



## Readability and vocabulary level of reading passages in Japanese University entrance exams

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# Readability and Vocabulary Level of Reading Passages in Japanese University Entrance Exams

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The validity and reliability of tests are influenced by a variety of factors, but their foundation is the level of difficulty of the vocabulary used, and thus the lexical cover ratio, as well as the readability of the passages used for reading comprehension. Most Japanese students enter their universities on the basis of written exams with an English section testing reading comprehension and knowledge of grammar and vocabulary. In two studies, we have looked at vocabulary frequency levels and readability of the English sections for the 2005 and 2008 exams of four major private universities in the Kansai region of Japan as well as of a national exam. We found that the difficulty of the entrance exams may have been a problem, although the Center Exam was easier. In this paper, we compared the results for 2010 with those for 2005 and 2008 exams for the same universities, and found that this continues to be a potential problem. We also looked at some additional factors, including the coverage of the vocabulary levels of the tests, based on the words that students learn in secondary schools and at the extent to which the vocabulary in tests at one university overlap with that in other tests at the same university.

## 1. Introduction

The validity and reliability of an exam can be influenced by, among other factors, appropriate lexical difficulty and readability of reading passages. While these are not sufficient conditions for a valid and reliable test, they form the foundation of the exam, and so they are necessary conditions. Therefore, looking at the lexical difficulty of tests and the readability of reading passages is useful in evaluating that facet of their validity and reliability.

Two previous studies (Kitao & Kitao, 2006; Kitao & Kitao, 2009) considered the lexical difficulty and readability of reading passages in the 2005 and 2008 entrance exams of four major private universities in the Kansai area and at a national exam over a period of 16 years (1990 to 2005). In this study we will compare those results with the 2010 exams. In addition, we will check on how much vocabulary in the reading passages in the 2010 university entrance exams is covered with the vocabulary students have

studied in senior high school English language textbooks and the extent to which the lexical items in the individual tests at one university overlapped with each other.

## 2. Background on the Japanese University Entrance Exam System

In Japan, most students enter universities through written exams, most of which include English sections. There are two types of exams. One is a centralized exam known as the "Center Exam," which is developed by The National Center for University Admissions and administered on the same day throughout Japan. It is used by national universities and some private universities, either alone or with interviews or another test. The other type of exam is given by individual universities. In these exams, the English section often makes up a high percentage of the total exam score, though the percentage depends on the university and the department. Different exams are used for different majors or for exams given on different days, so each

university can have several exams.

The largest part of most English exams is made up of one or more reading passages with multiple choice or cloze-type questions. In most exams, reading with vocabulary and grammar questions is highly emphasized, and there are a few long, difficult reading passages. Some tests also include grammar and vocabulary questions, translation questions, or questions to test students' knowledge of English pronunciation.

### 3. The Variety of Topics of Reading

The reading passages in entrance exams are usually adapted from published materials and may have notes added by the developers of the test. Topics of reading in the same tests are usually widely different. For example, exams given in 2010 by University A, a large Kansai-area university that we used in this study, each have two long reading passages for a total of about 1400 words. The 14 passages used in seven exams vary widely in their topics, as shown in the table below.

### 4. Previous studies

A number of studies have been done on the vocabulary frequency and readability of reading passages in the English sections of entrance exams. Hasegawa, Chujo, and Nishigaki (2006) looked at trends in exams and found that there has been an increase in the use of reading passages and dialogues for comprehension and also in the length of those passages. Their review of the literature indicated that there were problems with difficulty levels of vocabulary due to a low cover ratio (percentage of vocabulary used in the tests covered in junior high and high schools).

In their own study, they evaluated the lexical cover ratio of university exams and of the Center Exam from 1989 to 1998 and found a cover ratio of about 95% for the Center Exams and about 90% for the university exams.

Similarly, Chujo and Hasegawa (2004) examined Center Exams from 1993-2002 and 40 faculties at 26 universities from 2002 for cover ratio and readability and found the cover ratio and readability was appropriate for the Center Exams, but that only four faculties (10%) had a cover ratio of 95%, which they considered

Test	Passages	Topic
1	A	The importance of "free play" for children
	B	Toilet paper and the environment
2	A	Effects of color on cognitive behavior
	B	What can be learned from garbage
3	A	Abraham Lincoln as a speechwriter
	B	Animal communication
4	A	Effects of a calorie-restricted diet
	B	Getting women involved in computer science
5	A	Crowd behavior
	B	Getting children to enjoy nature
6	A	How butterflies fly
	B	The decrease in reading
7	A	Empathy
	B	A history of fashion

appropriate, and only 12 faculties (30%) had an appropriate level of readability.

Based on a review of literature on lexical cover ratio, Matsuoka and Hirsh (2010) concluded that a knowledge of 3000 word families was sufficient for a cover ratio of 95%, while 5000 word families would be required for a cover ratio of 98%. A cover ratio of 95% would allow readers to comprehend, particularly with the kind of assistance that they would get in a language classroom, but it would require a 98% cover ratio to read unassisted with accurate guessing of unknown words in context.

#### 4. Research Questions

We considered the following four research questions.

1. What is the level of difficulty of words used in the English entrance exams of four major private universities in 2010, and how has this changed between the 2005 and 2008 exams?
2. What is the lexical cover ratio of the vocabulary, based on vocabulary taught in English high school textbooks?
3. What is the level of readability of reading passages used to test reading comprehension, and how has this changed since the 2005 and 2008 exams?
4. To what extent does vocabulary overlap in the tests written by one university?

#### 5. Methodology

Using word frequency counters and measures of readability, we analyzed the English sections of 2010 university exams from four major private universities in Kansai, Japan. These universities are identified as University A (7 exams), University B (8 exams), University C (9 exams), and University D (9 exams). We analyzed each individual test and all of the tests together for each university.

For vocabulary frequency analysis and lexical cover ratio analysis, we used everything in English in the exams, including reading passages and questions. We removed Japanese instructions, question numbers and letters, etc.

For readability, lexical cover ratio, and vocabulary overlap analyses, we used only reading passages, excluding dialogues. In the case of cloze passages, we filled in the blanks and used the intact passages. The Center Exam had four reading passages. University A and University D had two reading passages per test. University B had three readings per test, with the exception of Test 7, which had two tests. University C had two (Tests 2, 6, and 7), three (Tests 4, 5, 8, and 9) or four reading passages per test.

Descriptive statistics were calculated for these tests.

##### *Levels of Vocabulary Frequency*

To analyze the vocabulary frequency of the exams, we used the Japan Association of College English Teachers 8000 (JACET) word list. The JACET list was developed based on the British National Corpus, but with adjustments to reflect language education in Japan. It is divided into 8 levels of 1000 words each. We use a web-based program (<http://www.tcp-ip.or.jp/~shim/j8web/j8web.cgi>) to calculate the percentage of tokens (total words) and types (unique words) at each level. We looked at the percentage of words at each of the eight levels, and words not included in the 8 levels but excluded contractions, proper nouns, and non-words from the analysis. We used the results to calculate the number percentage of words over the 4000-word level for tokens and types. According to Barrow, Nakanishi, and Ishino (1999), the average Japanese college freshman has a vocabulary of 2304 English words. Private university exams are probably taken by better-than-average students, so we used the 4000-word level for our evaluation (that is, levels 1-4).

### Lexical Cover Ratio

For the analysis of lexical cover ratio, we compared the vocabulary that appeared in at least six of the 16 standard high school English language textbooks (see Note and Appendix), a total of 2368 words (comparable to the number of words known by the average freshman, according to Barrow, Nakanishi, and Ishino [1999]) against all of the English words in the exams for each university in order to calculate the lexical cover ratio.

### Readability

We also looked at the readability of the reading passages (excluding dialogues) in the exams. To calculate statistics for the passages, including their readability, we used software to calculate two readability scales, the Flesch Reading Ease (FRE) scale and the Flesch-Kincaid Grade Level (FKGL). We also reported the number of words in reading passages and the number of words per sentence.

Readability scales are calculated using of sentence length (to represent grammatical complexity) and the number of letters or syllables in words (to represent lexical difficulty). The FKGL is represented in terms of US grade levels. To give an idea of the level of difficulty, a typical American newspaper story, which would be fairly difficult for most Japanese university students to read, is around 8 on the FKGL, meaning that it could be read by US students in the 8<sup>th</sup> grade or higher. On the FRE, the higher the score, the easier the reading passage would be. For native English speakers, a

FRE score between 30 and 49 indicates a very difficult reading, and 50-59 is fairly difficult. *Time* magazine, a US news magazine that would be quite difficult for Japanese university students, has a FRE score of about 52, and the *Harvard Law Review* has a score in the low 30s (Flesch-Kincaid readability test, n.d.).

These readability scales were developed for native English speakers, and the scores on the FKGL reflect this. However, Greenfield (2004) found high correlations between the two scales and measures of results of cloze tests with Japanese university students. This indicates that these readability scales reflect the relative difficulty of reading passages for Japanese readers.

### Overlap of Lexical Items

In order to look at the extent to which the vocabulary items used in the different tests used at one university, we calculated a matrix comparing each of University A's tests with each of the other tests given by University A, based on how many words and what percentage of words they had in common. In order to compare the lexical overlap in two exams, we subtracted the number of types in the combined exams from the total number of types in the two exams and divided it by the number of types in each exam to express the overlap for each exam in terms of percentage.

## 6. Results

### Descriptive statistics

Tables 1 and 2 provide descriptive statistics

Table 1. Descriptive statistics for all English words

	Nos. of Characters			No. of Words			Characters/Word		
	total	range		total	range		total	range	
		low	high		low	high		low	high
Center	15,443.00			3,230.00			4.78		
A Univ.	103,296.00	13,828.00	14,778.00	20,575.00	2,776.00	2,936.00	<u>5.02</u>	4.98	<u>5.14</u>
B Univ.	127,026.00	14,984.00	17,293.00	<u>27,303.00</u>	3,251.00	<u>3,832.00</u>	4.65	4.51	4.79
C Univ.	102,640.00	8,811.00	15,940.00	21,794.00	1,795.00	3,226.00	4.71	4.50	4.99
D Univ.	104,933.00	6,516.00	12,655.00	21,807.00	1,433.00	2,544.00	4.81	4.65	5.07

Table 2 *Descriptive statistics for the reading passages only*

	Nos. of Characters			No. of Words			Characters/Word		
	total	range		total	range		total	range	
		low	high		low	high		low	high
Center	7,242.00			1,505.00			4.81		
A	50,588.00	6,608.00	7,596.00	10,061.00	1,331.00	1,483.00	5.03	4.85	5.19
B	75,275.00	5,628.00	11,051.00	16,299.00	1,282.00	2,472.00	4.62	4.39	4.81
C	64,872.00	5,051.00	11,246.00	13,711.00	1,167.00	2,283.00	4.73	4.33	4.99
D	62,439.00	6,283.00	11,941.00	12,999.00	1,322.00	2,570.00	4.8	4.44	5.02

	No. of Sentences			Words/Sentences		
	total	range		total	range	
		low	high		low	high
Center	87			17.3		
A	485	65	75	20.74	19.67	21.8
B	974	98	141	16.73	9.5	20.71
C	705	53	113	19.45	15.92	24.55
D	683	64	171	19.03	15.03	22.41

Table 3. *Percentage of words over 4000 (tokens)*

	2005			2008			2010		
	range		mean	range		mean	range		mean
	low	high		low	high		low	high	
Center	1.84	5.12	3.08						4.33
A	4.22	5.95	4.93	6.29	9.88	8.12	5.05	7.29	5.99
B	3.06	4.58	3.69	2.24	5.92	4.04	2.81	6.03	4.32
C	3.65	7.68	5.05	3.4	7.74	4.96	3.29	6.57	4.96
D	4.58	7.04	5.57	3.23	8.71	5.31	4.04	6.76	5.34

for the exams used in this study. Table 1 shows the number of characters, the number of words, and the number of characters per word for all the English words in the tests. In total, University B's tests have the most English words (27,303), as well as the most words in an individual test (3,832). University A has the longest words, on average (5.02), as well as the individual test with the longest average words (5.14).

Table 2 shows the descriptive statistics for the reading passages only. University B has the largest number of words in English passages (16,299), while University D has the largest number of words in a single exam (2570). As with the total words, University A has the largest average number of characters in the

reading passage (5.03) and the largest average for an individual test (5.19). For all of its tests, University A has the largest number of words per sentence, on average (20.74) but University C has the individual test with the largest average number of words per sentence (24.55).

#### *Levels of Vocabulary Frequency*

The next tables show the percentages of tokens (Table 3) and types (Table 4) over the 4000-word level at each university and for the Center Exam. They include the range of percentages of each university's tests, comparing the results of the 2005 exams, the 2008 exams, and the 2010 exams. (In the 2006 study, Center Exams from 1990 to 2005 were included. The Center Exam was not included in the study of

Table 4. *Percentage of words over 4000 (types)*

	2005			2008			2010		
	range		mean	range		mean	range		Mean
	low	high		low	high		low	high	
Center	5.89	10.68	7.28						10.77
A	9.73	13.99	11.68	14.27	18.04	16.29	13.97	16.84	14.79
B	8.11	11.97	9.43	7.32	13.15	10.45	8.69	12.6	10.47
C	9.64	14.26	11.33	11.14	12.97	11.82	6.74	14.25	11.05
D	10.67	16.02	13.23	8.75	15.73	11.45	8.39	14.12	10.57

the 2008 results.)

As pointed out above, research has shown that if there is a cover ratio of less than 95-98% (i.e., 2-5% unknown words out of the total words in a reading passage), comprehension is difficult. While some words might be able to be guessed from the context, not all words can be, and with a relatively large number of unknown words, it becomes more difficult to guess unknown words, and passages become incomprehensible.

The Center Exam generally uses an easier level of vocabulary than the four private universities, although the Center Exam in 2010 had a percentage of unknown words on the high side of the range for past Center Exams. In 2010, all of the universities had tests with a percentage of unknown words that could potentially be a problem. For University A, none of the tests had fewer than 5% unknown words. University A did show a decrease between 2008 and 2010, though the percentages were not as low as they had been in 2005. University B had the lowest percentage of unknown words in 2005, but that percentage increased in each of the following studies. University C did not change greatly in a comparison among the three studies. For University D, some tests had a greater percentage of unknown words in 2008 than in 2005, while others had a smaller percentage. In 2010, the highest percentage of unknown words on an individual test was smaller, although the average remained about the same.

#### *Lexical Cover Ratio*

The results of the calculation of the lexical cover ratio of the 2010 exams appear in Table 5.

Table 5. *Lexical cover ratios for all English words*

	Mean	range	
		low	high
Center	81.26		
A	78.41	76.99	81.41
B	80.16	75.34	82.74
C	79.07	76.23	82.9
D	78	72.57	81.95

None of the exams have greater than 82.90% cover ratio, and the one with the lowest cover ratio has only 72.57%. This indicates that many of the test takers would have great difficulty comprehending the reading passages and would only be able to guess in answer to the multiple-choice questions.

#### *Readability*

Tables 6 through 10 show the range and the mean for the number of words in reading passages, the number of words per sentence, and the readability based on the FRE scale and the FKGL scale.

The level of difficulty of the readings in the Center Exam have increased since the exams studied in the 2006 study, and in 2010, it was more comparable to the difficulty of the four private university exams considered here. Many of the tests for the individual universities have reading passages that are comparable in difficulty to *Time* magazine, and some that are considerably more difficult. Except for University B, the universities all had at least some individual tests

Table 6. *The Center Exam readability results*

	2005			2010		
	range		mean	range		mean
	low	high				
# of words	757	1,338	1,092.25			1,505.00
wds/sentence	11.19	18.22	14.74			17.3
FRE	59.39	73.84	68.14			52.57
FKGL	4.94	9.43	7.42			10.22

Table 7. *University A readability results*

	2005			2008			2010		
	range		mean	range		mean	range		mean
	low	high		low	high		low	high	
# of words	1,280	1,557	1,372	1,622	2,386	1,768	1,331	1,484	1437.3
wds/sentence	17.22	25.7	21.47	19.01	24.29	21.97	19.67	21.81	20.74
FRE	37.15	50.46	43.48	36.97	46.14	42.91	38.6	53.8	44.71
FKGL	10.5	14.46	12.53	11.55	13.8	12.73	11.03	13.29	12.18

Table 8. *University B readability results*

	2005			2008			2010		
	range		mean	range		mean	range		mean
	low	high		low	high		low	high	
# of words	1,528	1,809	1,698	1,476	2,620	2,089	1,282	2,472	2037.4
wds/sentence	12.14	17.31	15.62	12.37	20.24	17.33	9.5	20.69	16.73
FRE	61.93	68.61	66.29	50.16	66.45	61.16	56.8	75.97	61.9
FKGL	6.7	8.51	7.89	7.24	11.08	9.03	5.02	10.35	8.78

Table 9. *University C readability results*

	2005			2008			2010		
	range		mean	range		mean	range		mean
	low	high		low	high		low	high	
# of words	929	1,814	1,317	812	1,646	1,428	1,167	2,238	1523.4
wds/sentence	14.2	23.83	16.68	15.38	26.19	19.05	15.9	24.55	19.45
FRE	37.07	63.24	53.38	38.85	64.63	52.64	42.3	62.99	52.21
FKGL	8.89	14.01	10.54	8.07	12.47	10.65	8.43	12.28	10.81

Table 10. *University D readability results*

	2005			2008			2010		
	range		mean	range		mean	range		mean
	low	high		low	high		low	high	
# of words	1,406	1,922	1,543	1302	1,473	1,406	1,322	2,570	1444.3
wds/sentence	14.67	19.8	17.21	17.86	27.5	21.14	15	22.41	19.03
FRE	57.37	68.68	61.68	26	66.92	56.86	43.8	65.78	52.9
FKGL	7.51	10.18	8.93	8.86	16.46	11.02	8.37	12.37	10.61



that were of an appropriate level for US 12<sup>th</sup> graders, and University A had at least one test that would be an appropriate reading level for first year university students in the US. The situation has not improved over 2005 and 2008 tests.

### Overlap of Lexical Items

The number and percentage of types in each of University A's individual tests that overlap with types for each other test and for all tests can be seen in Tables 11 and 12.

Table 11. *Lexical Overlap for University A (number of types)*

	types	tokens	type Test1	type Test2	type Test3	type Test4	type Test5	type Test6	type Test7	type all
Test 1	537	1469		940	925	905	918	889	891	2122
Test 2	579	1473	940		975	939	958	917	921	2122
Test 3	539	1339	925	975		930	937	892	912	2122
Test 4	545	1457	905	939	930		924	883	886	2122
Test 5	562	1449	918	958	937	924		891	902	2122
Test 6	521	1485	889	917	892	883	891		865	2122
Test 7	524	1351	891	921	912	886	902	865		2122
All	2122	10024	2122	2122	2122	2122	2122	2122	2122	

Table 12. *Lexical Overlap for University A (percentage of types) (%)*

	type	token	Test 1	Test 2	Test 3	Test 4	Test 5	Test 6	Test 7	all
Test 1	537	1469		32.8	28.1	33	33.7	31.5	31.7	100
Test 2	579	1473	30.4		24.7	32	31.6	31.6	31.4	100
Test 3	539	1339	28	26.5		28.6	30.4	31.2	28	100
Test 4	545	1457	32.5	32.8	28.3		33.6	32.5	33.6	100
Test 5	562	1449	32.2	32.6	29.2	32.6		34.2	32.7	100
Test 6	521	1485	32.4	35.1	32.2	35.1	36.9		34.5	100
Test 7	524	1351	32.4	34.7	28.8	34.9	35.1	34.4		100
all	2122	10024	100	100	100	100	100	100	100	

Table 11 shows the types and tokens for each of the seven tests. The number where Test 1 and Test 2 cross, that is, 940, is the types for Test 1 and Test 2 combined. All (2,122) is the number of types for all the tests combined. Thus Test 1 (537 types) + Test 2 (579 types) = 1116 types. 1116 - (Test 1 and Test 2 combined, that is, 940 words) = 176 unique words.

Therefore, Test 1 and Test 2 have only 176 common words.

537 words - 176 words = 361 words (words in Test 1 but not in Test 2)

579 words - 176 words = 403 words (words in Test 2 but not in Test 1)

176 words / 537 words x 100 = 32.8%

176 words / 579 words x 100 = 30.4%

Those two figures are shown in the crossing cells in Table 12.

Among the comparisons of pairs individual

exams, there was relatively little overlap. The exams with the least overlap were 2 and 3 (24.7%); the ones with the most overlap were 6 and 5 (36.9%). This indicates that only one quarter to one third of the each test overlaps with any other test.

## 7. Conclusions and Recommendations

The level of difficulty of the vocabulary and the readability of the reading passages on the university entrance exams considered in this study would be difficult for most students to handle, and this situation has not improved since studies of the entrance exams for 2005 and 2008. This could be a threat to the validity of these tests, since incomprehensible reading passages or a high level of unknown lexical items would lead students to guess and to use

test-taking strategies to try to figure out the answers rather than depending on an understanding of the reading passages and other types of items to choose their answers.

The lack of overlap among lexical items in different exams given by the same university suggests that if students do know some of the more difficult lexical items, it is purely luck whether they encounter words that they are familiar with or whether they encounter a large number of unknown words.

The JACET 8000 list is useful as a standard against which to check lexical difficulty. Programs available online make it easy to check the levels of words in a particular reading passage. One such program (<http://www01.tcp-ip.or.jp/~shin/j8web/j8web.cgi>) shows the percentage of words at each level, both in terms of tokens and types and provides a list of the words at each level, with the number of occurrences. In addition, the JACET 8000 Level Marker (<http://www01.tcp-ip.or.jp/~shin/J8LevelMarker/j8lm.cgi>) produces a text with words color coded and marked according to their level of difficulty.

In addition, online calculators of readability are available to check the readability of reading passages. For example, the one available at [http://www.online-utility.org/english/readability\\_test\\_and\\_improve.jsp](http://www.online-utility.org/english/readability_test_and_improve.jsp) calculates various statistics about a reading passage, such as the number of words per sentences, as well as several readability scales. It also lists sentences that might be problematic. This would make it easy for test makers to identify difficult sentences.

### Note

The sixteen senior high school English language textbooks were used in Kobayashi, Y., & Kitao, K. (2010). Comparing graded readers and authorized English language textbooks in junior and senior high schools —From the viewpoint of vocabulary and readability—. *Journal of Culture and Information Science*, 5, 1-15.

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## Appendix

Senior High School English Textbook Series (2002-2005) Used in This Study

English I (grade 10)

1. *Sunshine* (English IA) (Kairyudo)
2. *One World* (English IA) (Kyoiku Syuppan)
3. *Daily English* (IB) (Ikeda Shoten)
4. *English 21* (IB) (Tokyo Shoseki)
5. *New English Pal* (IC) (Kirihara Shoten)
6. *Access* (IC) (Kaitakusha)

English II (grade 11)

7. *Crown* (IIA) (Sanseido)
8. *Unicorn* (IIA) (Bunneido)
9. *Aurora* (IIB) (Chukyo Syuppan)
10. *Clipper* (IIB) (Taishukan)
11. *New World* (IIC) (Sanyu Syuppan)
12. *Acorn* (IIC) (Keirinkan)

Reading (grade 12)

13. *Raccorn* (RA) (Chikuma Shobo)
14. *New Horizon* (RA) (Tokyo Shoseki)
15. *Planet Blue* (RB) (Obunsha)
16. *Dream Maker* (RB) (Sanseido)