

The Development and Study of the Online Vietnamese Word Recognition Test for Undergraduate Students in Taiwan

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Abstract

This study aimed to develop a Vietnamese word recognition test for Taiwanese undergraduate students and to investigate students' performances at different learning stages. The formal test consists of 100 words as test items. With each word, test takers were asked to select the correct Vietnamese word form corresponding to the pronunciation they heard, and its corresponding Chinese meaning. We compiled a pre-test word list first, then after using ITEMAN to analyze the pre-test results, the inappropriate items were filtered out, and left us the final 100 words. 341 students recruited from 14 universities of Taiwan participated in the final test. The results showed that this test can effectively differentiate Vietnamese word recognition ability of students at different learning stages. Students' performance in word sound discrimination is mainly affected by the following factors: 1. knowledge of the correspondence between form and sound; 2. the complexity of the final structure; 3. word frequency; 4. relation to life experience or learning experience; 5. phoneme confusion. Students' performance in word meaning is generally affected by the knowledge of the form-sound-meaning correspondence, word familiarity, and part of speech.

Keywords: Vietnamese, word recognition test, Taiwan, undergraduate student

Introduction

In recent years, the economic and cultural exchanges between Taiwan and Vietnam have strengthened, and Taiwanese citizens' need to learn Vietnamese has also increased. Various universities across Taiwan offer Vietnamese courses, and the number of students taking these courses has increased year by year. Vietnamese and Chinese share some linguistic features. For instance, both languages are monosyllabic tonal languages and there are some shared consonants, vowels, and tones in their phonetic systems. However, Taiwanese students may find difficulties in learning Vietnamese because of the different writing systems (Chinese is logographic, Vietnamese is alphabetical), the addition of diacritic and tone marks, (e.g., *ăn*, *ỏ*, and some unique consonants and vowels (e.g., [d], [ɲ], [ŋ], /w/, /ɛ/, /ã/).

Although there are Vietnamese language proficiency certification tests in Vietnam and abroad, these proficiency tests do not include word recognition. There is also no independent nor standardized Vietnamese word recognition test. This means Vietnamese language teachers lack a tool that can correctly evaluate learners' word recognition capacity. Recognizing this gap, this

study seeks to develop a standardized Vietnamese word recognition test in Taiwan, to make up for the lack of assessment tools for measuring Vietnamese literacy ability.

Literature Review

Word recognition encompasses visual recognition, phonetic recognition, and word meaning translation (Perfetti, 1983). Harris and Hodges (1995) in their work *Literacy Dictionary*, defined both "literacy" and "word recognition" as "the process of determining the pronunciation and certain meaning of an unknown word" (pp. 282-283). Word recognition is the basis of reading comprehension and plays a key role in the reading process (Anderson et al., 1985; Hung, 1995; Hung et al., 2005; Ko, 1999). Stanovich (1991) pointed out that the ability to recognize words in the early elementary school years could explain most of the variation in reading ability through adulthood. Similarly, the word recognition ability during the elementary period of learning a new language could also play a significant role. Thus, it's critical that educators measure this skill accurately.

In alphabetic languages, the word recognition models based on dual-route theory and analogy theory are the most valued. The dual-route model posits two ways to recognize words: the visual route and the phonetic route. The visual route, also known as the direct route, allows readers to associate visual patterns with word pronunciations directly, without relying on phonetic intermediaries. With the phonetic route, readers analyze word morphemes using grapheme-phoneme correspondences (GPCs) to pronounce unfamiliar words (Huang & Hanley, 1994). Generally, for alphabetic language, readers generally use the visual method to read regular words (Baron, 1979, as cited in Goswami & Bryant, 1990). Analogy theory means that whether it is regular words or irregular words, familiar words or unfamiliar words, they are all based on the analogy of already recognized words. It is a process of activation and synthesis (Glushko, 1981, as cited in Goswami, 1986). Reading in analogy mode involves separating words into initials and finals, then matching these spoken units with letter spellings. This process requires two decoding skills: knowledge of grapheme-phoneme correspondence and onset-rhyme mixed pronunciation skill (Ehri, 1994). Understanding these word recognition models helps us understand the causes of students' word recognition errors.

Word recognition ability is commonly evaluated by learners' pronunciation and discerned meaning (Baumann, 1988, as cited in Hung et al., 2006). Similarly, Roth (2004) also claimed that when students learned to read, they translate printed words into corresponding sounds (phonological recoding), and match the meaning with a word in the student's mental lexicon (lexical access), that is, students must master both the pronunciation and meaning of the word. Roth (2004) divided word recognition assessment into two types: traditional and alternative approaches. The former usually incorporates formal measures, including standardized procedures for test administration and scoring, and aims to identify and place students. In contrast, the latter is classified as an informal approach because it promotes the importance of individualizing the test and using course-related materials (Salvia & Ysseldyke, 2001).

Traditional word recognition tests commonly use two methods: (1) Diagnosis of basic sight words (common words that readers can recognize instantly by sight, without having to decode them). This test method can be an individual or group test. Both individual and group test use a word list of 200~250 high-frequency words for assessment. In individual tests, students pronounce words, while in group tests, students only need to recognize the words by selecting the correct

dictation of the words they hear from a word list. (2) Phonics analysis diagnosis is often used to understand where students make mistakes by analyzing substitutions and mispronunciation items (Hung et al., 2006).

There have been many English and Chinese word recognition tests, almost all of which are traditional tests, such as the ones listed in the Appendix. The word recognition tests in Appendix selected word items by word frequency and both word pronunciation and meaning guided the test structure. Word frequency significantly impacts language learning and processing. The processing time of high-frequency words will be faster than that of low-frequency words, which is called frequency effect (Jackson & Morton, 1984). Thus, the previous word recognition tests refined their test items based on the frequency effect.

Our test is a traditional word recognition test, conducted as a group test with a word list. We referred to Baumann (1988)'s classification of vocabulary evaluation content mentioned above, with word pronunciation and meaning as the test content. Our test prompts test-takers to select the correct dictation of the word and its corresponding Chinese meaning after listening to a word's pronunciation. This study was conducted in two phases with a pre-test and formal test. The formal test items were refined based on feedback and results in the pre-test.

Research Design

This study aimed to develop a Vietnamese word recognition test for Taiwanese undergraduate students and explore differences in word recognition ability of Taiwanese students at different learning stages. First, based on the frequency effect, we selected the word items for the pre-test from three elementary Vietnamese textbooks to compile a word list for the pre-test. The formal test content was refined based on the feedback and results analysed after the pre-test. By analyzing the response data collected during the formal test, we described differences in Vietnamese word recognition performance among test-takers at different learning stages. The following sections provide details about the research participants, test compilation sources and principles, test content, testing procedure, and the scoring method of the test.

Participants

The participants of this test included the pre-test and the formal test participants. These two groups of participants were drawn from different student populations; the pre-test participants were not included in the formal test. Because one of the researchers was a Vietnamese teacher, we asked other Vietnamese teacher colleagues, who were teaching Vietnamese in some Taiwanese universities, to help collect samples by sending the test's link to their students. Aside from the researchers, no one had access to the responses or were able to confirm who participated.

Pre-test participants

A total of 103 undergraduate students from six universities in the northern, southern and an outlying island participated in the pre-test. Convenience sampling was used for the pre-test of this study, as the researchers asked the Vietnamese teachers of these six universities to send the test's link to their students. Because this is an online test, the participants were allowed to complete it at their leisure, but most of them did it during their Vietnamese classes. Table 1 shows the distribution of the number of participants in each learning stage of the pre-test samples.

Table 1*Distribution of the Number of Participants of the Pre-test*

Learning stage	Male	Female	Total
1 to 5 months	31	18	49 (47.6%)
6 to 11 months	13	34	47 (45.6%)
1 to 2 years	1	3	4 (3.9%)
> 2 years	1	2	3 (2.9%)
Total	46 (44.7%)	57 (55.3%)	103 (100%)

Formal test participants

The formal test was officially conducted in universities in eight counties and cities in northern, central, and southern Taiwan, as well as an outlying island, with a total of 341 participants. Table 2 shows that the greatest proportion of learners were those who had just studied for 1 to 5 months, followed by those who were in the second semester, that is, those who had studied for 6 to 11 months. Most Vietnamese courses in Taiwan universities were part of general education programs, in which students are required to take several general courses. These courses typically require two classes per week for a single semester. Many students do not continue their language studies beyond this requirement, so many of the study's participants' learning stage was within a single semester. Because the number of undergraduate students studying Vietnamese was not large and the distribution was uneven, convenience sampling was also adopted for the formal test. Table 3 shows the distribution of the sample size for formal testing, the school names presented in the table are all coded.

Table 2*Distribution of the Formal Test Samples According to Gender*

Learning stage	Male	Female	Total (%)
1 to 5 months	106	140	246 (72.1%)
6 to 11 months	13	32	45 (13.2%)
1 to 2 years	9	15	24 (7%)
> 2 years	13	13	26 (7.6%)
Total	141 (41.3%)	200 (58.7%)	341 (100%)

Table 3*Distribution of the Formal Test Samples*

Region	School	Number of participants (%)	Total
The Northern	A	20 (5.8%)	152 (44.6%)
	B	14 (4.1%)	
	C	3 (0.9%)	
	D	10 (2.9%)	
	E	78 (22.9%)	
	F	27 (7.9%)	
The Middle	G	20 (5.9%)	57 (16.7%)
	H	26 (7.6%)	
	I	11 (3.2%)	
The Southern	J	2 (0.6%)	90 (26.4%)
	K	32 (9.4%)	
	L	28 (8.2%)	
	M	28 (8.2%)	
Outlying island	N	42 (12.3%)	42 (12.3%)
Total			341(100%)

Test Compilation Sources and Principles

The pre-test adopted the compilation principles of Hung et al. (2006) and has been modified to align with the research subjects of this study and the characteristics of the Vietnamese language. Hung et al. (2006) sourced their test items from a list of common words that fit their research subjects and screened them according to the frequency effect. Word frequency refers to the number of occurrences of a single word in the general use of a language. Therefore, it plays an important role in language teaching and learning. The frequency of words determines learners' acquisition and retention of new vocabulary (Nation & Waring, 1997). Since there is no standard Vietnamese common-words-list or verified word frequency list tailored to our research subjects, the researchers selected three textbooks commonly used by Taiwanese college students as the compiling source of our test. The frequency effect involved in this research referred to the number of times a single word appears in the vocabulary lists of these three Vietnamese textbooks. The more times it repeats, the more likely Vietnamese learners in Taiwan are exposed to the word. The test items of

this Vietnamese word recognition were selected from the following materials: *Our Elementary Vietnamese 1 & 2* by L. H. Nguyen (2016, 2020), *Practical Vietnamese Easy Learning vol. 1 & 2* by T. T. H. Nguyen (2017) and the introductory Vietnamese teaching materials that the first author self-compiled for her own teaching purposes as a Vietnamese teacher. The vocabulary of these 3 materials was filtered according to the frequency effect to form the pre-test word list. The topics and vocabulary contained in these three materials are in line with the learning content of the vocabulary items proposed in Taiwan's 108 New Immigrants Language Curriculum (MOE, 2018) and the "Vietnamese Language Proficiency Framework for Foreigners" by the Ministry of Education of Vietnam for elementary level (MOE, 2015). In addition, our test was compiled with reference to the following compilation principles (adapted from Hung et al., 2006):

- (1) Use word frequency as the basis for word selection.
- (2) Proper nouns such as country names, place names, personal names and language names were not listed.
- (3) Multi-syllable words, such as “giới thiệu” (introduce) and “xin chào” (hello), were not included in the test items. Although polysyllabic words account for a large part of the Vietnamese vocabulary, in the three selected textbooks, the proportion of polysyllabic words was relatively small as they are commonly challenging for elementary learners. Therefore, polysyllabic words were not used in this test.
- (4) If the meaning of the word is difficult to explain clearly in Chinese, it should be deleted, such as interjections or discourse markers/fillers like “oi”, “á”, and “ạ”.

Test Content

Pre-test Question Book

Our pre-test content referred to the three Vietnamese teaching materials mentioned above. From this content, the researchers listed the words that appear in the texts of these three materials, a total of 1,270 words. When listing the vocabulary, proper nouns such as place names, person names, country names, and language names that appeared in the texts were not included in the word list. Nguyen (2016, 2020) and Nguyen (2017) each have two volumes, repeated words or homonyms appeared in both volumes of each textbook were listed once only. After enumerating the vocabulary list of the three textbooks, the researchers extracted the words that appeared repeatedly, that is, the words that appeared twice and three times. As a result, there were 119 words that appeared three times, and 197 words that appeared twice, a total of 316 words. Then, the customized word selection principles were used to filter these words, and obtained a total of 252 words, of which 103 words appeared three times (40.9%), and 149 words appeared twice (59.1%).

In order to consider the commonness of the words used for the test items, the researchers adopted the inverse ratio principle for those 252 words, that is, the words with more repeated occurrences must account for a larger proportion of the test items, and the less repeated words should account for a lower proportion. According to the inverse ratio mentioned above, the researchers randomly selected 89 words (59.1%) from the words that repeated three times and 61 words (40.9%) from the words that repeated twice. In total, there were 150 items in the pre-test question book.

In the pre-test, respondents listened to the pronunciation recordings of words and chose the corresponding word dictation and Chinese meanings. All of the questions were multiple-choice. The items were sorted according to presumed difficulty, from easy to difficult; that is, words that

appeared three times in each textbook were ranked first, followed by words that appeared twice.

Formal Test Question Book

After the pre-test, the ITEMAN analysis were carried out to do the item analysis. ITEMAN is a software platform for automated psychometric reporting. It helps calculate the indexes needed for a test analysis, such as average difficulty, difficulty index (the probability that test takers will answer a test item correctly), discrimination index (how well a test item can differentiate between good candidates and less able ones), etc. Then, the researchers selected the word items meeting the following criteria:

- 1) the pronunciation and meaning discrimination indexes were above 0.3,
- 2) the difficulty index of pronunciation was above 0.4,
- 3) the difficulty index of meaning was above 0.3, and
- 4) the difficulty indexes of both pronunciation and meaning were below 0.9.

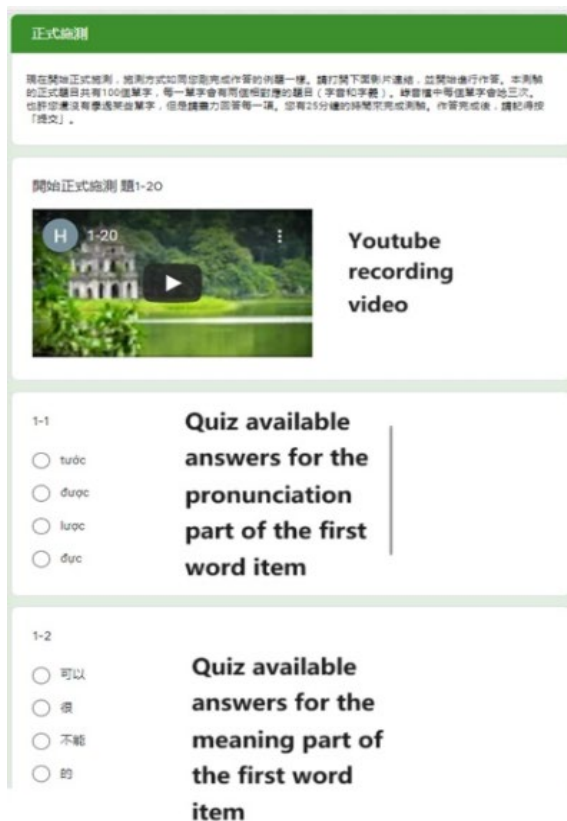
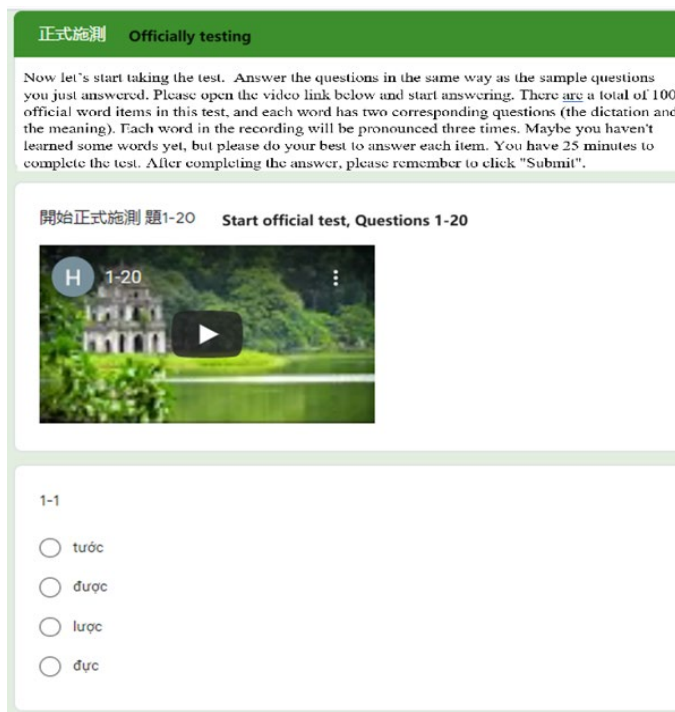
After deleting the items that didn't meet the above criteria, 102 items remained. However, there were 2 items that had poor distractors: some options of these 2 items were not selected, some options had positive or relatively low point biserial correlation coefficients (below .08). Thus, they were eliminated. Therefore, the formal test question book had a total of 100 words.

Testing procedure

Both the pre-test and formal test used the Google Forms platform. Subjects filled out basic information and responded on the same Google form. The Google survey collected participants' basic information, such as email, school, gender, major. There was a place to fill in names, but it was not a required question, and the participants could fill in any name (even anonymous). There was a "guarantee" sentence right above the basic information questions: "這些資料僅供研究者博士論文的研究分析，絕不會外洩。This information is solely for the research and analysis of the researcher's doctoral thesis and will remain confidential." This manuscript is a summary of the dissertation research.

The participants were also told about the purpose of this test and what they would do (in the description part at the beginning of the test). All the information collected was kept secured and de-linked from survey data. After reading the test administration instructions and completing the personal information part, respondents started responding by listening to the pronunciation of the word items recorded in the video and choosing the correct word forms/dictation and meaning of the words they heard. Before going to the formal test items, there were two practice items provided to familiarize the respondents with the test administration method. This procedure was explained at the beginning of the test.

All the formal test items were divided into 5 sections on the Google form. Each section contained 20 word-items. The items were divided into sections to avoid testing fatigue when completing the test. Each section first linked to a YouTube recording video which was followed by quiz questions on pronunciation and meaning. The pronunciation of words was recorded so that each word was read three times, and the interval between each two word-items was approximately 13 seconds. As a result, the entire test took about 25-30 minutes to complete. Figure 1 presents the appearance of the formal test, and Figure 2 shows the English translated version of Figure 1.

Figure 1*Appearance of the Formal Test***Figure 2***The English-translated Version of Figure 1*

Scoring method

Each correct answer was worth two points, of which one point was for the sound of the word, one point for the meaning of the word, and zero points for wrong answers or missing answers. Since there were 100 word-items in the formal test question book, the score range is 0-200 points. A high score indicates high word recognition ability, and vice versa.

Results

Descriptive statistical analysis of the test

In this study, the ITEMAN analysis was performed on the response data of the formal test. The results showed that the average difficulty of the whole test was 0.605 (which means 60.5% of students answered the items correctly), which was of medium difficulty and suitable for evaluating Vietnamese learners ranging from a few months to about two years of learning. The average difficulty index of the pronunciation part was 0.671, while the average difficulty index of the meaning part was 0.539, which also showed that discerning a word's meaning was more difficult than the pronunciation. The average point biserial correlation coefficient of this test was 0.556, indicating that the test has high-quality discrimination. Table 4 is a summary of the descriptive

statistics for each learning stage.

Table 4

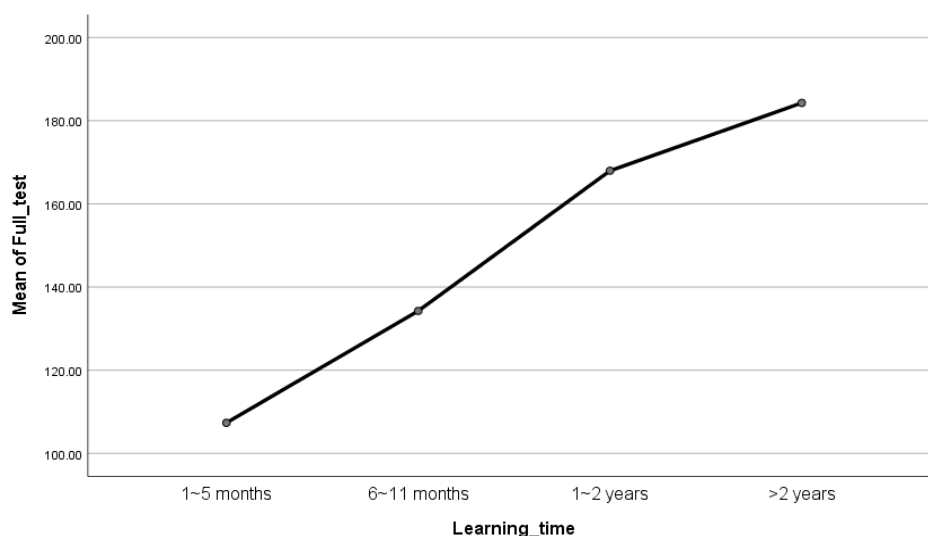
Summary Descriptive Statistics for Each Learning Stage

Learning stage	Stage 1 1 to 5 months	Stage 2 6 to 11 months	Stage 3 1 to 2 years	Stage 4 > 2 years	
n	246	45	24	26	
Pronunciation	N of items	100	100	100	100
	Mean	61	74	89	94
	SD	19.33	15.61	11.62	9.79
	Minimum	19	27	53	61
	Maximum	100	100	100	100
Meaning	N of items	100	100	100	100
	Mean	46	60	79	90
	SD	18.84	15.90	16.29	9.16
	Minimum	15	22	40	54
	Maximum	93	95	98	97
Whole formal test	N of items	200	200	200	200
	Mean	107	134	168	184
	SD	33.11	29.76	26.69	15.09
	Minimum	43	60	93	144
	Maximum	193	195	196	197

In the pronunciation part, the mean score of each learning stage was 61, 74, 89 and 94, respectively. The largest difference of mean scores was between stage 2 and stage 3, the next one was between stage 1 and stage 2, but this difference was relatively close to the difference between stage 2 and 3; the difference between stage 3 and stage 4 was relatively small.

In the word meaning part, the mean score of each learning stage respectively was 46, 60, 78 and 90. The largest difference was also between stage 2 and stage 3, and the difference between stage 3 and stage 4 was the smallest. The mean score for the meaning part of each stage was lower than that of the pronunciation part.

Table 4 also shows that as the amount of learning time increased, the performance of the students' word recognition ability also improved. The development from the second stage to the third stage was the most obvious, while from the third stage to the fourth stage became slower, but word recognition still showed improvement. This development was supported by the upward trend in mean scores on the whole formal test in Figure 3.

Figure 3*Mean Scores of the Whole Formal Test at Each Learning Stage***Reliability and validity**

Although this test includes two test contents: pronunciation and meaning, the correlation between these two parts was 0.686, thus the whole formal test was used as the unit of analysis for reliability and validity analysis.

Validity

Expert validity is needed to confirm the appropriateness of the pre-test content, thus the researchers invited three senior Vietnamese lecturers in Taiwan to review the suitability of the pre-test items, and then made modifications based on their feedback to finalize the pre-test items.

For the formal test, construct validity which assesses how well a test measures a theoretical construct or trait was applied. Previous studies generally believed that a learner's word recognition ability was positively related to the amount of time (s)he had learnt, thus the construct validity of this test was verified by differences in learning hours. Table 5 demonstrates that the means of Vietnamese word recognition tests increased over time, showing the different word recognition ability of different learning stages.

Table 5*Summary of Descriptive Statistics for each Learning Stage*

Learning Stage	<i>n</i>	<i>M</i>	<i>SD</i>
1 to 5 months	246	107.34	33.112
6 to 11 months	45	134.24	29.761
1 to 2 years	24	167.96	26.692
> 2 years	26	184.27	15.093
Total	341	121.02	38.870

Table 6*ANOVA Table for Different Learning Stages ($p < .001$)*

	Sum Sq.	df	Mean Sq.	<i>F</i>	η^2
Between groups	210813.48	3	70271.16	71.83***	.390
Within groups	329665.38	337	978.24		
Total	540478.86	340			

Then the ANOVA was used to see how learning stages affect word recognition ability, the *F* value obtained was 71.83, reaching a significant level ($p < .001$), which indicated that there were significant differences in the Vietnamese word recognition ability of students at different learning stages. The effect size shown in Table 6 is .390, which is large, indicating that the learning hours can explain 39% of the total variation in Vietnamese word recognition scores of college students in Taiwan.

Reliability

The Cronbach α coefficient of the internal consistency reliability obtained with 341 samples in the final test was 0.935, indicating that the items of this test are strongly correlated with each other and that they consistently measure students' word recognition ability. With the two parts of word pronunciation and word meaning, the α value obtained for the pronunciation part was 0.665, and the α value for the meaning part was 0.955, indicating that the scores of the meaning part had a high consistency, while the reliability of the pronunciation part was also acceptable. Students who perform well on one meaning item are so likely to perform well on others, while students' performance on one pronunciation item less significantly predicts their performance on other pronunciation items. It can be seen from Table 7 that the internal consistency coefficients of each stage ranged from 0.663 to 0.949. Except for the lower α value of stage 3, the α coefficients of the other three stages were all above 0.8. In general, the homogeneity of this test was high, and the internal consistency was quite ideal.

Table 7*Reliability Statistics*

	Stage 1	Stage 2	Stage 3	Stage 4
n	246	45	24	26
α	0.943	0.850	0.663	0.949

Description of word recognition ability of students at different learning stages**Stage 1**

In terms of pronunciation, the students in the first stage performed better in recognizing

words with a relatively high word frequency (that is, words repeated three times in the source vocabulary list), such as “nước (water), mấy (how many), tuần (week), lắm (very/so), dạ (huh/yes), phải (have to/must)”. These words can be regarded as "sight words" in elementary Vietnamese textbooks. Therefore, the correct rate was above 0.8. There were also some words with lower frequency, but because these words are almost constituted by single vowels with single consonants, they are quite easily recognized. This means that single vowels, single consonants and their grapheme-phoneme correspondences in Vietnamese were more easily identified by stage 1 students. It is worth noting that although the word “bia” (beer) is not a high frequency word, nor is it composed of a single vowel and a single consonant, its correct rate was the highest (0.89). This may be because the word was closer to the daily life of college students, so they remembered it more deeply.

For the formal test items with the lowest correct answer rates, there were two main types of errors - confusion of initial consonants and confusion of finals. First of all, regarding the initial consonants, most of the subjects encountered difficulties in distinguishing đ-[d] from l-[l]. Words with the initial sound of đ- such as “đông, độ, đêm” were misheard as words with the initial consonant of l- (lông, lộ, lên). The following are two examples of errors of initials confusion:

- | | | | | |
|---------|---------|---------|---------|---------|
| 52. (d) | a. đống | b. lông | c. long | d. đống |
| 83. (c) | a. độ | b. lộ | c. độ | d. lợ |

Based on our Vietnamese teaching experience and the observations of other Vietnamese teachers, it is easy for Vietnamese learners in Taiwan to confuse these two initials. The reason may be that đ- (IPA is /d/) and l (IPA is /l/) use the same articulation part - alveolar sound, but the pronunciation manner is different – đ- is a plosive sound, and l- is an approximant sound. It was difficult for students in stage 1 to distinguish the pronunciation of these two initials because there is no sound like đ- in Mandarin. In addition, “dùng-đùng” and “cái-gái” were also examples of initials confusion. The situation of c- (/k/) and g- (/ɣ/) is the same as that of đ- and l-. They use the same place of articulation, but the pronunciation manner is different; d- (/z/) and đ- cause confusion not only because of the similar manner of pronunciation, but also because their word forms are similar. Learners with such confusion may have not fully mastered the grapheme-phoneme correspondence of these two sounds.

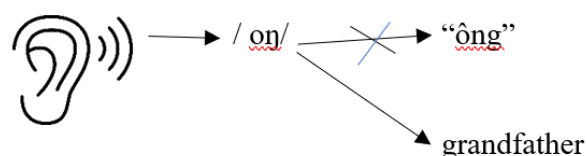
The other type of error was confusion of word finals. Confusion of finals was more common than confusion of initials, and for stage 1 students, it was even more difficult to identify finals than initials. Therefore, the correct rate of the items that belonged to the error type of finals confusion was low. Items such as “ăn, tầng, đều, hết, cần” all contain codas. To combine the pronouncing of main vowels and codas, learners must integrate their pronunciation skills and knowledge of grapheme-phoneme correspondence. This demonstrated that the knowledge of grapheme-phoneme correspondence of students in stage 1 was still deficient and needed to be strengthened. In addition, because these test items intentionally used similar multiple choice sounds as distractors, such as “ăn-anh-ân, đều-đều-đề-đều, hết-hết, cần-cần- còn”, the correct answer rates of these items were quite low, with the lowest being “ăn” (0.22). The most common confused vowels were ă (/ă/) and a (/æ/) in “anh”, e (/ɛ/) and ê (/e/), and â (/â/) and u (/u/).

In the meaning part, students’ familiarity with vocabulary positively influenced their discernment of a word’s meaning. The higher the familiarity, the higher the correct rate, such as “đi (go), học (learn), phở (Vietnamese Pho), uống (drink), cô (teacher), bốn (four)”. High

frequency words with great relation to students' lives have higher correct answer rates. Some words had a higher correct rate of identifying the meaning than pronunciation, such as "bốn (four), phở (Pho), uống (drink), ông (grandpa)". Although students might recognize the sound of the word (auditory aspect), they could not identify the form of the word (visual aspect). Figure 4 illustrates an example of this case; students heard the sound /oŋ/, knew what that meant ("grandfather"), but didn't know (or recognize) its correct visual form (i.e. its dictation) – "ông".

Figure 4

Illustration of the incomplete process of perceiving word form and meaning



The type of errors that students were likely to make at this stage were "similar pronunciation, wrong meaning" and "similar word form, wrong meaning". In some cases, it was confusing to decide which case should be classified into which type of error. Item 15 is a typical example.

15. (d) a. tôi b. đôi c. tối d. tôi
 (c) a. I b. dinner c. evening d. late night

When presented with the audio of "tối" (evening), students misheard "tối" as a similar-sounding "tôi" (I), so they chose the wrong meaning "I". This is a "similar pronunciation, wrong meaning" error. However, based on the students' specific responses, this test item could actually also be classified as "similar word form, wrong meaning" type of error. There was no "tôi" in the options of the pronunciation question of the word, however, students still chose its corresponding meaning ("I"). Even the subjects who chose the correct answer for the pronunciation - "tối", still chose the wrong meaning "I". There may be two explanations: (1) students were not sure about the word form of "tôi"; (2) students recognized the form and pronunciation of "tôi", but they did not grasp its semantic meaning, so they chose the more familiar semantic meaning, that is, "I". Generally, the low correct rate in the word meaning part of the formal test can be attributed to the students' incomplete knowledge of the word form-sound-meaning correspondence. As a result, the pronunciation of the word may be answered correctly, but the meaning of the word may be answered incorrectly. Table 8 features the test items with the lowest correct rate of word meaning, which correspond to the two types of errors mentioned above.

In addition, students at this stage had a strong understanding of words with specific meanings (content words), but the semantic meaning of function words was quite difficult for them. This could explain that the test items with the highest correct rate of students at this stage were all content words. Most of them were nouns.

Table 8*The Responses of the Test Items with the Lowest Correct Rate in Meaning at Stage 1*

Item No.	Word	Pronunciation options	Correct answer	Incorrect option, most selected	Corresponding pronunciation option, most selected	The word corresponding to the incorrect option selected
15	tối	tỏi-đôi-túi-tối	evening	I	tối	tôi
75	đôi	đôi-đói-tôi-đợi	double	hungry	đôi	đói
89	nghĩ	ngĩ-nhĩ-nghĩ-nhĩ	think	rest	ngĩ	ngỉ

To sum up, students in the first stage mainly used the visual-phonetic route for word recognition, but they could only recognize words with single vowels. The knowledge of the grapheme-phoneme correspondence of words with complex finals still needed to be strengthened. At this stage, the ability to recognize the word's pronunciation was better than the meaning.

Stage 2

Regarding the pronunciation assessment, students in the second stage generally performed better in recognizing words with high word frequency or high familiarity. The types of errors seen in this stage were similar to those of stage 1 students, besides the initial confusion (mostly “d-đ” and “đ-l”), final confusion (mostly “ã-a(nh), ây-ay, e-ê, â-ư”) and tone confusion. The following two test items are examples of “tone confusion” type of error:

79. (d) a. đê b. đều c. đèo d. đều
 86. (b) a. ngát b. nhất c. nhật d. mắt

Since students in stage 2 have learnt Vietnamese for a longer period of time than students in stage 1, their grapheme-phoneme correspondence knowledge was stronger. Therefore, although these students made similar mistakes as stage 1 students, their correct rates were much higher than that of stage 1 students.

Stage 2 students were able to grasp the meanings of common words related to their life experience, including function words with no specific meaning (such as “rất (very), khoảng (about), hoặc (or)”). This was a key difference from the stage 1 student performance. There were mainly three types of errors that students at this stage made in the meaning part of words, namely “similar word form, wrong meaning”, “meaning confusion” and “unclear word meaning error”. Among them, the first type of error was the most common. Items 35 and 74 below are examples of “meaning confusion” and “unclear word meaning error”, respectively.

35. (b) a. phở b. phải c. thả d. phải
 (c) a. 需要 need b. 左邊 left c. 必須 have to d. 是嗎 is it
 74. (b) a. đón b. đon c. đun d. đôi
 (b) a. 接 pick up b. 單子 bill c. 蹲 squat d. 雙 couple

When students saw the word “phải” in item 35, they might think of “phải không”, and choose the wrong meaning “is it?” (是嗎). In elementary Vietnamese teaching materials, texts

containing “phải không” are common, while “phải” (必須, must) was rarely seen, so students were more likely to confuse it. In the case of item 74, it is likely because the students did not know the meaning of the word “đơn” (單子, bill), they chose a total unrelated meaning (蹲, squat), which falls under the “unclear word meaning” type of error.

Although there was still a gap between the correct answer rates of pronunciation and meaning at this stage, the specific correct rate shows that the knowledge of the phoneme-meaning correspondence of stage 2 students has improved.

Stage 3

Students in the third stage performed better than those in the previous two stages in terms of word pronunciation and meaning. The students in the second stage had the highest correct rates of word pronunciation in the range of 0.93 to 1.00. In the third stage, the highest correct rates of word pronunciation all reached 1.00, and the highest range of word meaning correctness was also very high (0.97-1.00). Although the same type of errors still occurred in the pronunciation part, the error rate reduced significantly, suggesting that the pronunciation of those high frequency words or quite familiar words were fully understood. The most confusing sounds for students in the three stages included ă-a(nh), u-o, â-f, đ-l, c-g. Vietnamese teachers should teach these sounds more carefully when teaching phonetics to elementary level students to prevent confusion.

In terms of word meanings, the researchers found that students at this stage had a better mastery of the parts of speech in terms of the amount and diversity than those in the previous two stages. Specifically, students in stages 1 and 2 commonly identified nouns, followed by verbs and function words. By stage 3 there were also adjectives such as “ngon” (delicious) and “đẹp” (beautiful). As for the types of word meaning errors, while the common error type in the first two stages was "similar word form, wrong meaning", at stage 3, the most common error type was “similar pronunciation, wrong meaning”, such as items “ăn” (eating), “tự” (self), “cái” (piece). This result suggests a higher grapheme-phoneme correspondence ability of students. It can be seen from the pronunciation options that the students mistakenly selected because they could not distinguish between two similar sounds, such as *ăn-anh*, *tự-từ*, *cái-gái*. That made them wrongly select the corresponding word meaning. At this stage, students' extraction of word meaning was only affected by the pronunciation of the word, and there was no confusion between the pronunciation of the word and the meaning of the word due to unclear word form.

Stage 4

By stage 4, the 10 highest correct rates were all 1.00. The number of test items with a pronunciation correct rate of 1.00 was significantly higher than that of stage 3 students (21 items, compared to 11 items of stage 3). Additionally, the number of low frequency words also increased, such as “đợi” (wait), “bớt” (decrease), “luôn” (always), “xuân” (spring). Not only are these words less familiar, but their final structures are also quite complex (compared to just combining single vowels with initials), which showed that students at this stage had a fairly complete understanding of the grapheme-phoneme correspondence. There are also three types of errors in this stage, namely confusion of: initial consonants, finals, and tones. Finals can be regarded as the most complicated part of the Vietnamese syllable structure and difficult to master. Therefore, Vietnamese phonetic instruction should focus on this and increase the quantity of practice time.

By stage 4, the number of test items with meaning correct rates range from 0.98 to 1.00 increased significantly. Notably, the number of function words in these words was higher than that

of the first three stages. In addition, nouns/pronouns with high correct rates in this stage also involved a wider range of topics than those in the first three stages. In the first three stages, the students were more familiar with words expressing quantity and personal pronouns, while the nouns with highest correct rates of meanings in stage 4 also included words belong to different topics, such as money (tiền), season (xuân-spring), food (sữa-milk, thịt-meat), time (tuần-week). This meant that at this stage, students' cognition of semantics had developed to a certain extent.

The types of errors made by students in stage 4 in the meaning part included “similar pronunciation, wrong meaning”, “confusion of meaning”, “unclear meaning error” and “similar form, wrong meaning”. Among them, the proportion of “confusion of meaning” was the largest, followed by “similar pronunciation, wrong meaning”. Table 9 displays the list of the word recognition types of error mentioned in this study.

Table 9

List of Word Recognition Types of Error

Type of error	Description	Example
Confusion of initials	Occurs when similar or easily confused initial consonants lead to the wrong answer of pronunciation.	The audio recording pronounces “đo” [dɔ], but mishear [d] as [l] and choose “lo” [lɔ].
Confusion of finals	Occurs when similar or easily confused finals lead to the wrong answer of pronunciation.	The audio recording pronounces chẵn [cǎn], but mishear [ǎn] as [æŋ] and choose “chanh” [cæŋ].
Confusion of tones	Occurs when similar or easily confused tones lead to the wrong answer of pronunciation	The audio recording pronounces “đề”, but mishear ['] (tone value is 21) as ['] (tone value is 313) and choose “đề”.
Similar word form, wrong meaning	Choose the wrong word meaning due to confusion caused by similar word forms/dictations	The dictation of “theo” (follow) is similar to “treo” (hang), thus mischoose “treo”.
Similar pronunciation, wrong meaning	Choose the wrong word meaning due to confusion caused by similar pronunciation	“Cái” (a classifier/thing) is pronounced similarly to “gái” (female), thus mischoose “gái”.
Confusion of meaning	Errors caused by confusion about the meaning of words	<u>The correct answer is “<u>請</u>” (please), but choose “<u>請問</u>” (excuse me).</u>
Unclear word meaning error	If the pronunciation answer is correct but the chosen meaning is unrelated, it's classified as this type.	<u>The correct answer is “<u>看到</u>” (see), but choose “<u>那麼</u>” (so).</u>

Discussion

The results of this study showed that as the number of learning hours of students increased, their word recognition performance also improved. This result was consistent with the results of previous related studies (Meng et al., 2016; Huang, 2001). The performance differences between the stages were not consistently significant. The word recognition ability developed better in some stages, making the difference between some pairs of stages more obvious, while some stages were relatively slow, resulting in no significant difference between that pair of stages (Hung et al., 2005).

When our formal test was administered, the students in stage 1 had been learning for less than four months, so their vocabulary size was still limited. In addition, the Vietnamese phonetic system is relatively complicated, so it is difficult for students to learn and master quickly. As for the students in the second and third stages, because of the longer learning time, they were exposed to more words and were more familiar with the Vietnamese pronunciation, so their performance in the listen and identify part was naturally better than that of the students in the first stage. The difference between stage 3 and stage 4 was relatively small. This is perhaps because the students were largely familiar with the phonetic system, and their listening, speaking, reading and writing skills were developed in a more balanced way. In addition, the uneven number of subjects in each stage was another possible reason for the (in)significant difference.

Furthermore, the mean scores (see Table 4) indicate that the meaning part was more difficult than the pronunciation part. This difference may be related to the students' word recognition models. Vietnamese is an alphabetic language. Vietnamese learners, especially primary learners, often adopt a dual-route word recognition model or analogy theory (Harris & Colheart, 1986; Huang & Hanley, 1994; Goswami, 1986, 1990, 1991). Vietnamese has no irregular words - the same letter combination will consistently have the same pronunciation. When a learner encounters a new word, as long as he/she has learned the word(s) that is similar in spelling or contains the same letter string, he/she can pronounce it, although he/she may not understand its meaning. Consequently, it is understandable that the subjects performed better in the pronunciation part than in the meaning part.

According to the subjects' responses, primary learners used the visual-phonetic route as the main manner to recognize words. In stage 4, because the students had acquired a certain amount of vocabulary, their knowledge of grapheme-phoneme correspondence had also been strengthened significantly. Therefore, in addition to the visual-phonetic route, these students also used analogy theory to recognize words. This is in line with Ehri (1994)'s point of view. Because the students in the first two stages were developing knowledge of grapheme-phoneme correspondence, the test items that they got high correct rates were primarily words with high word frequency and high familiarity. The students in stage 3 and stage 4 already possess nearly perfect grapheme-phoneme correspondence ability, resulting in a higher proportion of low-frequency or less familiar words in their list of words with the highest correct rate. As Wang and Koda (2007) concluded, Chinese students are less sensitive to the grapheme-phoneme correspondence rules because their L1 is a logographic writing system, while Vietnamese has a Roman alphabetic writing system. The most common types of errors encountered in word sound recognition included "confusion of initials", "confusion of finals" and "confusion of tones", among which, "confusion of initials" was the most common and accounted for the largest proportion, followed by "confusion of initials". The most common examples of confusion are đ-l, c-g, ã-a(nh), e-ê, â-u, u-o, as well as the deep-heavy tone

and falling-asking tone. These examples of confusion arise not only from the similarities in articulation parts and pronunciation manners, but also from the absence of these sounds in the Chinese phonetic system. The phonetic differences between the two languages contributed to these errors.

Students at all stages were more sensitive to words with high word frequency or high familiarity related to their life experiences, which enabled them to perform better on such words. This finding further supports the past research of Muljani et al. (1998) and Akamatsu (1999).

Conclusion and Suggestions

This research developed an elementary Vietnamese word recognition test suitable for Taiwanese undergraduate students, explored the performance of Vietnamese word recognition ability of Taiwanese students, and analyzed the common errors made by Taiwanese undergraduate students in Vietnamese word recognition, along with possible causes of these errors. The official question book of this test was obtained after a pre-test, and demonstrated high-quality discrimination and ideal reliability and validity. Therefore, Vietnamese teachers in Taiwan can use this test to assess students' elementary Vietnamese word recognition ability. Based on the test results, teachers can make appropriate adjustments to teaching content and teaching methods according to students' common error types.

This test is an online multiple-choice test that can be administered without an examiner. However, its convenience does not guarantee that students will be able to pronounce the words correctly and may overestimate their knowledge of basic sight words or common words. Therefore, in the future, compilers of Vietnamese word recognition tests may consider using individual tests that allow subjects to pronounce the test words. If the words can be read quickly, they are likely sight words or common words with high familiarity.

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Appendix A: Examples of Word Recognition Tests

Test name	Published country/place	Author
Wide Range Achievement Test 5 (WRAT5)	USA	Wilkinson & Robertson, 2017
Woodcock-Johnson Psychoeducational Battery- Revised (WJ-R)	USA	Woodcock & Johnson, 1989
Chinese Literacy Scale for Preschool and Primary School Children	Hong Kong	Li, 1999
Chinese Character Recognition Test	Taiwan	Huang, 2001
The Battery of the Chinese of Pupils	Taiwan	Hung et al., 2003
English Word Recognition Test (for Taiwanese junior high school and elementary students)	Taiwan	Hung et al., 2006