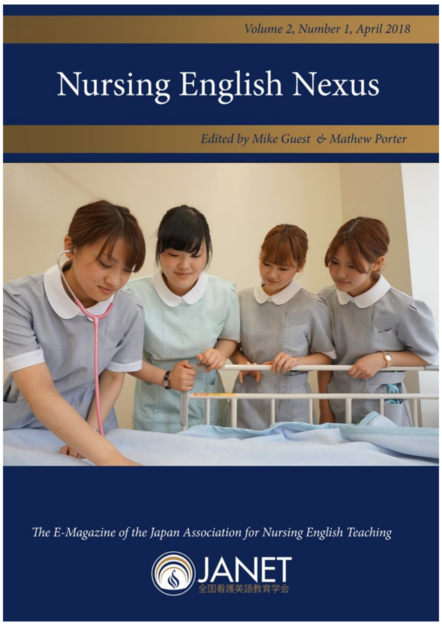

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The Development of Test Items to Assess Students' Graphophonemic Awareness of Nursing English-Language Vocabulary

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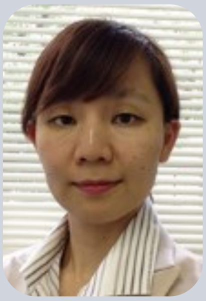

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Although assessing learner graphophonemic awareness of English-language vocabulary has been widely acknowledged in the field of assessing reading, little attention has been paid to developing test items that assess learners' proficiency of graphophonemic awareness in Nursing English-language vocabulary. In response, the aim of the present study was to develop test items to assess learners' graphophonemic awareness of such vocabulary using a Rasch analysis. The results revealed that of 40 test items, only 17 (42.5%) items corresponded with the learners' ability measure. The study indicates the need to develop test items that match students' proficiency in Nursing English-language vocabulary.

Keywords: *graphophonemic awareness, nursing English-language vocabulary, Rasch analysis*

Several researchers (i.e., Bishop, 2003; Zoccolotti, De Luca, Marinelli, & Spinelli, 2014) argue that identifying learners at risk of reading failure is crucial to provide them with adequate support and intervention. Bishop (2003) reports that graphophonemic awareness — that is, the ability to match letters (or graphemes) and sounds (or phonemes) in words — ranks among the best predictors in assessments of kindergarten students' reading proficiency. Greenberg, Ehri, and Perin (2002) add that their study on adult readers' reading difficulties revealed that deficient graphophonemic awareness contributes to difficulties in reading.

In English-language classrooms that teach nursing English reading, increased attention has been paid to learners' acquisition of vocabulary specific to nursing (Willey, McCrohan, & Shibata 2009). Little attention, however, has been paid to improving learners' graphophonemic awareness (Ichiyama, 2018a, b). Assessing graphophonemeic awareness is crucial to provide adequate help and support to students at risk of reading failure. (Greenberg, Ehri, & Perin, 2002; Doughty, Bouck, Bassette, Szwed, & Flanagan, 2013).

Unlike the English language, which has a deep orthographic structure in which the relationships between graphemes and phonemes are irregular, the Japanese language has a shallow orthography, involving one-to-one relationships between graphemes and phonemes (Kessler & Treiman, 2001). As Ichiyama (2016) points out, more than 50% of English-language vowel graphemes in Nursing English vocabulary in her study have phonemes that do not exist in Japanese-language pronunciation.

Developed by George Rasch (1980), a Rasch analysis is a statistical measurement technique that provides a log odds ratio of probability. As Wright and Linacre (1989) point out, a Rasch analysis transforms the raw scores (i.e., on nominal measures without an equal interval scale so that item scores cannot be totaled) of items and persons (e.g., examinees) into measures with interval scales on which, for example, a point for Question 1 is equivalent to a point for Question 2 as well. Hendriks, Fyfe, Styles, Skinner, and Merriman (2012) argue that nominal or ordinal scales traditionally used in assessment are less precise measures than interval or ratio scales and the use of Rasch analysis should therefore be encouraged.

A Rasch analysis provides fit statistics to assess the unidimensionality, or the extent to which the items measure a single construct (i.e., an attribute or variable that a test attempts to assess), such as graphophonemic awareness, of test items. Fit statistics provide information regarding the extent to which an observed response corresponds to the expected response based on the Rasch model. As Linacre (2013) suggests, deleting items and persons that do not fit the Rasch model leads to the removal of items and persons that do not assess graphophonemic awareness, and, in turn, the requirement of unidimensionality was met.

Using a Rasch analysis also benefits small-scale research. As Hambleton, Swaminathan, and Rogers (1991) point out, a Rasch analysis requires relatively few participants (e.g., 30 persons) to obtain useful, reasonable estimates.

This paper describes the process of developing and analyzing 40 test items to assess the graphophonemic awareness of nursing students at a tertiary-level institution in Japan.

Methods

The computer program WINSTEPS, Rasch version 3.81.0, developed by Linacre (2006) was used to analyze all data. A total of 40 test items were administered to 84 students as part of a final test in Nursing English during the Fall Term of 2016 at a tertiary-level institution in Japan. Words used in the study were chosen from the nursing English vocabulary book *Nursing Terms and Expressions Everybody Uses* (Onjo, Kawagoe, & White, 2007). Because participants in the study were first-year students in the Faculty of Nursing, words categorized as basic by Onjo et. al. (2007) were selected. Each item consisted of two English words with an underlined letter, as shown in the following example:

If the sounds of the underlined letters of both words are the same, then write "Y"; if different, then write "X" instead. If you do not know the sound of the letter on the left, then write "L"; if you do not know the sound of the letter on the right, then write "R". And if you do not know the sounds of both letters, then write "B".

*1. h**ea**lth br**ea**the*

In this study, as Wright (1994) proposes, items that did not fit the Rasch model (i.e., with an infit value greater than 1.3 or less than 0.7) were deleted until all items fit the Rasch model.

Results

Table 1 shows the number of test items and persons (that is, examinees) excluded from the analysis.

Table 1
Number of test items and persons excluded from a Rasch analysis

Analysis	Deleted Person		Deleted Item
	0.7 < Infit < 1.3	N	0.7 < Infit <1.3
1st	8, 13, 16, 18, 30, 31, 32, 34, 40, 42, 43, 47, 53, 58, 59, 64, 66, 68, 79, 83, 84	22	n.a.
2nd	19, 35, 45, 60, 63, 72, 75	7	n.a.

1st Analysis

Figure 1 displays the result of the first analysis in the distribution map. The map illustrates all 84 examinees and all 40 items on a common logit scale. Examinees are located on the right side of the scale and items on the left-hand side. The locations of the examinees and items correspond to the level of examinee proficiency and item difficulty. Each "#" on the left-hand side of the scale indicates the location of 2 examinees, and each dot indicates the location of one person. Each item is represented by a number with grapheme (s) and a number followed by a letter or letters. For example, "40ea" in the middle of Figure 1 indicates that Item 40's difficulty level is approximately medium level and that the item assesses how to pronounce a diphthong "ea." An "M" indicates the location of the mean measure, "S" indicates the one sample standard deviation away from the mean, and "T" indicates two sample standard deviations away from the mean.

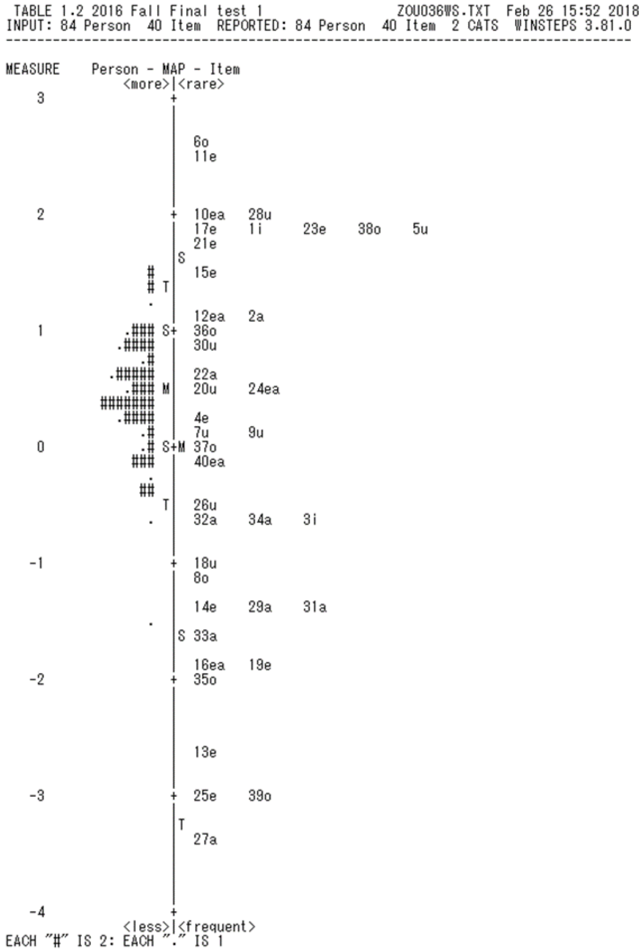

Figure 1. The distribution map (1st analysis).

In the 1st analysis, of the 84 persons measured, the infit ranges fell between 0.7 –1.3 except for 22 persons, as shown in Table 1. This possibly indicates that these examinees are among the mismatched persons, examinees that do not fit the Rasch model. Of the 40 items measured, all ranges fell between 0.7–1.3. The remaining items and examinees were put on the same difficulty scale through a Rasch analysis.

2nd Analysis

Figure 2 displays the result of the second analysis in the distribution map. The map illustrates all 62 persons and all 40 items on a common logit scale. Examinees are located on the right side of the scale and items on the left-hand side. The locations of the examinees and items correspond to the levels of examinee proficiency and item difficulty. Each "X" on the left hand side of the scale indicates the location of one examinee. Each item is represented by a number with grapheme(s).

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 TABLE 1.2 2nd 2016 Fall Final test 1           ZOU790WS.TXT  Feb 28 18:03 2018
INPUT: 55 Person  40 Item  REPORTED: 55 Person  40 Item  2 CATS  WINSTEPS 3.81.0
--------------------------------------------------------------------------------

MEASURE    Person - MAP - Item
                <more>|<rare>
    4                 +
                      |T
                      |
                      |
                      |  11e
                      |
    3                 +
                      |
                      |
                      |  10ea   5u
                      |  21e    6o
                      |
                      |  38o
    2                 +  28u
                      |S 17e
                      |  1i
                      |  23e
                   X  |
                   X T|
                 XXX  |  15e
    1             XX  +  2a
                 XXX S|  30u    36o
                XXXX  |  12ea   20u    22a
       XXXXXXXXXXXXX  |  24ea   7u
                 XXX M|
               XXXXX  |  37o
            XXXXXXXX  |  40ea   4e     9u
    0            XXX S+M
                XXXX  |
                   X  |
                   X  |  26u
                  XX T|  34a    3i
                   X  |  32a
                      |
   -1                 +  18u
                      |
                      |
                      |  29a    33a
                      |
                      |  14e    31a    8o
                      |S
   -2                 +
                      |
                      |
                      |  19e
                      |
                      |  16ea   35o
                      |
                      |
   -3                 +
                      |
                      |
                      |
                      |
                      |T 13e    25e    39o
                      |
   -4                 +  27a
                <less>|<frequent>
```

Figure 2. The distribution map (2nd analysis).

In the 2nd analysis, of the 62 examinees measured, all infit ranges fell between 0.7–1.3, except for 7 examinees, as shown in Table 1, possibly indicating a mismatch, an examinee that do not fit the Rasch model. Of the 40 items measured, all ranges fell between 0.7–1.3. The remaining items and examinees were put on the same difficulty scale through a Rasch analysis.

Discussion

As can be seen in Figure 2, 17 (42.5%) items match the examinee measures, indicating a moderate match between the examinee proficiency and item difficulty. The relatively large gaps, indicated by arrows in the figure, however, indicate the need to develop items that fill the space. As Jackson, Draugails, Slack, and Zachry (2002) point out, visible gaps (i.e., >0.3 logit) in the map indicate the need to add items in order to improve the measurement of the construct.

Conclusion

The study indicates that the items included are of a quality suitable for assessing students' graphophonemic awareness. The study, however, posed several limitations, including those concerning the amount of items developed and their implications to pedagogy. More items specific to Nursing English should be developed, and the question as to whether there are appropriate ways to teach graphophonemic awareness in order to support non-proficient readers in Nursing English courses should be explored.

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