)=14.2, p<.001, with explaining the variance at 12.1%. Conscientiousness, Openness, general intelligence, and verbal intelligence were all significant predictors. The only variable that was not significant was emotional intelligence (APM, b = .71, p<.001; STW, b = .37, p=.007; AES, b = .02, p=.60; C, b = .41, p<.001; O, b = .14, p=.032). Comparing with the previous model, verbal intelligence became significant. Regarding the importance (Table 12), Conscientiousness accounted for 58.8% of the variance being the most important variable for females, followed by general intelligence at 20.7%. This result is also consistent with the previous model.

Consequently, excluding prior academic performance provided a clearer understanding of the contributions and importance of the other variables, and the results were all consistent with previous models, indicating that prior academic performance did not obscure any relationship.

Table 10.

Regression Analysis for Variables Correlating to Academic Performance for Males without Prior Academic Performance

	Estimate	Std. Error	Beta value	t value	Pr(>|t|)
(Intercept)	67.6	0.92		73.7	<.001 ***
APM	1.06	0.34	.248	3.16	.002 **
STW	0.41	0.29	.110	1.40	.17
AES	-0.14	0.08	-.151	-1.68	.096
C	0.20	0.13	.130	1.49	0.14
O	0.16	0.13	.107	1.23	0.22

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

Table 11.

Regression Analysis for Variables Correlating to Academic Performance for Females without Prior Academic Performance

	Estimate	Std. Error	Beta value	t value	Pr(>|t|)
(Intercept)	70.7	0.42		167.3	<.001 ***
APM	0.71	0.18	.164	3.84	<.001 ***
STW	0.37	0.14	.116	2.69	.007 **
AES	-0.02	0.04	-.025	-0.53	.60
C	0.41	0.06	.298	6.57	<.001 ***
O	-0.14	0.07	-.098	-2.15	.032 *

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

Table 12.

Relative Importance Regression for Male, Female, and Overall Data without Prior Academic Performance

	Male	Female	Overall
APM	0.563	0.207	0.286
STW	0.160	0.149	0.127
AES	0.081	0.023	0.021
C	0.108	0.588	0.545
O	0.087	0.032	0.020

CHAPTER 4

Discussion

4.1 Overview

The current study aimed to explain the reasons for females outperforming males academically when males scored higher in the Raven's Progressive Matrices. Assumptions had been made that males would do better on academic performance because they did better on the RPM, which suggests a higher general intelligence, and general intelligence is a strong predictor for academic performance. Yet, previous studies failed to show this. In an attempt to resolve the conflict, this study included five variables that have been found to be related to academic performance. The variables are prior academic performance, verbal intelligence, emotional intelligence, Conscientiousness, and Openness. The data were separated by gender and were compared through each variable individually. The interpretations, limitations and future directions will be discussed in the following.

4.2 Key Findings

Prior to resolving the conflict, some presuppositions should be first confirmed. Regarding the Research Question (a), though only to a small degree (d=.20), males did score higher than females in the Raven's Progressive Matrices (RPM). This is consistent with Lynn and Irwing's (2004) result. Their effect size is slightly larger, where they suggested that d=.33 at the age of 20-29 years old. One explanation for the smaller effect size of this study is the use of highly selected sample (University students), because their abilities are more similar comparing to the general population. Next, we also confirmed Research Question (b) that females outperformed males in academic performance, but also only to a small degree (d=.24). This result is also consistent with

previous studies (Richardson et al., 2012; Voyer & Voyer, 2014). After these two presuppositions are proven valid, we can proceed to examining the reasons for females outperforming males academically while males score higher in the RPM.

In terms of gender difference, only emotional intelligence showed no significant result, which supports Goleman's (2017) study. More specifically, males scored slightly higher than females as opposed to the result from previous studies (Day & Carroll, 2004; Van Rooy & Viswesvaran, 2003). A small gender difference was also found in Conscientiousness. Consistent with Rosander and Bäckström's (2012) study, females performed better. Contradicting to Weisberg, DeYoung and Hirsh's (2011) result which states no difference, Openness showed small-to-medium effect size with males scoring higher. Surprisingly, males performed better in verbal intelligence to a small-to-medium degree, which contradicts all the previous evidence (Halpern, 2013) and beliefs. The reason for this could be our participants are all university students who have a higher intelligence level. To elaborate, Johnson, Carothers, & Deary's (2008) study reported that the males' distribution of general intelligence is more dispersed than females, meaning males exhibit more variability in both high and low ends of the distribution. This leads to males having higher score when we only examine the higher part of the data. Based on this aspect, verbal intelligence could experience the similar situation. Finally, in accordance with previous studies (Mau & Lynn, 2001; French et al., 2015), females outperformed males in prior academic performance, and the effect size is medium-to-large.

With the significant female advantage in prior academic performance and academic performance, we can infer that this advantage is steady. Furthermore, the effect size became small. This could provide evidence for gender difference of general intelligence. According to Lynn and Irwing (2004), male advantage in the RPM increases through time from 14 years old to

29 years old, which suggests that the male advantage in undergraduates is larger than that in high schools. This leads to the magnitude of male advantage on general intelligence becoming larger. Since general intelligence is a strong predictor for academic performance, if we hold every other variable constant, females' advantage on academic performance should be lower, which is the situation presented. However, this is only one possible reason for the decreased female advantage in academic performance, and many other variables could also explain this; thus, further explorations are needed.

In the overall data, prior academic performance, Openness, Conscientiousness, and general intelligence (i.e., APM scores) significantly predicted academic performance, and when prior academic performance was removed, verbal intelligence became significant. To be more specific, prior academic performance was shown as the strongest predictor for academic performance, which agrees with Richardson, Abraham, and Bond's (2012) research, and confirms the correctness of universities evaluating students through high school grades. Next, Conscientiousness is the second strongest variable, which is surprising because we thought it would be general intelligence. It is however still reasonable because according to Di Domenico and Fournier's (2015) study, Conscientiousness influences more on higher intelligence group, which our participants could be categorised in, since they are all undergraduates. Moreover, with potential range restriction on the APM, this allows Conscientiousness to explain more variance. Nonetheless, as expected, general intelligence also played an important role in predicting academic performance, consistent with previous studies (Day et al., 2010; Higgins et al.,2007). Openness and verbal intelligence were two unstable predictors. When we removed prior academic performance from our model, Openness became not significant but verbal intelligence became significant. Yet, they both accounted for only a small amount of variance individually,

which differs from many previous researches (Postlethwaite, 2011; Dollinger et al., 2008; Heaven & Ciarrochi, 2012). Emotional intelligence was also a weak predictor. One possible reason can be that Petrides, Frederickson and Furnham's (2004) research reported high intelligence group could be less influenced by the variance of emotional intelligence. Finally, prior academic performance, general intelligence, and Conscientiousness are confirmed strong predictors overall.

When we separated the data by gender, the importance of each variable is different in the male and female group, which could provide some explanations for females outperforming males academically while males scored higher in the RPM. Comparing the results from both groups, we recognised that prior academic performance was consistently the strongest predictor for both groups. However, the second strongest variable differs. It was Conscientiousness for females, but for males, Conscientiousness ranked the fourth strongest variable. Moreover, females also scored higher in Conscientiousness. This result indicated that Conscientiousness is a significant variable that causes differences in AP by gender. DeYoung, Quilty, and Peterson's (2007) research reported that Conscientiousness has two smaller aspects: orderliness and industriousness. As Conscientiousness being a more important predictor than general intelligence in the female group suggests that if females organise tasks well and are diligent enough, this can compensate the influence of intelligence to academic performance, and even perform better than males. Yet, this could be not as effective in males, because the contribution of Conscientiousness in the male group is relatively small. Furthermore, school grades often involve not only test results but also students' behaviours or deadlines, which if students show a higher degree of Conscientiousness, they will perform better.

General intelligence unsurprisingly was an important predictor for both males and females, though less influential than Conscientiousness in females. However, despite the fact that verbal intelligence only explained small amount of academic performance, it affects differently on males and females. The importance of verbal intelligence on males was slightly greater than females, indicating that male students with higher verbal intelligence might score higher in academic performance. This cannot be an explanation for the conflict, but it is still worthwhile to mention the influence of each variable.

Finally, one last possible reason for females outperforming males academically, while males score higher in the RPM is that the RPM could be not only measuring general intelligence. Gignac (2015) found that the RPM was not a pure intelligence measure, and visuospatial ability was found to be one significant factor that the RPM measures (Waschl et al., 2017), which males are slightly better at (Voyer et al., 1995). This could explain male's slight advantage on the RPM. Moreover, Abad and his colleagues (2004) reported that visuospatial ability can maybe explain some of the gender difference but there might be some other variables that cause this difference; yet, studies in this area are limited, so more studies are required. Furthermore, if the RPM examines other factors, then we could imply that eventually males do not have higher general intelligence. This agrees with numerous previous studies (Nyborg, 2003; Nisbett et al., 2012; Waschl & Burns, 2020). More specifically, Waschl and Burns (2020) reported that no gender difference was found in inductive reasoning, but significant male advantage was found in figural stimuli. In this case, inductive reasoning represents general intelligence and figural stimuli represent visuospatial ability. Therefore, the reasons for females scoring higher academically could simply be that they are more Conscientious or any other variables instead of general intelligence.

In a nutshell, males did perform better in the RPM, and females did outperform males academically. The strongest possible factor to explain this conflict is Conscientiousness which exerted more influence on females than males, and the influence could even exceed general intelligence. Moreover, if we attempt to explain the conflict comprehensively, variables that have different effects on males and females should all be considered, including Conscientiousness, general intelligence, verbal intelligence, and Openness. Lastly, another explanation could be that the RPM is also examining visuospatial ability, which males are generally better at, so males score higher in the RPM. Hence, there is no gender difference in general intelligence after all, so the difference in academic performance is caused by other variables.

4.3 Limitations

There are some limitations in this study, including the selection of participants or variables. First, our participants are all university students, suggesting that their prior academic performance and general intelligence are above average, which may lead to some variables becoming not influential, such as emotional intelligence. Next, our participants are all from the psychology department, which their abilities or personalities are different from students in other different departments. For example, psychology students might be more empathetic, and Bonner and Aspy (1984) reported that empathy affects academic performance. Psychology students could also have better communication skills, which is found also important for academic performance (Palos & Petrovici, 2014). Certainly, there are also skills that other departments are better at which might influence academic performance, so data with only psychology students might not be generalisable. In addition, the number of females in psychology programs is often more than males, which could confound the results; for example, some significance of the variables could be affected because there are more females in the data. Lastly, this data was

collected in 2010 to 2013, which is approximately 10 years ago. Students' traits or abilities could change throughout this decade, so more recent studies can also be helpful.

One more limitation is that this present study did not include every predictor for academic performance. For example, self-esteem, learning strategies, motivational factors, and many other factors that are related to academic performance are not included in this study (Richardson et al., 2012), and these variables could all possibly have different effects on males and females. Furthermore, the key explanation for the conflict mentioned earlier could also be in any one of them, so further exploration is required to identify this.

4.4 Implications

This current study identified the importance of the variables related to academic performance, and this could assist schools and students themselves understand more deeply about academic performance. From the result, we confirmed that prior academic performance is a strong predictor for academic performance, so universities filtering future students by their past grades is justifiable. However, prior academic performance is not the only variable that contributes to academic performance, suggesting that one did not perform well academically in the past still can improve from other aspects, such as Conscientiousness, general intelligence, or verbal intelligence. Additionally, for educational institutions, although eminent prior academic performance is an indication of good future students, many other factors are still not neglectable.

Furthermore, this present study also identified the gender difference in many variables. Understanding deeper on gender difference could aid students and teachers on learning and teaching process. For example, this study showed that females are more influenced by Conscientiousness on academic performance; hence, teachers, parents, or students themselves

could emphasize on cultivating this trait on females throughout the learning process if they hope to perform better in grades. For example, Javaras, Williams, and Baskin-Sommers (2019) suggested that there are three types of interventions can help improve Conscientiousness: behavioural and cognitive interventions, goal-related metacognitive techniques, and cognitive remediation therapy. On the other hand, males could cultivate general intelligence. Many people think that general intelligence is fixed, but Jaeggi, Buschkuehl, Jonides, and Perrig (2008) proved that improvements can be made through training. There are numerous ways to improve general intelligence, such as exercising or learning a new language (Aberg et al., 2009; Martensson et al., 2012). Moreover, although delivering lessons to students altogether could save time and might be the most effective, males and females are still different. If teachers could identify the difference within both genders, they can further develop programs specifying the key points for each gender, which could simplify students' learning process.

4.5 Future Direction

Participants in this study are limited to undergraduate students in psychology programs. More extensive studies encompassing other departments or other education levels are required. The more diversity included in the data, the more representative it might be, and the more helpful it becomes for students. Moreover, the number of females and males is not equal, which could obscure the analysis. Hence, gender groups with similar sample sizes are also needed in future studies.

This study provided some explanations for females outperforming academic performance while males scored higher in the RPM. However, those variables are not comprehensive enough for explaining the conflict, so future studies could include other variables that are related to

academic performance such as self-esteem, motivational factors (Richardson et al., 2012), or variables that are not yet found to resolve this conflict.

More studies examining the aspects the RPM measures are also required. Waschl, Nettelbeck, and Burns' (2017) study reported that the RPM also tests for the visuospatial ability; yet, this current study cannot confirm this, and only little evidence can be found in previous researches. More proofs are needed. In addition, with them finding one other aspect the RPM measures makes people consider that there could be other aspects we have not found.

4.6 Conclusion

This study aimed to explore the reasons of females outperforming males in academic performance while males score higher in the Raven's Progressive Matrices. First, we found that general intelligence, academic performance, prior academic performance, verbal intelligence, Openness, and Conscientiousness have significant gender difference, and females are better in prior academic performance, academic performance, and Conscientiousness. Overall, prior academic performance, general intelligence, Conscientiousness, and Openness are significant predictors for academic performance. However, the variables affected differently on males and females. The biggest difference is caused by Conscientiousness and general intelligence. General intelligence influences more on males whereas females are more influenced by Conscientiousness. Based on this result, the interpretation is that if females are Conscientious enough, the improvement on academic performance is expected, and the effect might also surpass males' academic performance. In addition, the RPM could be also examining visuospatial ability, which males are averagely better at. This could be the reason for males scoring higher in the RPM, but there is no gender difference in general intelligence; hence, the female advantage on academic performance could cause by any other factors. All in all, this

study confirmed the factors that are related to academic performance, and even identified their effects on males and females separately, hoping that this could assist educational services, teachers, or students themselves to improve academic performance. However, this study is not flawless, and more studies are required. Future directions can be on collecting more comprehensive data, identifying aspects the RPM is measuring, or exploring other possible factors related to academic performance.

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