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MEASURING INDONESIAN EFL LEARNERS' ENGLISH VOCABULARY KNOWLEDGE: A RASCH ANALYSIS APPROACH

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Abstract
This study sought to, first, measure Indonesian EFL learners' vocabulary knowledge across four modalities, i.e. Active Recall, Passive Recall, Active Recognition, and Passive Recognition; second, determine whether or not there were statistically significant differences between male and female participants' vocabulary knowledge and third, determine whether or not the participants' vocabulary knowledge across the four modalities were correlated. Data were collected by administering four sets of vocabulary tests to 71 EFL learners at an English Department of a higher education institution in Indonesia. Data were analyzed using Rasch analysis and *Spearman's-Rho* correlation technique. The results showed that the participants performed better on the recognition tests than on recall tests. No statistically significant difference was found between male female participants' vocabulary knowledge. Moderate and strong correlations were found among the participants' Passive Recall and Active Recognition, Passive Recall and Passive Recognition, and Active Recognition and Passive Recognition.

Keywords: EFL, Rasch analysis recall, recognition, vocabulary knowledge

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Introduction

The centrality of learners' vocabulary knowledge as a defining factor in the success of EFL learning has been repeatedly identified in research. Vocabulary knowledge has been found to impact on EFL learners' performance the four language skills, i.e., reading (e.g., Zhang, 2012; Thatsani, 2018; Binder, Cote, Lee, Bessette, & Vu, 2017), listening (e.g. Stæhr, 2009; Teng, 2016), speaking (e.g. Uzer, 2017; Putri, & Refnaldi, 2020; Kiliç, 2019), and writing (e.g. Al Arif,2017; Christina, 2021). Awareness of such a centrality has also made learning vocabulary as part of most ESL and EFL curricula and examinations across the globe. However, not all English words learned by EFL learners can be readily accessed when they are needed both for receptive and productive purposes. It depends on learners' word retention or learners' ability to retrieve the words when they need them. This is because some of the learned words will become either passive or active in learners' repertoires, depending on the intensity and frequency of encounter and use of the words by the learners (Laufer & Rozovski-Roitblat, 2014).

In an EFL context like Indonesia, the use of English in daily life is rare. Consequently, the intensity and frequency of encounter and use of learned English words by Indonesian learners is also low. English is mostly practiced by learners during classroom learning. This, in turn, impacts on the learners' word knowledge, and plausibly on the learners' English performance. As such, it is important for EFL educators to regularly assess and re-assess learners' retention of taught vocabulary as it will provide beneficial insights in understanding learners' learning achievement. Many studies on vocabulary knowledge (e.g. Feng, 2015; Eckerth & Tavakoli, 2012; Zhang & Lu, 2015; Pignot & Shahov, 2012; Laufer & McLean, 2016; Stewart, 2014; Mann & Marshall, 2012; Stubbe,2013; Türk, & Erçetin, 2014) drew on the concept of four degrees or modalities of knowledge of meaning (Laufer, Elder, & Hill, 2004). The concept distinguishes vocabulary knowledge into four types. First, *Active Recall* that refers to the ability to retrieve L2 equivalence of a given L1 word without cue; second, *Passive Recall* that refers to the ability to retrieve L1 equivalence of a given L2 word without cue; third, *Active Recognition* that refers to the ability to identify L2 equivalence of a given L1 word among several options provided; and fourth, *Passive Recognition* that refers to the ability to identify L1 equivalence for a given L2 word among several alternatives provided.

Despite the facts that vocabulary knowledge plays a central role in determining the success of EFL learning and the low intensity and frequency of use of learned English vocabulary by Indonesian EFL learners, research that specifically measures the learners' vocabulary knowledge across different modalities of vocabulary knowledge (Laufer et al., 2004) is so far still scarce. Most studies focused on vocabulary size (e.g., Novianti, 2016; Sudarman & Chinokul, 2018). In light of this, the present study sought to, first, measure Indonesian EFL learners' English vocabulary knowledge across the four modalities; second, determine whether or not there were a statistically significant differences between male and female participants' vocabulary knowledge; and third, determine whether or not the participants' vocabulary knowledge across the four modalities were correlated.

Literature Review

Knowing a word

Any vocabulary teaching and, consequently, testing should depart from the concept of knowing a word or lexical knowledge as it provides the framework of what to teach and what to test. However, scholars propose different concepts of lexical knowledge. Milton (2009), for example, suggests that lexical knowledge comprises receptive and productive divisions. The receptive knowledge refers to words that one recognizes, while the productive division refers to words that one recognizes and is able to use for productive purposes. Nation (2001), Milton and Fitzpatrick (2013) suggest three aspects involved in knowing a word or lexical knowledge: form, meaning, and use, both for receptive and productive purposes. Knowing the form comprises knowledge of how a word sounds and how it is written. In addition, it also involves knowledge of word parts such as prefixes, suffixes, stems and word family. Knowing the meaning involves knowledge of meanings a word could convey, the web of concepts and referents or denotative meaning associated with the word, its synonyms and antonyms, and its connotation in particular contexts. Knowing the use involves knowledge of; first, patterns in which a word usually appears (grammatical function); second, other words that usually appear with the word (collocations) and, third the situations in

which the word appears and its frequency of use. However, Laufer and Paribakht (1998) remind that lexical knowledge should be perceived as "a continuum consisting of several levels and dimensions of knowledge" (p.367) rather than a dichotomy of knowing or not knowing. The level may start with knowledge of the form only and increasingly develops into a full command for use in communication (Laufer & Paribakht, 1998)

Nevertheless, Pignot and Shahov (2012) suggest that, although a wealth of literature is available on foreign language vocabulary acquisition, all are basically centered on a simple question of "what does knowing a word mean?" or what does lexical knowledge involves?. The most uniformly identified answer among language learners has known a word means the ability to recognize its form and meaning when it is spoken and written (Nation, 2010). However, Milton (2009) argues that such a concept of knowing a word is oversimplified. They contend the concept separates form from meaning and overlooks the complexity of vocabulary knowledge that is more than just knowing the two.

Testing vocabulary knowledge

Assessments of vocabulary knowledge mostly focus on size, i.e. the number of words one knows, and depth, i.e., to what extent one knows a word (Milton, 2009). Size tests mostly comprise of L1 –L2 word matching items selected based on different word-frequency groups. As for the depth test, the issue is not as straightforward as that of the size test because its scope depends on the concepts of lexical knowledge the test draws on. However, Laufer et al. (2004) argue that, regardless of the concept of lexical knowledge a test is built on, "the form-meaning link is nevertheless central to whatever being tested" (p.204) for the test is basically seeks to assess whether the meaning of the target word is known by test takers or not. Therefore, vocabulary tests should first and foremost tap test takers ability to identify the correct association between form and meaning (Laufer et al., 2004).

Pertaining to one's ability to comprehend or to produce a word, a distinction has been commonly made between passive-receptive and active productive vocabulary knowledge (Laufer et al., 2004; Milton, 2009). However, the distinction has not been uniformly understood by researchers due to interchangeability between the two types of vocabulary knowledge in real test situations. In order to resolve the problem, Laufer et al. (2004) propose the concept of four degrees knowledge of meaning that further distinguish the passive-receptive and active productive vocabulary knowledge into the ability to supply " the form for a given concept vs. Supplying the meaning for a given form; and recall vs. recognition of form or meaning" (p.206). Based on this concept, they introduced a framework for testing vocabulary knowledge that consists of: first, Active Recall, i.e. the ability to retrieve L2 equivalence of a given L1 word without cue; second, Passive Recall, i.e. the ability to retrieve L1 equivalence of a given L2 word without cue; third, Active Recognition, i.e. the ability to identify L2 equivalence of a given L1 word among several options provided; and fourth, Passive Recognition, i.e. the ability to identify L1 equivalence for a given L2 word among several alternatives provided. This concept of vocabulary knowledge is used in the study reported in this article.

Research on Vocabulary Knowledge

Studies on vocabulary knowledge, i.e. size and depth, have largely focused on its impacts on language learners' global proficiency in the language being learned and mastery of individual

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language skills. For the former, the literature shows that studies in different contexts, for example, on Spanish (Miralpeix & Munoz, 2018) Danish (Stæhr, 2008) Omani (Roche and Harrington, 2013), Malaysian (Mohd Nasir, Ab Manan, & Azizan, 2017), Chinese (Ling, 2015) EFL Learners confirmed that vocabulary size determines the learners' overall English proficiency.

Studies on the latter, however, show mixed findings. For reading, research by Sen and Kuleli (2015), Rashidi and Khosravi (2010) on Iranian EFL learners, Ma and Lin (2015) on Taiwanese, and Nouri and Zerhouni (2016) on Moroccan EFL learners found that vocabulary depth predicted reading performance better than size. But a study by Li and Kirby (2015) on Chinese EFL learners found that vocabulary size predicted reading comprehension better than depth. Similar findings were also reported by Zhang and Annual (2008) on their study of Singaporean ESL learners. Moreover, studies on listening comprehension of Chinese EFL learners (Teng, 2014) indicated that both vocabulary breadth and depth significantly predicted listening comprehension. However, study by Afshari and Tavakoli (2017) on Iranian EFL learners showed that vocabulary size was a better predictor of listening comprehension. As for speaking performance, Milton (2013) suggests that the relationship between vocabulary knowledge and L2 speaking performance has been understudied. Among few studies on the relationship are Enayat and Derakhsan (2021) who studied Iranian EFL learners and found that vocabulary size was a better predictor of speaking performance than vocabulary depth. However, Mirapex and Munoz (2017) showed that vocabulary size moderately predicted speaking performance and also other skills among Spanish EFL Learners. Last but not least, studies on the relationship among vocabulary size and depth and writing performance, e.g. Wu, Quentin Dixon, Su, and Zhang (2021) on Chinese EFL learners showed that depth exerted significant impacts on writing performance. Yet, Lee's (2014) and Dabbagh and Janebi Enayat's (2021) studies on Korean and Iranian EFL learners respectively showed that vocabulary size was a significant predictor of writing performance. Overall, variations in the research findings on the association among vocabulary size and EFL learners' performances in the four language skills suggests that both size and depth exert, to a more or lesser degree, impact on the skills. However, studies that explore the root of the variations are needed.

As for research on English vocabulary knowledge focusing on the four modalities, Laufer et al. (2004) found that active recall was the most difficult modality and, therefore, reflected the strongest vocabulary knowledge. Similar findings also reported by Makarchuk (2013), Karakoç and Köse (2017).

Methodology

Participants

The participants of the present study were 71 semester 6 English department students at a state higher education institution in Indonesia. They comprised all registered students of the department for semester 6. 28 of them were male and 48 were female coming from 3 groups, two of which consisted of 20 students, and the other one consisted of 21 students. The choice of having all participants of the same semester was based on the characteristic of the data collection of the study that was a language test in nature. As such, the items of the test should be well targeted to a specific group of participants.

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Data collection

The data were collected through administration of 4 sets of written English vocabulary tests to the 3 groups of participants. The first set focused on active recall. The second set tested active recognition. The third set tested passive recognition, and the fourth set tested passive recall. The time limit for each round was 20 minutes with a 5-minute break in between. The administration of the tests for each group was conducted in different times and places as agreed by the participants.
4 sets of English vocabulary tests were used to collect the data. Each set contained 50 vocabularies purported to measure one of the four modalities of vocabulary knowledge (Laufer et al., 2004). The first set aimed at measuring Active Recall where Indonesian words were provided and the participants were asked to supply the words' equivalences, e.g. Kendaraan =..... The second set was purported to measure Active Recognition where participants had chosen one English equivalence from 4 alternatives provided for Indonesia words, e.g. Terjadi= a. Occur, b. Core, c. Goal, d. Undergo. The third set sought to measure Passive Recall in which English words were provided and the participants should supply the Indonesian equivalences, e.g. Similar=.....

The last set sought to measure Passive Recognition where English words were given and the participant had to choose one correct Indonesian equivalence from 4 alternatives provided, e.g. Occur= a.Tujuan, b. Inti, c.Terjadi, d. Menjalani. Responses to the items were dichotomously scored. Every correct response was scored "1", and incorrect response was scored "0".
All the 50 items in the 4 test sets were similar and related to each of the items in the sets. The items of the second first set (active recall) and the second set (passive recall) were identical. Similarly, the items of third and the fourth sets were also identical and of English equivalences for the Indonesian words of the first and the second sets. Such an arrangement of test items was meant to ensure that the test measures the four modalities of vocabulary knowledge with references to the same items. In order to minimize cross test-sets checking by the participants, the order of the items in each set was randomized and each test set was separately administered.

The 50 items in each test sets were adopted from Academic Word List (Coxhead, 2000) that contains 570 English words that appear frequently in academic texts. The selection of the items started with randomly picking 200 words from the list. These words were then compared with the words contained in various learning materials from different subjects the respondents had previously taken in during their study at the department. 50 words of the list that frequently appeared in the learning materials were chosen as test items. This was to ensure that the participants had already encountered the word before the test.

Data analysis

Data analyses were conducted in two phases using Rasch analysis (Rasch, 1980; Bond & Fox, 2013) and nonparametric inferential statistical test . The first phases sought to examine the validity and reliability of the data sets. While, the second phase sought to measure Indonesian EFL learners' English vocabulary knowledge across the four modalities, to determine whether or not there were a statistically significant differences between male and female participants' vocabulary knowledge, and to determine whether or not the participants' vocabulary knowledge across the four modalities were correlated.

Data analysis in the first phase was conducted using Wisteps Rasch analysis computer software (Linacre, 2006). The rationales for the adoption of Rasch analysis in the present study are: (1) Rasch analysis facilitates assessment of validity and reliability of the data, and (2) Rasch analysis, through Wisteps software, presents the estimates of item difficulty and person ability on a common linear logit scale. Hence, the evolution of a participant's ability against different levels of item difficulty can be performed at the same time. The higher the position of an item on the logit scale which is indicated by its measure value, the more difficult the item is. Similarly, the higher the position of a person on logit scale, the higher the possibility for him or her to score correctly on items which are below his or her measure. These two statistical features were needed to meet the objectives of the study. Data analysis in the second phase was performed on IBM SPSS Computer Software Version 22.0.

Findings

Validity and reliability

Before embarking on further assessment of the estimates produced by Rasch analysis, it is necessary to evaluate the validity and reliability of the instruments. Information on validity in Rasch analysis is provided by two indices, i.e. *Item Polarity* that indicates the contribution of items to the construct being measured, and *Item Fit Statistics* that indicates the directionality of the items to the construct. Information on reliability is provided by *Item Reliability Index* that indicates the reproducibility of item ordering, and *Item Separation Index* that shows the separation of items on a continuum of increasing intensity (Bond and Fox, 2013).

Assessment of the Item Polarity of the data resulted from each of the four sets of the tests showed that all the items had positive values that ranged between .00 to .56 for Active Recall, .01 to .53 for Passive Recall, .02 to .66 for Passive Recognition, and .04 to .59 for Active Recognition. For Item Fit Statistics, all the items of the four test sets had an *Infit Mean Square* value within an acceptable range of 0.5 to 1.5 (Linacre,2006). The values ranged from .63 to 1.11 for Active Recall, .83 to 1.20 for Passive Recall, .72 to 1.35 for Passive Recognition, and .63 to 1.10 for Active Recognition. As for reliability, the Item Reliability Indices were .81, for Active Recall , 90 for Passive Recall, .94 for Passive Recognition, and .93 for Active Recognition. The Item Separation Indices showed the items for Active Recall test can be separated into 1.45 levels of difficulty, 2.72 for Passive Recall, and 4.11 for Passive Recognition, and 3.56 for Active Recognition. Hence, for the Active Recall that showed low separation, overall, the data showed that the instruments were valid and reliable.

The participants' performances across four modalities of vocabulary knowledge

To define the participants' knowledge in the four modalities of vocabulary knowledge, assessments of *means measures* for items and persons of each modality (Table. 1.) were conducted. The table shows that the mean measures for Active Recall were 4.90 S.D. =1, 93, which was considerably higher than that of Passive Recall, mean measure= 2, 47, Passive Recognition, mean measure=-.70, and Active Recognition, mean measure=-1.08. These indicated that the Active Recall test was the most difficult one for the participants, followed by, in a descending order of

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difficulty, the Passive Recall test, the Passive Recognition test, and the Active recognition test. Furthermore, with the means of measures for personal ability for all the 4 tests set at .00. and the means measures for items being above that of persons', it can concluded that the two recall tests were relatively difficult for the participants. On the contrary, the means of measures for both Active and Passive Recognitions were below .00, indicating that the two recognition tests were relatively easy for the participants. Thus, the participants performed better on recognition tests than on recall tests.

Table 1. *The participants' performances across four modalities of vocabulary knowledge*

Active Recall						**Passive Recall**					
		Raw Score	Count	Measure	Model Error			Raw Score	Count	Measure	Model Error
Mean	I	3.9	70.0	4.90	1.14	Mean	I	14.3	70.0	2.47	.67
	P	2.7	32.0	-.07	1.18		P	9.2	44.0	.00	.51
S.D.	I	10.5	1.14	1.93	.56	S.D.	I	17.5	.1	2.43	.49
	P	2.1	.0	.43	.52		P	4.6	.1	1.07	.12
MAX.	I	67.0	70.0	6.53	1.84	MAX.	I	70.0	70.0	6.03	1.85
	P	1.64	.14	1.96	1.03		P	28.0	44.0	3.92	1.09
MIN.	I	.0	70.0	-4.11	.29	MIN.	I	.0	69.0	-6.09	.26
	P	.0	32.0	-4.97	1.68		P	1.0	43.0	-3.27	.39
Passive Recognition						**Active Recognition**					
		Raw Score	Count	Measure	Model Error			Raw Score	Count	Measure	Model Error
Mean	I	41.3	70.0	-.70	.35	Mean	I	43.7	68.0	-1.08	.36
	P	29.5	50.0	.00	.38		P	29.5	50.0	.00	.38
S.D.	I	69.0	70.0	15.5	.0	S.D.	I	12.7	.0	1.49	.14
	P	10.2	.0	.34	.07		P	10.2	.0	1.38	.34
MAX.	I	1.64	.14	1.96	1.03	MAX.	I	67.0	68.0	1.12	1.03
	P	48.0	50.0	3.31	.74		P	48.0	50.0	3.31	.74
MIN.	I	13.0	70.0	-5.16	.28	MIN.	I	21.0	68.0	-5.16	.29
	P	6.0	50.0	-3.60	1.38		P	6.0	50.0	-3.60	.07

Notes: I= Item, P=Person

Comparisons between male and female participants vocabulary knowledge

Due to the nor-normal distribution of the data, the statistical comparisons between male and male participants' vocabulary knowledge across the four modalities were conducted using the nonparametric *Mann-Whiney U* test. The results show that there was no statistically significant difference, $p = >.05$. These results indicated that both male and female participants had an equal performance on the test sets.

Correlations among participants' vocabulary knowledge

Using *Spearman's rho* non-parametric correlation, moderate and strong associations were identified between: (1) Active Recall and Passive Recall, *r*=.411, *p=.000;* (2) Passive Recall and Active Recognition, *r=600, p=.000*; (3) Passive Recall and Passive Recognition, *r=569, p=.000;* and (4) Active Recognition and Passive Recognition, *r=783, p=005*.

Discussion

The present study sought to measure the participants' vocabulary knowledge across the four modalities of vocabulary knowledge. The findings showed that they performed better on recognition tasks than on the recall tasks. This concurs with Laufer *et al.* (2004) Makarchuk (2013), Karakoç & Köse (2017) who also found similar findings in their studies. The findings and the centrality of vocabulary mastery in whole discourse of EFL learning, to some extent, could be linked to why Indonesian EFL learners' development of active productive language skills, i.e. speaking and writing, tends to be slower than that of receptive language skills, i.e. reading and listening (Inayati, 2015; Ampa & Akib, 2019). Research by Asyrafi, Makmur, and Marzulia (2018) identified lack of vocabulary as the first problem faced by Indonesian EFL learners in developing their productive skills.

In terms of vocabulary size, the findings also indicated that, for the 50 words tested, the participants' passive vocabulary were larger than their active counterparts, which is also a common feature of passive English, and concur with Mangewa (2013), and Wero, Machmud and Husain (2021), who also found similar findings in their study of the vocabulary size Nevertheless, this highlight the need for EFL educators at the research site and possibly in Indonesia in general to evaluate the extent to which vocabulary mastery has been given sufficient portion in the curricula and to promote a more productive skills oriented English teaching. This is important considering the foreign language status of English in Indonesia where English learning sessions, whether in formal or informal education setting, are the only situation for most Indonesian EFL learners to practice their English (Wirza, 2018; Marcellino, 2015).

This study showed that there was no difference in the vocabulary knowledge among male and female participants, suggesting that they performed equally on the tests. This findings concurred with Mehrpour, Razmjoo, and Kian's (2011) study on Iranian EFL learners, and Duy and Nguyen's (2019) study on Vietnamese EFL learners, but contradicted Llach and Gallego (2021) who found female Spanish EFL learners had a better receptive vocabulary knowledge than their male counterparts. As for the moderate to strong association among the respondents vocabulary knowledge across the four modalities, especially between Passive Recall and Active Recognition, and between Active Recognition and Passive Recognition, the findings suggest that any modality of the pairs could predict its counterpart. However, further studies are needed to explore the prediction.

Conclusions

Although limited in scope, the present study provided some information on the nature of participants' vocabulary knowledge. It could be extended and pondered on in order to better understand the relationships among different modalities of vocabulary knowledge, and, to a larger

extent, EFL learners' achievements in general. The discussion of the findings highlights the need for more attention to vocabulary teaching and learning as it is a vital aspect in EFL education.

Innovative techniques and strategies in for vocabulary teaching should be sought and implemented. The variations between the findings of the present students and other studies in the field could also serve as new areas to explore and describe. Therefore, further research is recommended, particularly ones that study the relationship between different vocabulary learning and teaching strategies and vocabulary knowledge. In addition, as studies on vocabulary knowledge in relation to internet or IT mediated English language acquisition is also worth conducting.

Disclosure statement

The author certifies that he has no affiliations with or involvement in any organization or entity with any financial or non-financial interest in the subject matter or materials discussed in this paper.

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