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Investigating the Relationship between Vocabulary Knowledge and Academic Success of Arabic Undergraduate Learners in Swansea University

Reem ALSAGER , James MILTON

Swansea University, UK

Abstract

The number of Arabic learners studying abroad has increased significantly over the last decade, and continues to increase. To test such students' proficiency with English in an academic setting, most universities use standardised exams, such as the Test of English as a Foreign Language (TOEFL) or the International English Language Test System (IELTS). Although these tools are considered valid entry tests (Taylor and Falvey, 2007) they don't appear to be useful predictors of academic success (e.g. Cotton and Conrow, 1998). We have therefore tried to find alternative measures to help refine our ability to predict academic performance. These include vocabulary knowledge using the XK_Lex test (Milton & Al-Masrai, 2009); intelligence test (Wechsler Abbreviated Scale of Intelligence, WASI) and a foreign language aptitude test (Modern Language Aptitude Test, MLAT; Carroll & Sapon, 1959).

36 Arabic undergraduate students in Swansea University participated in this study. The results of the measures were correlated with participants' Grade Point Average (GPA) as a measure of academic achievement. The findings suggest that a vocabulary knowledge threshold of 5000 and above is necessary for L2 learners to undertake international education; below this volume of vocabulary, they risk failure or academic hardship during their studies. No correlation was found between intelligence or aptitude test scores and learners' academic achievement, but a significant relationship was noted between intelligence and vocabulary knowledge, confirming the trend that learners with high intelligence scores are more likely to possess an extensive vocabulary than learners with low intelligence scores.

1. Introduction

In the past decade there has been huge growth in the number of Arabic students completing their university education abroad. This trend has been powered by government sponsorship schemes, and leading these schemes is Saudi Arabia's King Abdullah Scholarship Program (KASP), which is set to run until at least 2020. According to UNESCO data on international student mobility (2012), Saudi Arabia was the fifth highest country in the world for number of students studying abroad, with 62,500; more than half (33,066) of whom study in the United States, with 9,773 in the United Kingdom. According to the Institute of International Education (IIE), the total number of Arabic students (not only those from Saudi Arabia) studying in the United States in 2013/14 was 73,721 and, based on data from the HESA Student Record, the total number of students from the Middle East studying in the United Kingdom in the same period was 27,520. It can therefore be seen that Arabic students abroad comprise a significant population of foreign students in their host countries, so investigations into predicting learner success for Arabic students is needed to ensure they are being as well catered for as possible.

In the current study, learner vocabulary knowledge is measured using the XK_Lex test (Milton and Al-Masrai, 2009) and the relationship between learner vocabulary knowledge scores and academic achievement analysed to determine the extent to which vocabulary tests can act as a substitute for current standardised tests. CALP (Cognitive Academic Language Proficiency), by Cummins (1979, 1981), is related to academic performance, so learners' CALP knowledge will be quantified and its relationship to academic achievement examined using Grade Point Average (GPA). Furthermore, the effects of general intelligence and foreign language aptitude on learners' academic achievement will be investigated alongside vocabulary knowledge. These predictions are investigated through a number of tests to determine what predictor has the strongest effect on learners' academic achievement.

2. Background

2.1 Vocabulary Knowledge as a Predictor of Academic Success

A number of studies carried out in the 1980s and 90s concluded that vocabulary knowledge is a prerequisite for most of language abilities (Alderson & Banerjee, 2001). Vocabulary knowledge is necessary for overall language proficiency and supports learners' ability to communicate (Laufer, 1989; Nation, 2001; Milton, 2009). Corpus studies stated that the 2000 most frequent words in the English language represent between 80-85% of any written or spoken English text (Nation, 1990), but L2 learners require a greater vocabulary knowledge than this to comprehend an academic text. Some studies have proposed that L2 learners should possess a vocabulary knowledge of between 8000 and 9000 word families to comprehend written texts, and a knowledge of 6000-7000 for a spoken one (Nation, 2006). There is general agreement in the literature, however, (Nation, 1990, Meara et al., 1997) that a minimum threshold of 5000 word-families should be attained in order to undertake a course of study in English-medium colleges and universities.

In Denmark in 2008, Staehr discovered a marked relationship between EFL secondary school learners' vocabulary size and the skills of listening, reading and writing. He concluded that vocabulary size explains 72% of the variance in learners' ability to attain average scores in reading tests, 39% of the variance in listening tests, and 52% of the variance in writing tests. Staehr's findings strongly suggests that vocabulary knowledge is a highly influential aspect of learners' performance in the four learning skills (the fourth being spoken production of language).

Findings like this allow us to say with some confidence that the larger the learner's vocabulary knowledge, the greater their ability to read without much effort, with lower cognitive demands required from them (Segalowitz, Segalowitz & Wood, 1998). Accordingly, L2 learners' vocabulary knowledge must first be adequately established in order for them to be adequately prepared for learning. Such observations suggest that vocabulary knowledge may function as a good predictor of academic achievement.

2.2 BICS & CALP as components of vocabulary knowledge

The concept of BICS and CALP was introduced by Cummins (1979, 1981). BICS is an abbreviation of *Basic Interpersonal Communicative Skills*, and CALP is an abbreviation of *Cognitive Academic Language Proficiency*. BICS is related to conversational fluency while CALP is related to academic performance in second language setting. Cummins tried to shed the light that BICS & CALP are separate components of language proficiency where language proficiency is totally different from academic performance. Cummins tried to draw educators' attention to the two dimensions of English language proficiency, which are conversational and academic, and how these aspects contribute greatly to the academic difficulties learners of English as a second or other language may encounter. Cummins suggested that L2 learners usually reach peer-appropriate levels in conversational fluency during their first two years of exposure to English, whereas 5 to 7 years of exposure is needed

to attain academic grade norms, such as vocabulary knowledge. The BICS and CALP distinction, hence, helps us identify learners' vulnerabilities if they are to attain educational equivalence with native speakers.

BICS & CALP distinction might influence vocabulary development. The 2000 most frequent words in English are usually considered so because they comprise much of the functional and structural vocabulary necessary for communication. These words cover around 80% of written English texts, and Adolphs & Schmitt (2003) proposed they provide about 95% coverage of any spoken text. Accordingly, knowledge of these most frequent 2,000 words in English might well relate to BICS. Less frequent words, such as those found in Schmitt and Schmitt's mid-frequency vocabulary (2014) or Milton and Alexiou's infrequent vocabulary (2012), which comprise a large proportion of the content vocabulary essential for academic writing and take a longer time to acquire, might well equate with CALP.

2.3 Foreign Language Aptitude and Academic Performance

Work in foreign language aptitude began in the 1920s, but it became a significant field of study when John Carroll, the founder of language aptitude research, developed his Modern Language Aptitude Test (MLAT) (Carroll, 1981). The MLAT test has been widely used in many countries as a good predictor of language learning rate in formal settings. Carroll (1981) defined foreign language aptitude in practical terms as "the individual's initial state of readiness and capacity for learning a foreign language and probable facility in doing so" (p.86). Skehan (1989) described language aptitude as "one of the central individual differences in language learning" and "consistently the most successful predictor of language learning success" (pp. 25, 38).

Carroll (1981) suggested that measuring learners' language aptitude by an instrument such as the MLAT is a better predictor of academic performance success than general measures of

academic ability. Factor analytic studies (such as those performed by Wesche, Edwards, and Wells, 1982) have suggested that measures of both general intelligence and language aptitude can overlap substantially, and that some components of language aptitude are related more closely with academic ability than others. Related components of language aptitude seem to be those that describe a logical orientation toward second language learning. While ‘aptitude’ is commonly related to a particular area of performance, ‘intelligence’ tends to carry a broader meaning, not limited to a discipline but rather involving all areas of learning in general.

Correlation figures between several language aptitude and language proficiency tests range from 0.23 to 0.73 (Grigorenko et al., 2000). A study by Ehrman and Oxford (1995) reported that language aptitude among individual differences correlates more closely with academic performance and ability, explaining 25% of the variance. Eleven years later, Nikolov and Ottó (2006) found in their study that language aptitude was the strongest predictor of language proficiency achievement at the end of the academic year. In an earlier study involving Arabic learners of English in a classroom context, Reves (1983) found that language aptitude played an important role in predicting success in formal and informal settings, with the learners simultaneously attaining Hebrew in naturalistic environment (cited in Skehan, 2002). Skehan’s (1989) analysis of Reves’ study led to the conclusion that language aptitude plays a more important role in naturalistic settings of second language acquisition than in instructional settings. Later, Harley and Hart (1997) proposed that language aptitude had minimal utility in predicting academic competence in L2 with young immersion learners, but found a significant correlation between aptitude and proficiency measures in the case of older learners.

In the present study, we will examine the relationship between foreign language aptitude and academic achievement for Arabic undergraduate learners in Swansea University using the MLAT test to determine its utility as a predictor of L2 academic performance.

2.4 Intelligence and Academic achievement

In recent years, increased interest has been shown in the relationship between general cognitive ability and academic achievement. Many researchers suggest that there is significant evidence for positing a strong relationship between intelligence and academic success, claiming it can explain 51% to 75% of the variance (Rohde & Thompson, 2007). Furthermore, practice and theory implications have been widespread in order to understand the nature of the relationship between intelligence and academic achievement (Rohde & Thompson, 2007). A study by Jensen (1998) found high correlations (.50 to .70) between high-school learners' academic achievement and intelligence scores. More recently, Luo, Thompson, & Detterman (2003) examined the assumption that the relationship between general cognitive abilities and academic achievement was significantly related to mental speed, finding it could explain 30% of the variance in scores. However, after controlling the component of mental speed, the shared variance between general cognitive abilities and academic achievement decreased to around 6% (Luo et al., 2003). This shows that specific intelligence components, such as mental speed, can account for some of the relationship between intelligence and academic achievement.

In a study by Watkins, Lei & Canivez, (2007), they reported that there has been much debate about the fundamental precedence of intelligence and academic achievement. They stated that some researchers believe that general intelligence and academic achievement are identical concepts, while others view the relationship between them as reciprocal. Still others emphasize that intelligence is fundamentally related to academic achievement, citing data that suggest learners' academic achievement depends largely on their general cognitive abilities

over all grade levels (Laidra, Pullmann & Allik, 2007) (cited in Naderi et.al 2010). In our study, the effects of general intelligence on learners' academic achievement (GPA) will be investigated using the Wechsler Abbreviated Scale of Intelligence (WASI) intelligent non-verbal test.

3. Aims and Objectives

The purpose of this study is to compare Arabic undergraduates' academic performance (GPA) at the end of the 2014/15 year of study in Swansea University by examining their vocabulary knowledge in general and comparing it to their CALP knowledge (specifically cognitive/academic language proficiency) to determine whether or not vocabulary knowledge is an effective predictor of academic success. A further aim is to test other predictor variables, such as general intelligence and foreign language aptitude, to allow conclusions to be drawn about their relationship with academic success. The general aim of the study is to establish:

- Whether or not academic performance by Arabic undergraduate learners at Swansea University can be predicted by measuring their vocabulary size. Academic performance will be measured by Grade Point Average (GPA) taken from academic transcripts, and vocabulary size will be measured using the XK_Lex test (Milton & Al-Masrai, 2009).

-The study aims to achieve the following objectives:

- Quantify learners' BICS & CALP knowledge

- Calculate a correlation between learners' overall vocabulary knowledge using the XK_Lex test and their academic achievement (GPA)

- Calculate a correlation between BICS & CALP knowledge as components of vocabulary knowledge and learners' academic achievement.

- Calculate correlations between learners' academic performance (GPA) and other variables such as general intelligence and foreign language aptitude and if these can be considered accurate predictors of academic success.
- Running correlation tests between learners' vocabulary knowledge and general intelligence / foreign language aptitude.

The motivation for this study is to investigate the relationship between BICS & CALP knowledge as components of vocabulary knowledge and the academic achievement of Arabic undergraduate learners in Swansea University. Of particular interest is the possible use of vocabulary measures as a potential tool for identifying learners' level of English and subsequent ability to undertake international education.

4. Method

4.1 Participants

The participants in this study are 36 Arabic undergraduate students in Swansea University, most from the Gulf area. Undergraduate students in Swansea University usually follow a three-year degree plan, and the participants in this study were drawn from all three years and from different departments, including business, medical engineering, chemical engineering and medicine. Participants were tested in the second semester of the study year 2014/15.

4.2 Tests

The participants in this study undertook three different tests: the XK_Lex test (Milton & Al-Masrai, 2009), the Modern Language Aptitude Test (MLAT; Carroll & Sapon, 1959) and the Matrix Reasoning Subtest from the Wechsler Abbreviated Scale of Intelligence (WASI). The following section constitutes an explanation of each test.

4.2.1 The XK_Lex test

The XK_Lex (Milton & Al-Masrai, 2009) is a Yes/No test designed to measure receptive vocabulary knowledge. Words used in the test are distributed into 10 columns, with each column containing 12 words. Two of the words in each column are false words placed there to account for participants' possible overestimation and guesswork. The first five columns represent the 5000 most frequent words in the English Language, drawn from the first five bands of Nation's frequency list (1984). The final five columns represent the next most frequent 5000 words, drawn from the vocabulary frequency bands of Kilgarriff's list (2006). Participants in this study were asked to tick the words they think they knew and were scored by counting each ticked real word as 100 marks, and each ticked false word as 500 marks, which are then deducted from the total score to give an adjusted score.

4.2.2 The MLAT Test

The Modern Language Aptitude Test by Carroll and Sapon (1959) was designed to measure foreign language aptitude and to predict the degree of an individual's success in learning a foreign language. The long form of the test contains five subtests: *Number Learning*, *Phonetic Script*, *Spelling Clues*, *Words in Sentences* and *Paired Associates*. In this study, the short form was used, which includes the last three parts of the long form (*Spelling Clues*, *Words in Sentences* and *Paired Associates*). The subtests used in this study are:

Part III: *Spelling Clues*. In this section, participants read an English word presented to them in abbreviated spellings, as it is pronounced (thus measuring the sound symbol ability), and are asked to choose one answer out of five that matches the meaning of the presented word. This depends to some extent on the learners' English vocabulary knowledge. It includes 50 items and the participant has 5 minutes to finish it, so there is a significant element of time

Part IV: *Words in Sentences*. In this section, participants read a key sentence in which one word is underlined, and are then asked to find a word that has the same grammatical function in a second sentence in which five phrases and words are underlined as possible answers. This measures the learners' sensitivity to grammatical structure and ability to deal with grammatical features of foreign language. It includes 45 items and participants have 15 minutes to complete it.

Part V: *Paired Associates*. Here, participants are asked to memorize a list of nonsense words with their equivalent English meanings, and then choose the correct English word in a multiple choice setup that corresponds to the nonsense word. This measures learners' ability to memorize words in foreign language (the rote memory aspect).

4.2.3 The Matrix Reasoning Test (WASI)

The Wechsler Abbreviated Scale of Intelligence (WASI) is an intelligence test containing four subtests: *Vocabulary*, *Block Design*, *Similarities* and *Matrix Reasoning*. In this study, we used the matrix reasoning subtest, which measures nonverbal ability and general intelligence. The participant is asked to complete 35 incomplete grid patterns by stating the number of the correct answer from the five choices provided.

5. Results

5.1 Results of Measuring Learners' Vocabulary Knowledge and its Relation to Academic Achievement (GPA)

In this subsection, the results of vocabulary size, BICS & CALP knowledge and the relationship between vocabulary knowledge and academic achievement, intelligence and foreign language aptitude are discussed.

5.1.1 BICS and CALP Knowledge

In order to quantify learners' BICS and CALP knowledge in this study, a certain calculation was made. BICS knowledge equals the most frequent 2,000 words in English whereas CALP knowledge ranges from the 3,000 to 10,000 most frequent. Table 1 (below) provides a descriptive analysis for BICS & CALP knowledge.

Table 1: Learners' BICS & CALP Knowledge

Vocabulary knowledge	No. of participants	Minimum	Maximum	Mean
BICS	36	1100	2000	1739
CALP	36	1800	7500	4706

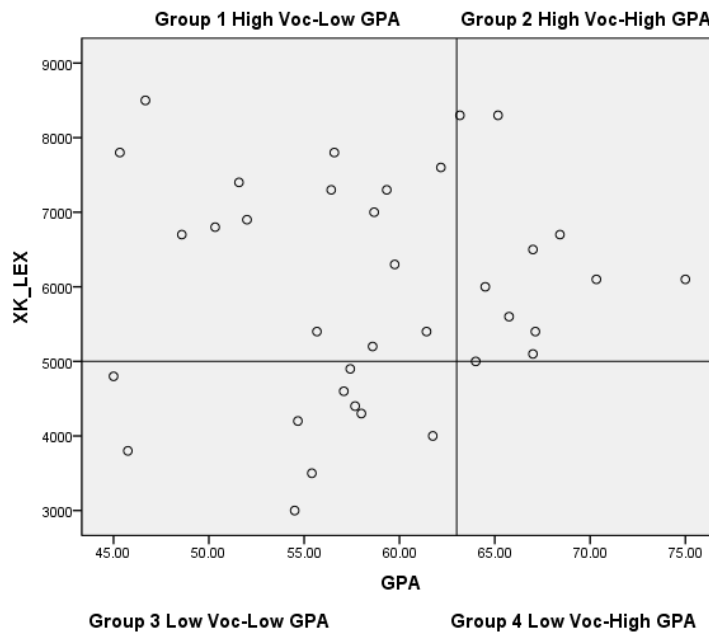
Table 1 shows the number of participants and their minimum, maximum and mean average scores for BICS and CALP knowledge. The mean score for BICS was 1739, suggesting a ceiling effect and showing that the learners had mastered most of the 2000 most frequent words in English by this stage of their education. The mean score of CALP was 4706, however, strongly suggesting that these learners had mastered only around 20% of the less frequent words by this time (CALP knowledge) and there is much more variation which might have the influence we suspect on academic performance.

5.1.2 Relationship between Vocabulary Knowledge and Academic Achievement (GPA)

If learners' vocabulary scores are compared with their academic achievement (GPA), no observable relationship is apparent. The correlations that appear are small and not statistically significant. The correlation between vocabulary size and GPA is very small ($r = .020$, $p = .908$) as well as with the BICS ($r = .179$, $p = .296$) and CALP scores ($r = .022$, $p = .898$). In

order to demonstrate a relationship between learner vocabulary size and GPA, the learners were divided into four groups according to their scores (shown in Figure 1).

Figure 1: Scatter graph of Learners' Vocabulary size and GPA



Learners were divided into the four groups according to a certain calculation: A GPA of 36 or above is considered high and below this number is considered low, whereas in vocabulary scores 5000 and above is considered high and below this level of vocabulary the score is considered to be low. The mean scores of vocabulary size and GPA for all groups are displayed in Table 2, below.

Table 2: Mean scores in Vocabulary Size and GPA

Group	Number of Participants	Mean XK_Lex Vocabulary size	Mean GPA
Group 1: High vocabulary size, Low GPA	15	6893	55
Group 2: High vocabulary size, High GPA	11	6282	67

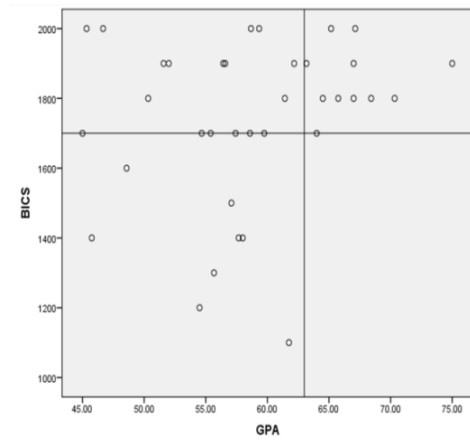
Group 3: Low vocabulary size, Low GPA	10	4150	55
Group 4: Low vocabulary size, High GPA	0	0	0

Table 2 shows the number of participants and their mean scores for vocabulary size and GPA, divided into the four groups described above. Group 1's mean score for vocabulary size is 6893, considered high and a mean GPA of 55, considered low, so in this group learners with high vocabulary scores achieved a low GPA: possible reasons for this are described in the Discussion section below. Group 2 scored high in both vocabulary size (6282) and GPA (67): this result is reasonable and highly expected based on the statements made in the opening sections. Group 3 scored low in both vocabulary size (4167) and GPA (54), making them the inverse of Group 2 and therefore as expected a result. Group 4 contained no learners at all, meaning learners with a low vocabulary size were unable to attain a high GPA.

5.1.3 BICS Knowledge and Academic Achievement

As BICS knowledge is associated with conversational fluency which requires much of the functional and structural vocabulary necessary for communication that exists in the 2,000 most frequent words in English, a correlation analysis was made between BICS knowledge which equals the 2,000 most frequent words in English and learners' academic achievement. No significant correlation was found ($r = .179$, $p = .296$) and this result was expected since the participants are university students which they are expected to master the first 2,000 words of English and accordingly, BICS knowledge will not associate well with academic performance. Learners were divided into groups according to their scores in order to illustrate a connection between BICS knowledge and GPA.

Figure 2: Scatter graph of Learners' BICS knowledge and GPA



Learners were divided into groups according to their scores; a GPA of 63 and above is considered high and below this number is low, with a BICS threshold of around 1700 or above considered high and below 1700 considered low. Learners with threshold BICS knowledge of around 1700 and above were likely to achieve a high GPA and vice versa, with learners showing a level of BICS knowledge below 1700 expected to score a low GPA.

Table 3: Mean scores in BICS knowledge and GPA

Group	Number of Participants	Mean BICS	Mean GPA
Group 1: High BICS, Low GPA	15	1827	55
Group 2: High BICS, High GPA	11	1855	67
Group 3: Low BICS, Low GPA	10	1480	55
Group 4: Low BICS, High GPA	0	0	0

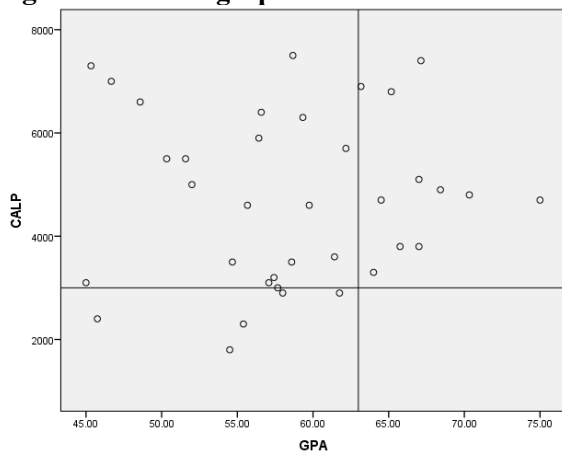
Table 3 shows the number of participants and the mean scores of BICS knowledge and GPA for each group. Group 1's mean BICS score is 1827 which considered high BICS and a GPA mean of 55, which considered low. Learners in this group score high BICS but low GPA and

this result is unexpected and will be discussed in the Discussion. On the other hand, Group 2 & 3 have a positive relationship between CALP knowledge and GPA scoring either high in BICS 1855 and GPA 67, or low in both BICS 1480 and GPA 55. There were no learners in Group 4 (low CALP, high GPA).

5.1.4 CALP Knowledge and Academic Achievement

As CALP knowledge is associated with Academic Language Proficiency, the relationship between learners' CALP knowledge and GPA was investigated. No significant correlation was found ($r = .022$, $p = .898$) and learners were divided into groups according to their scores in order to demonstrate a connection between CALP knowledge and GPA. Figure 3, below, indeed shows a relationship between CALP knowledge and GPA.

Figure 3: Scatter graph of Learners' CALP knowledge and GPA



As before, learners were divided into groups according to their scores. A GPA of 63 and above is considered high and below this number is low, with a CALP threshold of around 3000 or above considered high and below 3000 considered low. Learners with threshold CALP knowledge of around 3000 and above have high vocabs and know most of the first 2,000 words and were likely to achieve a high GPA and vice versa, with learners showing a level of CALP knowledge below 3000 expected to score a low GPA. The mean scores of CALP knowledge and GPA for all groups are displayed in Table 4, below.

Table 4: Mean scores in CALP knowledge and GPA

Group	Number of Participants	Mean CALP	Mean GPA
Group 1: High CALP, Low GPA	15	5667	55
Group 2: High CALP, High GPA	11	5109	67
Group 3: Low CALP, Low GPA	10	2820	55
Group 4: Low CALP, High GPA	0	0	0

Table 4 shows the number of participants and the mean scores of CALP knowledge and GPA for each group. Group 1's mean CALP score is 5667, considered high, and a GPA mean of 55, considered low, so learners in this group a high CALP score but a low GPA. Reasons for this unpredictable result are examined in the Discussion section below. Group 2 shows that there is a positive relationship between CALP knowledge and GPA: a high CALP of 5109 relating here to a high GPA of 67. The situation is the same for Group 3, with a low CALP (2820) relating to a low of GPA (55). As before, there were no learners in Group 4 (low CALP, high GPA).

5.1.5 Relationship between Vocabulary Size and Intelligence

The results of the investigations carried in our study between vocabulary size and intelligence scores point significantly to the fact that vocabulary size has a strong relationship with intelligence. Table 5 (below) shows the correlation between the intelligence test (WASI) and the XK_Lex, BICS and CALP vocabulary size.

Table 5: Relationship between Vocabulary Size and Intelligence

WASI	XK_Lex	BICS	CALP
Correlation	.461**	.415*	.364*
Sig	.005	.012	.029

Table 5 shows a significant correlation between the intelligence test (WASI) and the vocabulary test (XK_Lex) ($r = .461^{**}$, $p = .005$). The same can be seen with BICS ($r = .415^*$, $p = .012$) and CALP ($r = .364^*$, $p = .029$), showing moderately strong correlations with intelligence. Figure 4 shows that there is a clear and strong relationship between vocabulary size and intelligence.

Figure 4: Scatter Graph of Vocabulary Size and Intelligence

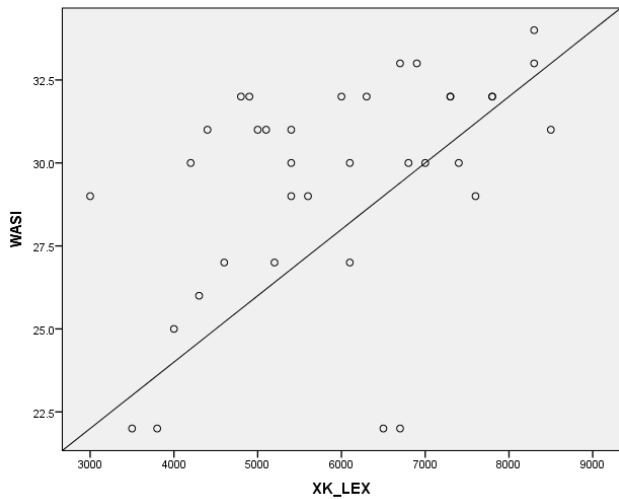


Figure 4 confirms the trend that learners with high intelligence scores are more likely to score highly in vocabulary tests than learners with low intelligence scores. This result supports earlier studies, which illustrated a strong relationship between intelligence scores and vocabulary size scores.

5.1.6 Relationship between Vocabulary Size and Foreign Language Aptitude

A Pearson Correlation Analysis was made in order to investigate the relationship between vocabulary size and foreign language aptitude. The results indicate a strong correlation coefficient, as reported in Table 6 (below).

Table 6: Relationship between Vocabulary Size and Foreign Language Aptitude

MLAT	XK_Lex	BICS	CALP
Correlation	.431**	.447**	.467**
Sig	.009	.006	.004

The results reveal a generally strong relationship between foreign language aptitude (MLAT) and vocabulary size (XK_Lex) with a significant correlation ($r = .431^{**}$, $p = .009$). The same thing can be seen with BICS ($r = .447^{**}$, $p = .006$) and CALP ($r = .467^{**}$, $p = .004$). These significant correlations suggest that when a learner possesses a large vocabulary, he/she is likely to display greater aptitude for foreign language learning. The greater the size of vocabulary, the better the score in foreign language aptitude tests such as the MLAT.

5.2 Relationship between Intelligence, Foreign Language Aptitude and Academic Achievement

To investigate the impact that variables such as intelligence (using the WASI test) and foreign language aptitude (using the MLAT) have on learners' academic achievement (GPA), a correlation analysis between the variables was carried out, with the results displayed in Table 7 (below).

Table 7: Relationship between GPA, WASI and MLAT

GPA	WASI	MLAT
Correlation	.098	.224
Sig	.569	.188

Table 7 shows no correlation between GPA and WASI ($r = .098$, $p = .569$) or GPA and MLAT ($r = .224$, $p = .188$). This means that the intelligence test (WASI) and foreign language aptitude test (MLAT) in this study are not related to learners' academic achievement (GPA). In other words, these results suggest that MLAT and WASI in this study were unable to predict learners' academic achievement (GPA).

6. Discussion

This study has attempted to investigate the relationship between learners' vocabulary knowledge scores and their academic achievement, to determine whether or not vocabulary tests can be a good predictor of academic achievement. As Cummins' CALP is related to academic language proficiency, learners' CALP knowledge was quantified and examined in relation to their academic achievement. Many researchers claim that vocabulary size is related to academic success (Bornstein and Haynes, 1998; Biemiller and Boote, 2006, cited in Milton and Treffers-Daller, 2013), the claim that motivated this study. In addition, other factors, such as intelligence and foreign language aptitude, were investigated, to determine their relationship with academic achievement. In this section, the results of this study will be discussed in light of the research questions.

6.1 Vocabulary Knowledge and its Relation to Academic Achievement (GPA)

The first general aim of this study was to investigate the relationship between learners' vocabulary knowledge scores and their academic achievement. Although no significant correlation between these was found, a relationship appeared when learners were divided into groups according to their scores (as displayed in Figure 1 in the Results section, above). Group 1 possessed a large vocabulary knowledge (above 5000 words) but their GPA was low, posing a potential contradiction to the hypothesis that the larger the size of vocabulary, the greater the GPA. This result could be explained in several ways.

First, the majority of the participants were drawn from the Engineering department, which focuses on project-based learning. This means that in the department most of the participants belonged to had a low text focus, and a lower subsequent need for extensive general academic vocabulary (while containing a large amount of very topic-specific lexis not included in the tests). This sets Engineering apart from departments such as those in the Arts and Humanities, where the need for a large general academic vocabulary is imperative. Furthermore, Engineering assignments are largely focused on projects and mathematical formulations rather than the writing of extended essays, which may explain the learners' large vocabulary knowledge and low GPA. Second, the grading criteria in Engineering depends far more on evaluating formulae, substitutions, and conceptual understanding than on assessments of writing style or command of academic expressions. Finally, the learners' educational deficit could be explained by motivational and affective obstacles (Dweck and Elliott, 1983; Lepper and Hodell, 1989). Some learners may have the ability to learn and achieve academic success (with a high GPA), but lack the motivation to do so despite their large vocabulary knowledge.

Group 2 demonstrated both high vocabulary knowledge and high GPA, a result in line with previous studies (Morris and Cobb, 2004; Daller and Xue, 2009; Roche and Harrington, 2013) which demonstrated a significant correlation between the size of vocabulary knowledge and academic performance.

Group 3 showed the same relationship but in the inverse, with low scores in both vocabulary size and GPA. As an expected result, learners with a small vocabulary size will have a low GPA and struggle to understand university-level texts during their studies. As predicted, there were no learners with a small vocabulary size and a high GPA, which reveals that learners who lack necessary lexis cannot achieve a high GPA.

These results emphasise the relationship between vocabulary knowledge and academic achievement. In addition, they show that measuring vocabulary knowledge (XK_Lex) could constitute a sufficient tool to predict academic achievement; the results support the importance of vocabulary knowledge as a prerequisite for academic success and suitability to undertake international (English-medium) education (Meara, et al., 1997; Waring & Nation, 2004).

The mean of the learners' vocabulary size is 5944, constituting almost 6000 of the 10,000 most frequent words in the English language. If this figure is compared with the undergraduate native English speaker vocabulary mean score in Milton and Treffers-Daller's 2013 study, which is 7973 words out of 10000, we find that there is almost exactly a 2000-word difference between the Arabic students in our study and the monolingual English speakers in Milton and Treffers-Daller's (2013), as displayed in Table 8, below.

Table 8: Mean scores of Arabic Learners Compared with Milton and Treffers-Daller's (2013) Normative Scores.

Vocabulary Knowledge	Mean
Current study	5944
Milton & Treffers-Daller (2013)	7973

Table 8 shows a 20% difference in vocabulary scores between the Arabic undergraduates in our study and the undergraduate monolingual English speakers in Milton and Treffers-Daller's (2013) study. These figures suggest that Arabic students need to acquire almost 2000 more lexical items to be within the range of monolingual English speakers. Furthermore, these figures suggest that a threshold of 5000 words of English is an essential prerequisite for Arabic undergraduates to enter and potentially succeed in international (English-medium) universities. This lends credence to the indication that below this level of vocabulary, learners

ought to struggle with comprehending the textbooks that comprise vital parts of academic courses, as these contain large numbers of academic and infrequent lexical items. Such learners therefore risk failure or academic hardship during their studies.

In sum, learners with greater vocabulary knowledge tend to score higher in their exams and assignments, and obtain higher GPAs than learners with smaller vocabulary knowledge (Milton and Treffers-Daller, 2013). Vocabulary size scores appear to be a good indicator of knowledge and attainment.

6.2 CALP Knowledge and its Relation to Academic Achievement (GPA)

As CALP is associated with academic language proficiency, the precise purpose of this study was to compare learners' CALP knowledge scores with their academic achievement (GPA). The results show some modest association between CALP scores and GPA when learners were divided according to their scores, as displayed in Figure 3 in the Results section above. An estimate of vocabulary knowledge based on the bands containing words of lower frequency (CALP knowledge scores) may provide an accurate predictor of learners' attainment (GPA). Group 1 attained a large CALP knowledge (above 3000 words) but a low GPA. This result may contradict our hypothesis that learners with a large CALP knowledge will achieve a high GPA as CALP is linked with academic proficiency. The reasons behind this are the same as those described in the previous section. Group 2 confirms our hypothesis, whereby learners with a large CALP knowledge (above 3000 words) achieved a high GPA, and the same was found in Group 3 but in the inverse, whereby learners with a small CALP knowledge (below 3000 words) attained a low GPA. Learners' mean score of CALP knowledge is 4706 words, which indicates that they know nearly 20% of the less frequent lexical items and, accordingly, this suggests that learners need to double their CALP knowledge if they are to come within the range of monolingual English speakers.

These results suggest that the weaker the learners' CALP knowledge, the poorer they are expected to accomplish, both in overall academic performance and in academic English proficiency measures, which are necessary to succeed in their studies.

6.3 Vocabulary Knowledge and Intelligence

The findings presented above reveal a strong, significant relationship between vocabulary scores and intelligence scores ($r = .461^{**}$, $p = .005$). This result suggests that vocabulary scores could be an excellent predictor of learners' intelligence. It has been assumed in the literature that general intelligence can be effectively predicted from vocabulary measures (Miner, 1961). Sternberg and Powell (1983:878) pointed out that "vocabulary has been recognized not only as an excellent measure of verbal comprehension but also as one of the best single indicators of a person's overall level of intelligence". The greater the learner's vocabulary knowledge, the higher intelligence score he/she will attain and vice versa; the greater the IQ of the learner, the larger vocabulary knowledge he/she will possess. An early study by Jensen (1980), proposed that vocabulary could be a reliable measure of intelligence "because the acquisition of word meanings is highly dependent on the *eduction* of meaning from the contexts in which the words are encountered" (p. 146). A further study, by Donald and Brown (1970) used the Peabody Picture Vocabulary Test (PPVT) as a measure of intelligence on an adult patient population in a county hospital. They administered the PPVT and the Doppelt Short Form of the Wechsler Adult Intelligence Scale (D-WAIS) to 150 outpatients and found that the correlation between the two tests is strong, at .81.

The significant relationship between vocabulary knowledge and intelligence scores demonstrated in this study supports the validity of the XK_Lex as a short yes/no vocabulary test as an adequate predictor of general intelligence. A study by Miner (1961), using a short vocabulary test as a measure of intelligence, found that the correlation between the two scores is sufficiently strong, although the findings of this study reveal that vocabulary tests

such as the XK_Lex test could not only predict learners' academic performance, but also overall general intelligence.

6.4 Vocabulary Knowledge and Foreign Language Aptitude

The results of this study indicate a strong correlation coefficient between vocabulary size scores and foreign language aptitude scores, using the MLAT ($r = .431^{**}$, $p = .009$). As the short form of the MLAT was administered here, all three subsections (*Spelling Clues*, *Words in Sentences* and *Paired Associates*) were correlated with overall vocabulary scores and with BICS and CALP. The MLAT correlates the most significantly with CALP scores ($r = .467^{**}$, $p = .004$). This result indicates that foreign language aptitude is strongly associated with CALP knowledge, which comprises academic and less frequent words. More particularly, the overall vocabulary scores correlate significantly with *Spelling Clues* ($r = .445^{**}$, $p = .006$), whereas there was no correlation between vocabulary score and the other two subsections (*Words in Sentences* and *Paired Associates*). This could be explained by reference to the fact that *Spelling Clues* measures the sound symbol ability, where learners are required to read an English word presented in abbreviated spelling, as it pronounced, and then match the meaning of this word with one of five choices presented. *Spelling Clues* depends highly on learners' English vocabulary knowledge, and this may explain the relationship found between this section and learners' vocabulary scores.

Learners with high foreign language aptitude tend to possess a larger vocabulary size than learners with low foreign language aptitude. Dahlen and Caldwell–Harris (2013) investigated whether learners' foreign language aptitude, determined using the MLAT, would have predictive value on their vocabulary learning. They found that learners with high foreign language aptitude tend to learn more vocabulary items than those with low foreign language aptitude. The findings in our study support this hypothesis, showing that learners with high

foreign language aptitude possess a larger vocabulary size than learners with low foreign language aptitude.

6.5 Intelligence and its Relationship to Academic Achievement (GPA)

The results imply that there is no significant relationship between learners' intelligence scores and academic achievement (GPA). This result does not support other studies, such as Jensen (1998) and Rohde and Thompson (2007), which reported strong correlations between learners' intelligence scores and their academic achievement. There have been studies, however, that investigated the relationship between intelligence and foreign language learning, such as Genesee (1976), which showed that intelligence, is not a critical variable in predicting foreign language learning potential.

The discrepancy between the results of this study and those of Jensen and Rohde and Thompson may be explained by observing that in this study the matrix reasoning subtest was administered as a non-verbal intelligence test to measure non-verbal ability and general intelligence, and that as a result, learners' intelligence scores did not depend on their L2 lexis but rather on their cognitive abilities. On the other hand, learners' academic achievement depends to some extent on their L2 proficiency. Since these learners' L2 is the language they use to study in university, their intelligence scores may not be related to their academic achievement. Another reason is the small number of learners that participated in this study; a larger number of participants may give better results.

The findings lead us to speculate that intelligence scores do not always predict academic achievement, and that there may be other variables, such as motivation, that should or must be taken into account when formulating such predictions. Clearly, the relationship between intelligence and academic achievement is complicated and may vary according to the intelligence measure used.

6.6 Foreign Language Aptitude and its Relationship to Academic Achievement (GPA)

The results indicate that learners' foreign language aptitude, measured by the MLAT (*Spelling Clues, Words in Sentences* and *Paired Associates*) is not related to their academic achievement (GPA). This result is unexpected, and contradicts previous studies, such as Carroll (1981), Skehan (1989) and Robinson (2007). One reason for the contradiction could be the MLAT itself as a measurement of L2 aptitude. Many investigators have challenged the idea that L2 aptitude can be measured by the MLAT (Dörnyei, 2005b; Robinson, 2002b, 2007; Sáfár & Kormos, 2008; Skehan, 2002). One such criticism is that the concepts underlying the MLAT do not give a complete description of L2 aptitude. This has been proposed by investigators who have revealed that MLAT is not always a good predictor of foreign learning, especially when instruction is more communicative (Robinson, 2007) or less intense (Carroll, 1962, 1990). This does not mean that the MLAT as a measurement of L2 aptitude is unreliable, but rather that the group of factors that contribute to successful second language acquisition needs to be expanded beyond the concepts underlying the MLAT. A further reason for the discrepancy could be classroom variables such as teachers, peers, materials and instructional techniques, which could mislead and minimize the effects of L2 aptitude on academic achievement (cited in Winke, 2013).

Though this result does not agree with the initial hypothesis that language aptitude is a good predictor of L2 academic performance, it is not necessarily surprising. After a certain level of learning beyond the beginner level, the relationship between foreign language aptitude and academic performance becomes much less significant. Carroll's (1962) study on native English speakers learning Chinese as a foreign language found that the relationship between foreign language aptitude, measured by the MLAT, and their academic performance became insignificant after they progressed beyond the beginner level. However, other variables, such

as motivation and strategy use, could be a good predictor of academic performance. In other words, foreign language aptitude is not always a good predictor of academic achievement.

7. Conclusion

This study was carried out to investigate the relationship between vocabulary knowledge and academic achievement for Arabic undergraduate learners in Swansea University. The findings presented in this study suggest that vocabulary knowledge measured by the XK_Lex test (Milton & Al-Masrai, 2009) could be a useful predictor of learners' academic achievement. The findings indicate that a threshold of 5000 words of English and above is a prerequisite for an undergraduate L2 learner to comprehend academic texts, and below this volume of vocabulary the learner risks failure and other negative ramifications during his/her course of study. Moreover, one of the advantages of using a vocabulary measure in this study was to easily quantify learners' knowledge into high frequency bands, associated with BICS, and lower frequency bands, related to CALP. When the relationship between CALP knowledge and academic achievement is examined, it appears to be a good predictor of learners' academic achievement as well as vocabulary knowledge. The larger CALP knowledge the learner possess, the higher GPA he/she will achieve. It would seem that learners' academic achievement can possibly be explained by the size of vocabulary knowledge they possess and their academic ability.

The findings of this study also revealed a positive relationship between vocabulary knowledge and intelligence. This suggests that vocabulary knowledge is an excellent predictor of learners' intelligence. The greater vocabulary knowledge, the higher IQ the learner demonstrates. Furthermore, the investigations have shown a strong relationship between vocabulary knowledge and foreign language aptitude. Learners with high foreign language aptitude have a larger vocabulary size than learners with low foreign language

aptitude. The findings illuminate the importance of vocabulary knowledge, not just as a predictor of academic achievement but also as a predictor of both intelligence and foreign language aptitude. In other words, a quick yes/no vocabulary test, such as the XK_Lex, could be a useful tool to predict learners' overall academic performance. However, the major general conclusion to be drawn from the study is the great importance of vocabulary knowledge in predicting learners' language proficiency and academic achievement.

Conversely, the findings suggest that intelligence and foreign language aptitude appear to be less accurate predictors of learners' academic performance. The sample used in this study was quite small, so it can be safely suggested that a larger sample would give more reliable results. Repeating this study with a larger sample and using more rigorously designed tests, as well as the inclusion and consideration of further variables, such as motivation and strategy use, would be ideal.

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Appendices

Appendix A

English XK-Lex Vocabulary Test

Please look at these words. Some of these words are real English words and some are not but are made to look like real words. Please tick (✓) the words that you know or can use. Here is an example. **cat** ✓

Thank you for your help!

new	commerce	organise	accuse	victory
gummer	tindle	wookey	candish	skave
word	dust	fountain	tend	jewel
near	nonsense	movement	landing	reliable
peace	fond	likely	volume	harden
produce	sweat	provide	tube	sorrow
you	cap	castle	liner	dial
wife	worry	steam	previous	enclose
do	plenty	steady	style	sneeze
add	guide	pole	outline	apparatus
kilp	broy	orrade	plaudate	overend
build	pump	guest	keeper	roast
prosecutor	addict	gulp	idleness	carnation
samphirate	treadway	darch	callisthemia	mordue
referral	detachment	thud	blizzard	plaintively
illuminate	unsure	assassin	rut	gurgle
gown	reinforcement	wrench	incessant	heal
verge	enlightenment	backdrop	blunder	allure
counsellor	workman	unfold	springboard	atone
skipper	feudal	upheaval	shrapnel	locket
authorise	quartet	animation	skip	nudge
sour	psychic	banish	bastion	barn
neminary	fallity	treggle	snape	tearle
holly	appropriation	peninsula	maroon	contrive

Appendix B

The Matrix Reasoning Test (WASI)

The following picture is one of the 35 incomplete grid patterns:

