Refining the Flesch Reading Ease Formula for Intermediate and High-Intermediate Esl Learners

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ABSTRACT

ESL instructors tend to rely on their judgment in estimating the difficulty level of reading passages for their learners. This common sense method, despite being drawn from experience, gut feeling and intrinsic knowledge of the learners' ability, is neither efficient nor objective. A more objective method is available such as using readability formulas to estimate the difficulty level of the passages. One of the highly reliable readability formulas which have been validated to be used in an ESL/EFL context is the Flesch Reading Ease (FRE) formula. The FRE formula has a difficulty scale that ranges from 0 (the least difficult) to 100 (the most difficult), which is rather broad and general. Therefore, it was the intention of this study to refine the FRE difficulty scale for the use of a specific group of learners and identify additional predictors of passage difficulty to enhance the ability of the formula in estimating the difficulty level of reading passages. To do that, the study replicated Vogel and Washburne's (1928) process of developing modern readability formula. Reading passages at intermediate and high intermediate levels from several ESL reading coursebooks were analyzed. Three computational tools, the Flesch Reading Ease formula, Writer's Workbench 8.18 and WordSmith Tools 4.0 were used to extract information related to the text characteristics of the passages at text, sentence and word levels respectively. Findings of the study revealed the development of a more refined FRE formula at intermediate difficulty level scale. This refined formula, referred as IDL Formula, used the FRE scores and the coverage of the first 2000 high frequency words of English (HFW scores) of the passages as predictors of passage difficulty. This formula

is able to measure 88.7% of passage difficulty, and has a high reliability with the Bormuth mean cloze scores. This formula is meant to be used by ESL instructors, test-setters, materials writers, publishers and curriculum designers to estimate the difficulty level of reading passages at intermediate and high-intermediate levels.

Keywords: difficulty level, Flesch Reading Ease formula, intermediate scale, readability, reading passages.

INTRODUCTION

Matching learners with reading materials that match their language ability is a perennial concern of ESL instructors. It is not an easy task to ensure the difficulty level of reading materials is within the range of learners' language ability. ESL instructors usually rely on their personal judgment to determine the difficulty level of reading materials selected for their learners.

This common sense method, despite being drawn from experience, is very subjective and could lead to inconsistency. Instructors are found to be consistent in ranking reading materials according to the difficulty level (Chall, 1958; Gunning, 2003). However, their ranking could be inaccurate and inadequate if it is compared to an objective method of measuring materials difficulty. Hancioglu and Eldridge (2007) found the opposite results. The participants were asked to rank five reading materials from the easiest to the most difficult and the results showed that the ranking was inconsistent except for one reading material that was ranked as the easiest almost unanimously.

Besides that, this method is unreliable if it is done by untrained instructors (Klare, 1984). Klare (1984) also claimed that judgment of materials difficulty by untrained instructors could not be relied upon as their ratings often varied by several grade levels. The same evidence could be found in a study conducted by Anealka (2010a), who asked the participants to rate the difficulty level of five reading passages. The results showed that there was no agreement in the rating of the difficulty level of these five reading passages. This inconsistency could be due to the length of experience the instructors have in teaching the target ESL learners. As

reported, 63.9% of the respondents had more than 15 years of experience teaching ESL learners, 22.2% of the respondents had between 10 to 15 years of experience and the remaining 13.9% had less than 10 years of experience.

The present study, however, did not undermine the role of judgment in determining the difficulty level of reading materials for ESL learners. It acknowledged the use of judgment as it was pertinent in aspects dealing with content meaningfulness, moral values and topic variety. Rather, the study intended to enhance the efficiency of this method by combining it with a more objective method of estimating the difficulty level of reading materials.

The most common objective approach to estimate reading materials difficulty is by using readability formulas. The use of readability formulas in estimating difficulty level of reading materials has received many positive reviews (refer to Klare, 1969; Gilliland, 1972; Flesch, 1979; Fry, 1989; Weaver & Kintsch, 1991; Jones, Evanciew & Anderson, 1995; Chavkin, 1997; Stephens, 2000; Parker, Hasbrouk & Weaver, 2001; Bailey, 2002; Fry, 2002). Additionally, some readability formulas, including the one used in this study, the Flesch Reading Ease Formula, have been widely used and tested for their reliability (Chall, 1958; Klare, 1969; Hamsik, 1984; Greenfield, 1999; Shokrpour, 2005).

THE FLESCH READING EASE (FRE) FORMULA

The Flesch Reading Ease formula is a readability formula that measures how easy written materials can be read and understood (Richards, Platt & Platt, 1992). It is regarded as one of the oldest and most reliable readability formulas (Klare, 1969) which can be relied on without too much inquiry (readabilityformulas.com).

The FRE score is derived from a formula created by Rudolf Flesch in 1943 (revised in 1948). The formula uses the average sentence length and the average number of syllables per word as predictors of materials difficulty. The FRE formula is displayed in Figure 1.

$Y = 206.835 – 1.015(X_1) – 84.6(X_2)$
Y= Reading Ease Score
X_1 = Average Sentence Length
X_2 = Average number of syllables per word

Figure 1: The Flesch Reading Ease Formula

The formula uses scores between zero and hundred (0-100) to measure the readability level of reading materials. Higher scores indicate the materials are easier to read and understand, and lower scores indicate the materials are getting more difficult to read and understand. The descriptive categories used by the formula are displayed in Table 1.

Table 1: Descriptive Categories used in the Flesch Reading Ease Formula

Reading Ease Score	Descriptive Categories	Estimated Reading Grade
90 – 100	Very Easy	5th Grade
80 – 90	Easy	6th Grade
70 – 80	Fairly Easy	7th Grade
60 – 70	Standard / Plain English	8th and 9th Grade
50 – 60	Fairly Difficult	10th to 12th Grade (High School Sophomore to Senior)
30 – 50	Difficult	In College
0 - 30	Very Difficult	College Graduate

ASSUMPTIONS OF THE STUDY

Despite the availability of a more objective approach to estimate difficulty level of reading materials, most of the readability formulas are meant for general English language users. There is no specific reference on the difficulty range for specific groups of learners that ESL instructors can refer to when selecting reading materials. The most common reference available

is the difficulty scale of the Flesch Reading Ease formula. Scores of the Flesch Reading Ease formula can be grouped into seven difficulty levels starting from 'Very Easy', 'Easy', 'Fairly Easy', 'Standard English', 'Fairly Difficult', 'Difficult' and 'Very Difficult' (see Table 1). The difficulty scale also provides the groups of readers, using grade levels, who can read and understand reading materials rated at the respective categories. However, this information is not sufficient, as it is too general. It only tells how readable the reading materials are in a very broad sense, and the group of readers that can comprehend them. It does not provide any indication on a more specific range of materials difficulty a reader can possibly handle for instance, ESL learners at intermediate and high-intermediate levels.

Since there was no specific reference on the difficulty range of reading materials for intermediate and high-intermediate ESL learners, to begin with, assumptions about the difficulty level of these materials needed to be made. This was based on Sinclair's (1992) advice that a researcher should always begin with "hypothesis and hunches, however vague..." (cited in Alsree, 1997). This study therefore started with the assumption that the difficulty level of reading materials for ESL learners at intermediate and high-intermediate levels started somewhere between the lowest and the highest ended of the intermediate difficulty level (IDL) scale as shown in Figure 2. The research assumption is indicated by the broken line in Figures 2 and 3.

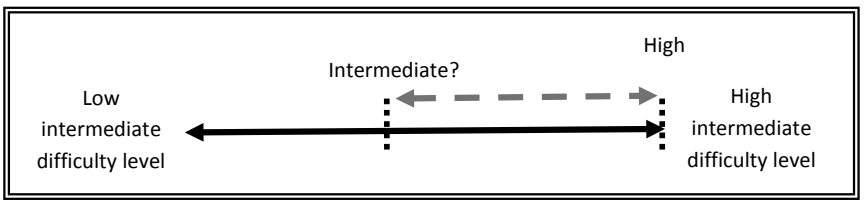


Figure 2: Research Assumption on the IDL Scale

Looking at the IDL scale from the Flesch Reading Ease scale, it was again assumed that the intermediate and high-intermediate reading materials should fall in the range 70 and 30 or 'Plain English' and 'Difficult'. Figure 3 shows the Flesch Reading Ease Scale.

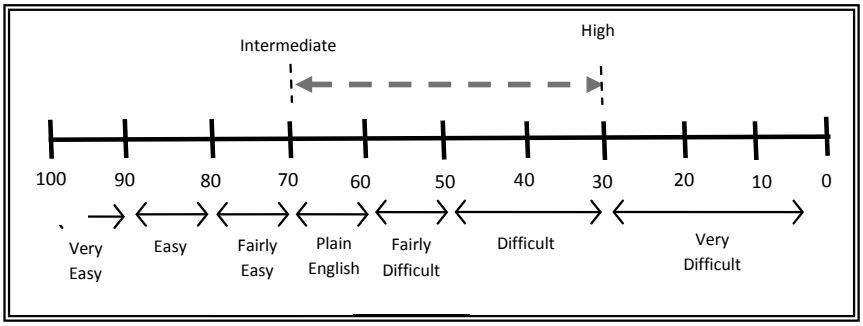


Figure 3: Research Assumption on the Flesch Reading Ease Scale

This difficulty scale of reading materials at the two levels was rather broad and general. Therefore, based on this research assumption as a starting point, this research would pursue to define and refine the IDL scale to describe needs of the learners at intermediate and high intermediate level. Statistical tests were used to determine where the Intermediate point began and the High-intermediate point ended. The IDL scale established by the study was plotted between the two points. With this, the refined IDL scale would serve as the reference for ESL instructors to use in selecting reading materials for ESL learners at these two levels.

AIMS OF THE STUDY

The main aim of the study was to refine the FRE difficulty scale for the use of intermediate and high-intermediate ESL learners. The study also aimed to identify additional predictors of materials difficulty that can enhance the ability of the formula in estimating the difficulty level of reading materials. For the purpose of this study, one type of reading materials used in teaching reading skills – reading passages, was used to create the corpus of intermediate and high-intermediate materials.

METHODOLOGY OF THE STUDY

This study used the modified process of creating readability formula for a specific group of learners as used in Anealka (2010b). This process, to a

large extent, replicated the process taken by Vogel and Washburne's (1928) in establishing the difficulty level formula to measure difficulty level of reading passages. The modified process of creating readability formula for a specific group of learners is shown in Figure 4.

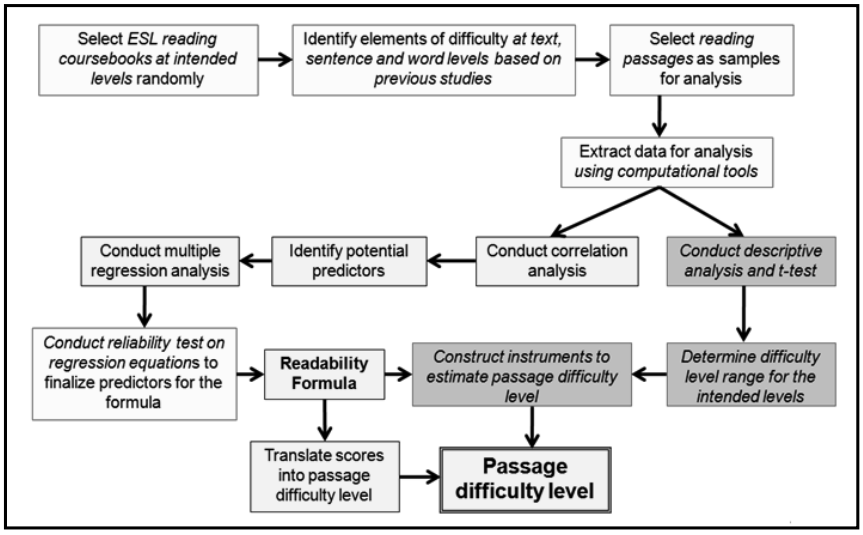


Figure 4: The Modified Process of Creating Readability Formula for a Specific Group of Learners (Anealka, 2010b)

Selection of Samples

The present study used three sets of ESL reading coursebooks from three prominent publishers namely Oxford, Heinle & Heinle and Thompson Learning publication houses. Each set comprised two reading coursebooks, one at intermediate level and the other one at high-intermediate level. The selection of the coursebooks was at random.

Elements of passage difficulty were determined based on previous studies and literature. There were many factors that could affect reading materials difficulty. Some of the factors were readers' background knowledge (Johnson, 1981; Carrell, 1987; Day, 1994; Nuttall, 1996; Oakland & Lane, 2004; Hudson, 2007), interest and motivation (McLaughlin, 1968; Shehadeh & Strother, 1994; Day, 1994; Johnson, 1998; Oakland & Lane, 2004), organization of the reading materials (McLaughlin, 1968; Shehadeh

& Strother, 1994; Day, 1994; Hudson, 2007; Mesmer, 2008), legibility of the reading materials (Shehadeh & Strother, 1994; Day, 1994; Johnson, 1998; Mesmer, 2008) and complexity of words and sentences in the reading materials (McLaughlin, 1968; Richards, Platt & Platt, 1992; Shehadeh & Strother, 1994; Day, 1994; Chavkin, 1997; Johnson, 1998; Oakland & Lane, 2004; Stenner & Stone, 2006; Mesmer, 2008).

Although many of the factors had not yet been quantified, readability of reading materials was highly correlated with two factors that could be easily measured: sentences and words (Bailey, 2002). Chavkin (1997) identified that the most strongly associated factors to readability were word difficulty and sentence length. These two factors or variations of these two factors could be found in all readability formulas currently in use (Chavkin, 1997). Studies had confirmed that inclusion of other factors in the formula contributed more work than it improved the results (Stephens, 2000). It showed that readability of reading materials could sufficiently be measured using word difficulty, sentence length and variations of the two. There was no need to include factors other than word difficulty, sentence length or the variations of the two.

Out of these many factors, only quantifiable sentence and word-related factors were selected as the present study involved the use of computational tools to extract relevant information from the passages. Therefore, six text characteristics were selected as elements of reading passage difficulty: the overall difficulty as measured by the Flesch Reading Ease formula (FRE), the average sentence length (ASL), the use of simple and compound sentences (S/Cd), the use of complex and compound-complex sentences (Cx/CdCx), the average word length (AWL) and the coverage of high frequency words within the different words used in the passage (HFW).

The present study used all the words and sentences in 75 selected reading passages taken from the selected coursebooks at the two levels. It was necessary for the present study to use whole passages because it intended to look at the overall passage difficulty level and not just at sentence and word levels only.

Instruments for Data Collection

Extraction of data from the sample passages was done using the three computational tools, Flesch Reading Ease Writer's Workbench 8.18 and WordSmith Tools 4.0. Readability Statistics function in Microsoft Word was used to generate the FRE scores of the passages. Writer's Workbench 8.18 was used to extract information on the ASL, S/Cd and Cx/CdCx from the passages and WordSmith Tools 4.0 was used to extract information on the AWL and HFW of the passages.

Data Analysis

The present study used both descriptive and inferential statistics to analyze the data. The study also performed all the necessary tests to fulfill the assumptions required prior to conducting inferential analysis. Types of analysis performed were descriptive, correlation and multiple regression analyses. The descriptive analysis was used to establish the range of passage difficulty for intermediate and high-intermediate levels. The correlation analysis was used to determine the relationship between passage difficulty level and text characteristics of the passages that contributed to the difficulty level of the passages, while the multiple regression analysis was used to determine which of the text characteristics could be the significant predictors of passage difficulty. The types of test performed were t-test and reliability test. The t-test was used to determine whether there was a significant difference between the text characteristics of intermediate from high-intermediate reading passages, while a reliability test using the Bormuth Set (1971) was conducted to determine the reliability of the equations resulted from the multiple regression analysis. Regression equation that produced higher correlation with the Bormuth mean cloze scores was selected to be the formula to estimate passage difficulty level for ESL learners at intermediate and high-intermediate levels.

Results

Results of the descriptive analysis displayed in Table 2 show that on average, reading passages at intermediate level are easier than reading passages at high-intermediate level. It can be seen from the means scores of FRE, ASL, S/Cd, Cx/CdCx, AWL and HFW.

Table 2: Means Scores of Text Characteristics of the Passages

Text Characteristics	Intermediate	High-Intermediate
FRE	54.32	48.05
ASL	17.93	19.74
S/Cd	51.37	45.58
Cx/CdCx	48.63	54.42
AWL	4.63	4.83
HFW	66.99	60.18

Note: FRE= Flesch Reading Ease; ASL= Average Sentence Length; S/Cd = Simple/ Compound; Cx/CdCx = Complex /Compound-Complex; AWL= Average Word Length; HFW = High Frequency Words

Results of the t-test as displayed in Table 3, show that the means of text characteristics in the intermediate reading passages are significantly different from those of high-intermediate passages. The results show that these characteristics could be used as predictors of passage difficulty level for ESL learners at the two levels.

Table 3: Results of the T-test

Text Characteristics	t-value	P
FRE	-3.884	.000
ASL	3.329	.001
S/Cd	-2.052	.044
Cx/CdCx	2.052	.044
AWL	4.591	.000
HFW	-5.053	.000

Note: FRE = Flesch Reading Ease; ASL = Average Sentence Length; S/Cd = Simple/Compound; Cx/CdCx = Complex /Compound-Complex; AWL = Average Word Length; HFW = High Frequency Words

However, results of the correlation analysis, displayed in Table 4, show that only four out of six potential predictors are significantly correlated with the difficulty level (DL) of the passages. This results show that S/Cd and Cx/CdCx could not be used as predictors of passage difficulty for ESL learners at the two levels.

Table 4: Relationships between the DL of the Passages and the Text Characteristics of Intermediate and High-Intermediate Reading Passages (n=75)

	DL	FRE	ASL	S/Cd	Cx/CdCx	AWL	HFW
DL		-.816*	.362*	-.083	.083	.778*	-.774*
FRE	-.816*		-.375**	.173	-.173	-.895**	.423**
ASL	.362*	-.375**		-.582**	.582**	.286*	-.435**
S/Cd	-.083	.173	-.582**		-1.000**	-.109	.056
Cx/CdCx	.083	-.173	.582**	-1.000**		.109	-.056
AWL	.778*	-.895**	.286*	-.109	.109		-.475**
HFW	-.774*	.423**	-.435**	.056	-.056	-.475**	

** Correlation is significant at the .01 level * Correlation is significant at the .05 level
Note: FRE = Flesch Reading Ease; ASL = Average Sentence Length; S/Cd = Simple/ Compound; Cx/CdCx = Complex/Compound-Complex; AWL = Average Word Length; HFW = High Frequency Words

Another potential predictor, AWL, is dropped as it does not fulfil one of the assumptions required prior to conducting multiple regression analysis. The stepwise method of regression analysis also confirms that only FRE, ASL and HFW could be the potential predictors of passage difficulty. Results of the analysis, as displayed in Table 5, show that FRE, HFW and ASL contribute 89.6% to the difficulty level of the passages. These three variables are predictors of passage difficulty $F(3,71)=213.061$, $p<.05$. Although as a whole, these three variables contribute 89.6% to the difficulty level of these passages, individually, the three variables have different contribution to the difficulty level of the passage. From the results of the multiple regression analysis, FRE has a moderate significant correlation with passage difficulty level, $r=.622$, $p<.05$. HFW also has a moderate significant correlation

with passage difficulty level, r=.561, p<.05. However, ASL has a slight significant correlation which is almost negligible with passage difficulty level, r=.115, p<.05.

Table 5: ANOVA of FRE, HFW and ASL of IR and HIR Passages

	df	Sum of Squares	Mean Square	F-Value	P-Value
Regression	3	50.209	16.736	213.061	.000
Residual	71	5.577	.07855		
Total	74	55.787			

R Square = .900, Adjusted R Square = .896

Results of the second multiple regression analysis, as displayed in Table 6, shows that FRE and HFW contribute 88.7% to the difficulty level of IR and HIR passages. These variables are predictors of passage difficulty F(2,72)=290.761, p<.05. The results also show that both FRE and HFW have a moderate significant correlation with passage difficulty level, r=.596, p<.05 and r=.522, p<.05 respectively.

Table 6: ANOVA of FRE and HFW of IR and HIR Passages

	df	Sum of Squares	Mean Square	F-Value	P-Value
Regression	2	49.641	24.820	290.761	.000
Residual	72	6.146	.08536		
Total	74	55.787			

R Square = .890, Adjusted R Square = .887

A reliability test is conducted on the two equations to check their consistency in estimating the difficulty level of a reading passage. The reliability test is important so as to ensure the equation chosen as the difficulty level formula yields a consistent difficulty level when ESL instructors use it to estimate difficulty level of reading passages.

An alternate-forms technique of estimating reliability, which is also referred to as the equivalent-forms or parallel-forms technique (Ary, Jacobs & Razavieh, 2002) is used to test the reliability of the two equations. Thirty-two reading passages taken from the Bormuth Set and the established mean cloze scores of these passages obtained in the original study (Bormuth, 1971) are used to perform the reliability test of both equations. These 32 passages, ranging in length from 239 to 300 words, excluding titles, have become the foundation for readability formula revision in Chall and Dale (1995) and Greenfield (1999).

The two equations are used to calculate the y-values of these passages. These y-values are then correlated with the established mean cloze scores of the passages. A correlation analysis using Pearson Product-Moment Correlation Coefficient is conducted to determine the relationship between the established mean cloze scores and the y-values calculated using both formulas. Results in Table 7 show that there is a high significant positive correlation between the established mean cloze scores and the y-values of the passages estimated by both equations, $r=.884$, $p<.01$ for the first equation and $r=.908$, $p<.01$ for the second equation.

Table 7: Correlation Analysis between the Y-Values and the Mean Cloze Scores of the Passages in the Bormuth Set (n=32)

Y-Values of	Mean CLOZE Scores
First Equation (FRE, HFW & ASL)	.884**
Second Equation (FRE & HFW)	.908**

** Correlation is significant at the .01 level (2-tailed)

Based on the results, it can be concluded that both equations are reliable and can consistently predict the difficulty level of a passage. However, the second formula is selected as the difficulty level formula to estimate the difficulty level of IR and HIR passages for ESL learners as it is more reliable than the first equation. The formula, henceforth referred as the 'IDL Formula', is determined by two predictor variables, FRE and HFW. The 'IDL Formula' is shown in Figure 5 below.

$Y = .06812(X_1) + .06757(X_2) - 4.878$
Where:
Y= Y-Value
X_1 = Flesch Reading Ease Score
X_2 = Coverage of High Frequency Words

Figure 5: The 'IDL Formula' to Estimate Difficulty Level of IR and HIR Passages

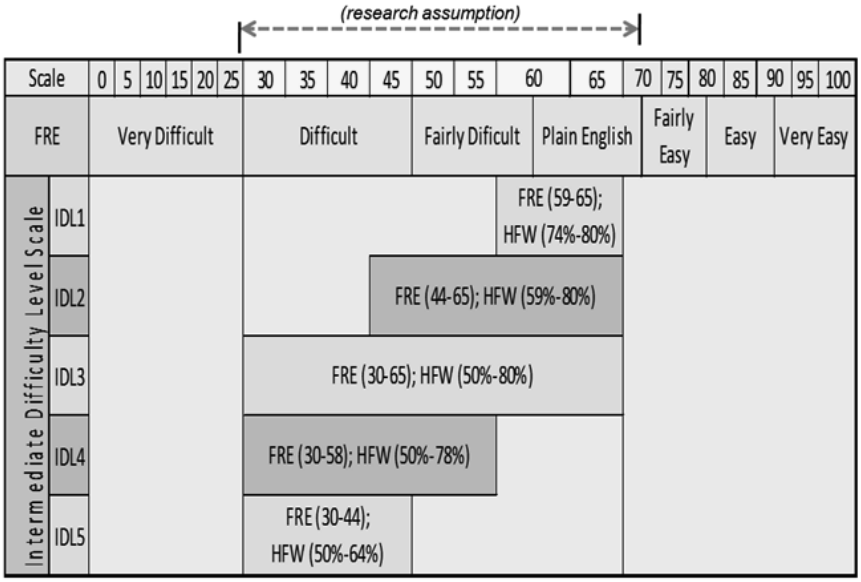
Higher FRE and HFW values lead to higher Y-values and lower FRE and HFW values lead to lower Y-values. The Y-values are then translated into Intermediate Difficulty Levels (IDL) as shown in Table 8. Reading passages that have a y-value between 4.5-5.4, 3.5-4.4, 2.5-3.4, 1.5-2.4 and 0.5-1.4 are placed at IDL^1, IDL^2, IDL^3, IDL^4 and IDL^5 respectively.

Table 8: Conversion Table for Y- Values

Y-Values	Difficulty Level
4.5 – 5.4	IDL^1
3.5 – 4.4	IDL^2
2.5 – 3.4	IDL^3
1.5 – 2.4	IDL^4
0.5 – 1.4	IDL^5

Using the IDL formula and the ranges for FRE and HFW scores determined from the descriptive analysis, the IDL scale for ESL reading passages is established. The research assumption stated earlier claims that the intermediate difficulty range would be between 30 and 70. However, the results show that the range is between 30 and 65. Results of the study also show that ESL learners at intermediate level can use reading passages rated at IDL^1 – IDL^4, while ESL learners at high-intermediate level can use reading passages rated at IDL^2 – IDL^5. Table 9 shows the refinement of the FRE difficulty scale using the IDL Scale (IDL^1-IDL^5).

Table 9: Refinement of the FRE Difficulty Scale using the IDL Scale (IDL[1]-IDL[5])



CONCLUSION

The descriptive and the t-test results of the study that deal with text characteristics of intermediate and high-intermediate reading passages for ESL learners lead to somewhat predictable conclusions: intermediate reading passages are easier to read and understand as opposed to high-intermediate reading passages and vice versa. Despite these not surprising outcomes, the descriptive analysis and the t-test are significant as they provide a solid foundation to refine the intermediate difficulty range. Other sentence and word factors that can affect the difficulty level of the passages should be considered as well.

However, results in the correlation analysis only see the potential of FRE, ASL, AWL and HFW as predictors of passage difficulty level and not S/Cd and Cx/CdCx. The multiple regression analysis eliminates another predictor, AWL, and finalizes two potential equations to serve as the difficulty level formula to refine the intermediate difficulty scale. A

reliability test is conducted and results of the test show that the formula with two predictors (FRE and HFW) is more reliable than the formula with three predictors (FRE, HFW and ASL). The two-predictor formula is chosen over the three-predictor formula to serve as the difficulty level formula in the present study. This formula is meant to be used by ESL instructors, test-setters, materials writers, publishers and curriculum designers to estimate the difficulty level of reading passages at intermediate and high-intermediate levels.

Results of these analyses are used to refine the IDL scale. The development of the refined IDL scale enables the users to select appropriate reading passages for ESL learners. The reliability of the 'IDL Formula' is high (.908). However, only 88.7% of the difficulty factors are accounted for. Therefore, users should not expect a one-to-one relationship between predicted difficulty level and the actual difficulty level of the passages.

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