

## **Title: Readability as Applied to An ABE Assessment Instrument**

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### Abstract

This study examined the procedure for applying the Fog, Flesch, and Fry readability formulas to the Internal, Powerful Others, and Chance Scales and in modifying the instrument for use with adult basic education (ABE) students. Item writing procedures, quality comparisons, application of the formulas, and a Q-sort were used to develop a modified scale suitable for an ABE learner with reading skills of the fourth- and fifth-grade range. Field trial results and comprehension limitations of the readability formulas are discussed.

### Introduction

Research in adult basic education (ABE) involving the measurement of the internal-external locus of control construct indicated that the instrument was difficult for adult learners to read. Understanding of the intent of the 24 items in the Levenson Internal, Powerful Others, and Chance Scales (IPC) was therefore hindered. Locus of control is a personality variable derived from Rotter's (1966) social learning theory. It refers to the degree to which individuals perceive the events of their lives as being a consequence of their own actions (Lefcourt, 1981). People who generally believe that reinforcements are controlled by forces external to themselves such as fate, chance, luck, and powerful others are referred to as externals. Other people who tend to believe that their own behaviors are the primary factors in receipt of reinforcements are termed internals.

Over the past four decades, one of the problems in adult education has been the assessment of readability--how to tell whether a particular piece of writing is likely to be readable by a particular group of adult readers. In examining the phenomenon of a test or scale being difficult for adult learners to read in a research setting, the concept of readability was once again invoked. In the broadest sense, readability is the sum total (including interactions) of all those elements within a given piece of printed material that affect the success which a group of readers have with it (Dale & Chall, 1948). The success is the extent to which they understand it, read it at optimum speed, and find it interesting.

This definition of readability considers three major aspects of the reading process: comprehension, fluency, and interest. Comprehension refers to the understanding of words and phrases and to the relating of ideas in the passage to one's experience. Fluency is the extent to which a person can read a given text at optimum speed. This element emphasizes the perceptual aspects of reading. The third component refers to the motivational factors which will affect interest. These three elements are not separate but interact with each other to affect readability.

McLaughlin (1979) defines readability as the degree to which a given class of people find certain reading matter compelling and comprehensible. This definition stresses both the characteristics of the reader as well as the degree of "compellingness" of the text. He argues that a definition of readability must be based on the characteristics of the readers because it can be assumed that people will tend to continue to read only that which they understand. Alternatively, readability refers to the ease of understanding of written materials due to the style of writing used (Klare, 1975). The style of writing (or how the content of writing is stated) can be measured in such a way that a numerical value can be assigned to each writing style. These values are assigned through the use of

readability formulas where the numerical value that results from the measurement of style quantifies the ease or difficulty of the writing. With most formulas this numerical value has been translated into an educational skill level associated with the material.

## Readability

Abram (1981) states that the history of readability dates back to 900 A.D. when word counts were used as a rough index of reading ease. Lorge (1944) explains how in compiling and studying the body of laws called the Talmud, the Talmudists counted the occurrences of words and ideas in seeking to distinguish differences in meaning. Modern research into readability began in 1921 when Thorndike published a list of English words used more frequently in texts. Assumptions were made that the more frequently a word was used, the more familiar readers became with it and the easier it was to read. During the 1920's, research activities concentrated on looking for word factors that could be used to predict readability. Research broadened during the 1930's and throughout the 1940's, deriving formulas that could accurately predict readability using the least number of factors.

A readability formula or index "is like a yardstick that helps us measure certain qualities in the writing so we can make objective judgements about reading level" (Laubach & Koschnick, 1977, p. 12). Many readability formulas have been developed as a result of research into factors within writing that correlated highly with style difficulty. Most readability formula values are calculated by measuring sentence and word familiarity or word length. There are several widely used readability formulas.

**The Lorge Formula.** Lorge first published his formula for children's material in 1939. The formula was designed to cover grades 3-12. It set the stage for many to follow by using the Standard Test Lessons in Reading (McCall & Crabbs, 1925) as the criterion of difficulty. The formula considers three factors: average sentence length in words, number of prepositional phrases per 100 words, and the number of different hard words on the Dale list of 763 words.

**The Flesch Formula.** In 1943, Flesch published his formula using the original McCall-Crabbs Standard Test Lessons in Reading as a criterion. In designing it for general adult reading matter, he felt it gave proper attention to abstract words as well as sentence length. The formula uses four factors: number of syllables per 100 words, average number of words per sentence, number of personal words per 100 words, and number of personal sentences per 100 sentences.

**Dale-Chall Formula.** Similar to Flesch's, it used the 1925 McCall-Crabbs Standard Test Lessons in Reading as a criterion. It has a 3,000 word list, which was deemed preferable to the 763 word list used by Lorge and especially for the more difficult levels of readability. Flesch's count of personal references was avoided as unnecessary, and only two factors were used in order to keep it easy to use. They are the average sentence length and the percentage of unfamiliar words (words outside the Dale list of 3,000 words).

**The Fog Index.** Gunning's Fog Index (1952) is similar to Flesch's Reading Ease formula. Rather than counting syllables as Flesch did, Gunning proposed counting words of three or more syllables. He termed these "hard words". The formula is based on two counts: average sentence length and percentage of words having three or more syllables.

**The Readability Graph.** Fry developed a "Readability Graph" in 1965 for predicting readability. He used the common formula variables of syllables per 100 words and words per sentence. The user marks the counts of the variables on a graph and then reads the readability grade score directly from it. Fry's graph has been validated using both primary and secondary level materials.

The Bormuth Formula. In 1969 Bormuth published the most extensive readability analysis yet made. Bormuth used 330 passages which were about 100 words each and which ranged in difficulty from first grade to college and covered a wide range of subject matter. The cloze procedure of deleting every fifth word was used as the criterion of difficulty. This formula contained from 14 to 20 variables each. Bormuth also developed multiple regression equations to predict word length, minimal punctuation unit length, and sentence length.

The Mugford Readability Chart. Mugford (1970) developed a predictive method for readability in the form of a graphic solution much like Fry's. His Readability Chart was intended for 5.5 to 15-year reading ages but has been extended to cover material for adults. It uses the common variables of word-length in syllables and sentence-length in words, but it also takes repetition into account.

Harris-Jacobson Readability Formulas. Harris and Jacobson (1974) developed three readability formulas for primary grade materials. They were based on 481 samples from 56 books. These comprised all of the primary grade pupil books in six widely used series of basal readers and totalled 97,868 words.

### Readability of Adult Materials

Formal procedures have been used to assess the readability of adult magazine materials (Dulin, 1968), vocational materials (Williams, 1979), industrial education textbooks (Clark, 1978), business communication textbooks (Razek & Cone, 1981), economics textbooks (McConnell, 1982), and occupational educational textbooks (New York State Educational Department, 1982). The United States Army evaluated the usefulness of readability formulas for identifying material that would be comprehended by readers at a given reading skill level (Kern, 1980). Extension of this approach was outlined by Marshall (1979) who provided guidelines for analyzing and evaluating textbooks based on comprehensibility rather than readability. Use of readability formulas for writing adult materials to a desired reading level, matching readability levels of material to the reader's skill level, and use of these concepts in adult education was documented by Abram (1981). However, the review of research literature did not reveal application of these procedures to standardized testing instruments. However, text items must also be written at appropriate reading difficulty levels if test scores are expected to yield valid results.

Systematic procedures should be considered for implementation in evaluating written materials. The Dale-Chall (1948), Harris-Jacobson (Harris & Sipay, 1975), Fry (1972), Fog (Klare, 1963), and Flesch (1951) are the most suitable and have the greatest potential for use with an adult audience. These formulas represented the two major approaches to the calculation of readability: estimating the number of unfamiliar words versus the number of syllables per word in addition to sentence length. Although these formulas have been used with adult audiences, only minimal attention has been given to the reading difficulties and characteristics of the ABE learner when responding to standardized tests.

## The Study

The purpose of this study was to examine the procedures for applying readability formulas to a standardized test and a modified version of the test. The personality construct of "locus of control" has been extensively used by investigators in a wide variety of situations and has occupied a central position in personality research for more than 15 years. Thus, different locus of control scales have been developed. In conducting research in an ABE environment, Levenson's Internal, Powerful Others, and Chance Scales (IPC) were considered to be a representative measure of the construct.

The IPC Scales were developed as a reconceptualization of Rotter's 1-E Scale, Levenson (1981) states that the multi-dimensional view of locus of control developed from questions about the validity of combining expectancies of fate, chance, and powerful others under the heading of external control. Individuals who believe in the influence of powerful others (one external orientation) will behave and think differently from individuals who feel the world is unordered and unpredictable (a second external dimension). In the former case, a potential for control over events exists.

The scales are composed of items adapted from Rotter's scale and items written specifically to measure beliefs about the operation of the three dimensions of control: beliefs in personal control (Internal Scale); powerful others (Powerful Others Scale); and chance or fate (Chance Scale).

The I Scale measure the extent to which people believe that they have control over their own lives (e.g. "When I make plans I am almost certain to make them work"); the P Scale deals with powerful others (e.g. "In order to have my plans work, I make sure that they fit in with the desires of people who have power over me"); and the C Scale is concerned with perceptions of chance control (e.g. "It's not wise for me to plan too far ahead because many things turn out to be a matter of good or bad luck"). (Lefcourt, 1981, p. 17)

Pretesting on 36 items included item analysis and correlations with the Marlowe-Crowne Social Desirability Scale (Crowne & Marlowe, 1964). The resulting IPC instrument has three eight- item subscales with a six-point Likert-type format. The test is administered to students as a single test having 24 items.

Internal consistency reliability estimates were only moderate. According to Levenson (1981), this is to be expected when the items sample a variety of situations. For an adult psychiatric sample of 115, alpha reliabilities were .51 for the I Scale, .72 for the P Scale, and .73 for the C Scale (Wallston, Wallston & Devellis, 1978). Levenson (1973) found similar estimates for a hospitalized psychiatric sample (.67, .82, and .79, respectively). Split-half reliabilities were .62, .66, and .64 for the IPC Scales. Test-retest reliabilities for a one-week and seven-week period were both in the .60 to .79 range (Lee, 1976; Levenson, 1973).

Levenson (1981) states that the validity of the scales has been demonstrated through convergent and discriminant methods (Campbell & Fiske, 1959) designed to show significant low order correlations with other measures of the general construct as well as a pattern of theoretically expected positive and negative relationships with other variables. However, low order correlations of the construct validation analysis are not clearly described.

The means and standard deviations of the IPC Scales for various adult populations such as psychiatric patients, cancer patients, the elderly, rural women, prisoners, and

alcoholics have been reported (Levenson, 1981). In an evaluative study of suggestive-accelerative learning and teaching as a method of teaching vocational agriculture, a group of ninth graders were tested with the scales (Walters, 1977). However, one of the limiting characteristics of the instrument is that it has not been standardized on an adult basic education population. The sophistication of the wording may cause a percentage of the learners with low reading skills to not understand scale items.

There are five differences between the IPC Scales and the Rotter 1-E Scale (Levenson, 1981).

1. They are presented as Likert scales, instead of in a forced-choice format so that their three dimensions are most statistically independent of one another than are the two dimensions of Rotter's scale.
2. The IPC Scales make a personal-ideological distinction. All statements are phrased so as to pertain only in the person answering. They measure the degree to which an individual feels he or she has control over what happens, not what the person feels is the case for "people in general".
3. The items in the scales contain no wording that might imply modifiability of specific issues. Both factors of personal versus ideological control and system modifiability were found by Gurin et al. (1969) to be contaminating factors in Rotter's 1-E Scale.
4. The IPC Scales are constructed in such a way that there is a high degree of parallelism in every three-item set.
5. Correlations between items on the new scales and Marlow-Crowne Social Desirability Scale are negligible and nonsignificant. (Lefcourt, 1981, p. 18)

Because of these alleged measurement improvements, the IPC Scales were considered superior to the Rotter 1-E Scale for the purposes of the research with an ABE population. Although the Internal, Powerful Others, and Chance Scales (IPC) have been used with adult populations, further investigation of the scales' readability characteristics was deemed necessary. Since adult learners who have reading levels at the grade equivalencies from 5 to 12 enroll in community college retraining programs, it was necessary to use an instrument having a readability index of grade 5 equivalency, which was the assumed lowest reading level of the adult group. A number of readability principles were considered for use in modifying the IPC to make it consistent with the reading skills of the adult learner. The first step in assessing the readability of the IPC was to apply current readability formulas to the existing instrument. Three formulas were used: Fog Index, Fry Readability Graph, and the Flesch Formula. Laubach and Koschnick (1977) suggest the use of the Fog Index and the Fry Readability Graph for measuring the readability level of adult materials. The Fog Index was developed for use with the adult materials and yields scores equivalent to grade levels. Absolute values of the Fog Index, however, are often slightly higher than the scores derived from other formulas. Thus, the slightly higher score derived from the Fog Index provides greater assurance that readers will be able to cope easily and accurately with the assessed materials.

In contrast, the Fry Readability Graph is more useful to evaluators of materials than to writers preparing documents. It is routinely used by Literacy Volunteers of America. There are two notable limitations inherent in the formula: (a) in the word count, proper names and number are omitted for assessment purposes and (b) counting the number of syllables in each word tends to blur the perception of which are the difficult words. The Flesch (1974) formula was included in this study because it provides a human interest

score derived from an assessment of the "personal words and sentences". Application of the Flesch formula yields two scores: reading and human interest. Each has a range of 0 to 100. The interpretation for reading ease is from unreadable to readable where readable means material that is understandable by people who have finished fourth grade and, therefore, who in the language of the Census are functionally literate (Flesch, 1974, p. 259).

## Results

Sampling procedures of the formulas are very similar. Reading specialists have raised the issue as to how many samples give a good readability estimate. The three formulas used in the study recommend taking three 100-word samples from different parts of a text. Fitzgerald (1979) points out that in using the Fry Readability Graph to estimate the readability level of several secondary texts and basal workbooks, three samples did not give consistent estimates. He states that such material is not consistent in its difficulty level. In this study the IPC Scales are less than 500 words in total length. By sampling the beginning, middle and end of the Scales, it seemed that consistent estimated would be calculated. However, this problem of sampling procedures raises another question for investigators modifying test items. Reading of continuous prose may differ from disconnected options. Test items are written in a way which is more information loaded. Thus assessment of comprehension becomes important.

In calculating sentence length, the Fog and Flesch formulas both arrive at an average sentence length by counting the number of words and sentences. The Fry formula is slightly different yielding an average number of sentences per 100 words. Calculation of the average number of syllables are factors in both the Fry and the Flesch formulas. The Fog Index, instead, estimates the percentage of hard words. Each formula has a different method of finding and interpreting grade level or score. A human interest and reading ease score are only calculated in the Flesch formula.

Results of applying each formula to the IPC Scales appear in Table 1. Values reported indicate that the IPC Scales are not suitable for the ABE learner having a grade 5 reading skill level. Since the IPC Scales are not appropriate for the designated group of ABE learners, the instrument was modified.

### A Modified Scale

The 24 items of the IPC Scales were modified according to the steps outlined by Laubach (1977, pp. 33-35). The writings of Flesch (1974), Laubach and Koschnick (1977), and Thorndike (1944) and the Thorndick-Barnhart Dictionary (1969) served as major resources for the item writing procedure.

Comprehensibility. According to Marshall (1979), low readability of a selection does not ensure high comprehensibility. When sentences and vocabulary are oversimplified, cohesion is lost. As a result, comprehension becomes much more difficult because the reader must infer the missing information. Low comprehensibility occurs when there is no connection between the selection and the knowledge of the reader. Marshall suggests the use of a checklist as an indication of comprehensibility. Although Marshall's concept of comprehensibility pertains to books and articles, guidelines for instrument or scale comprehensibility were not found in the literature. Therefore, the checklist procedure was adapted in modifying the scale but was recognized as a methodological limitation.

Four checklist questions were selected as the guidelines for determining the comprehensibility of the modified items.

1. Are the key vocabulary terms defined clearly? Are they used in a variety of different contexts that are likely to be meaningful to the learners?
2. Are all new concepts introduced in the context of familiar concepts? Are they well defined in the scale sentence?

3. Are ideas clearly related to each other? Will the learner be able to understand the relationship among the ideas?

4. Has the author of the instrument addressed an audience of readers with backgrounds similar to those of the learners who will be reading the scale?

A panel of judges comprising two ABE teachers from a community college and one ABE teacher from a school board examined the readability of the modified scale. The above checklist procedure was used. Revisions were then made. A comparison of the original IPC and revised IPC items was then assessed according to categories as follows: words, sentences, ideas (the nature of the intended statement or facts presented in the passage), and approach (the "personability" of the writing assessed as being dynamic vs. static, active vs. passive, or personal vs. impersonal).

The IPC and the modified IPC (MIPC) were compared on the basis of words, sentences, ideas, and approach. The MIPC has no difficult words, has an average sentence length of 13.7 words, includes fewer abstract thoughts, and has a personal, active approach. On the other hand, the IPC contains hard words of three or more syllables, has an average sentence length of 14.7 words with some complex clauses, includes several abstract thoughts, and has an approach which is negative as well as personal and active. The MIPC, thus, contains words with fewer syllables, is shorter in sentence length, has fewer abstract thoughts, and is less negative in approach. The incorporated changes were designed to lower the readability level for the modified instrument which was assessed by application of three readability formulas. The readability formula scores for the MIPC presented in Table 1 indicate the Fog Index score at the 5.4 grade level and a Fry Readability Graph plot in the fourth grade range.

Q-sort. A Q-sort was conducted in order to determine if the modified items were still measuring the three dimensions of locus of control. Q-sort is a relative rating task which is used to study similarities among ratings of sentiments by different persons (Nunnally, 1978). It grew out of a general methodology developed by Stephenson (1953) for the study of verbalized attitudes, self-description, preferences, and other issues in social psychology, clinical psychology, and the study of personality.

A Q-sort adaptation was conducted on two groups. A rating form was constructed to include three statements describing the conceptualization of the IPC Scales. The items of MIPC were read to a group of three doctoral candidates in adult education. The members marked the item numbers in the rating columns that they felt represented the concept. The same procedure was followed with a group of three adult education faculty members. In this case, the modified items were read to each faculty member in individual interviews. Results revealed that all items of the MIPC were rated according to their projected conceptualization except for item 20. Item 20 (If I get into a car crash, it's mostly because of the other driver) was classified as being appropriate for all three control orientations. As a result, an additional item suggesting a powerful others control orientation was constructed and included in the field trial.

Typing of the MIPC. The MIPC was typed with sample margins and a pleasing amount of "white space". Laubach and Koschnick (1977) suggest an 11-12 point type size for most persons above the third grade reading level. The MIPC was typed using an 11-point type size with Roman type. Three extra points of leading between each item and each rating scale were employed to improve ease of reading. Length of type was fixed at five-and-one-half inches.

Follow-up Study. The results confirmed that the MIPC had a readability grade level

suitable for an adult with reading skills of the fourth- to fifth-grade range. The Flesch reading ease score of 91.2 confirms that the MIPC should be very easily read and that the instrument is interesting to read as indicated by the human interest score of 53. On the basis of these results, it was concluded that the MIPC is operational for ABE learners having reading skills of a grade five equivalency and higher.

In order to test the readability level of MIPC Scales, a field trial was conducted. A total of 39 students enrolled in an adult education program participated in the field trial. They were told to complete the MIPC, circle any word that they could not read, and underline any word or phrase they could not understand. All of the 39 students reported no difficulty in reading the MIPC. Comprehensibility was assessed and was found appropriate for the adult education group. It was decided that any word or phrase that yielded 15% or over in level of comprehensibility difficulty would be further modified. In addition, the introduction to the direction section was revised.

The data were entered into an item and test analysis computer program (Nelson, 1974). Product-moment correlations between the three modified scales were similar to those reported in the literature. Product-moment correlations of each modified item with the three subscales, total scale score, Hoyt estimate reliability, and standard error of measurement were calculated to assess the revised instrument. The Hoyt estimates of internal consistency for the sample of 39 ABE students were .33 for MI, .90 for MP, and .85 for the MC.

## Discussion

Although application of principles to modify an instrument to assure a low readability level did confirm that the procedure has desired merit for producing reading materials having readability qualities appropriate to the reading levels of ABE learners, it is recommended that a more comprehensive adult readability formula be derived which incorporates additional characteristics beyond word difficulty level and sentence length. Evidence to support the recommendation concluded that (a) present readability formulas cannot match material to readers at targeted reading grade levels, (b) rewriting to lower the formula reading grade level score does not increase comprehension, and (c) requiring that text be written to satisfy a targeted reading grade level score focuses attention on meeting the score requirement rather than on organizing the material to meet the readers' information needs (Kern, 1980). A similar conclusion maintains that teachers can gain only a very rough estimate of readability level from the existing diagnostic measures (Sternglass, 1976). It can be argued that current readability formulas ignore or violate current knowledge about the reading process (Bruce, 1981). Most formulas affect only sentence length and word difficulty while ignoring factors that influence text comprehensibility such as cohesion, the number of inferences required, the number of items to remember, the complexity of ideas, rhetorical structure, dialect, required schemata, punctuations, clauses, and double phrases. Nor do they account for reader-specific factors such as interest and the purpose of reading. The Fry Readability Graph and the Fog Index do not yield comprehension information or personal interest scores and, thus, are inadequate for use with ABE learners. Flesch did incorporate a human interest score which is a step in the desired direction. However, a severe limitation in the use of readability formulas is their failure to assess the meaning or comprehension of text. Comprehension is the process of dealing with meaning and from this perspective readability and comprehensibility are not interchangeable terms (Marshall, 1979). Similarly, the problem with the conventional use of readability formulas is the arbitrariness of the numeric scores they yield. The numbers are not referenced to the skills of the students who are expected to read the material. It is very difficult to determine what student populations the "grade-equivalent" scores from a conventional readability formula refer to. (Kirkwood et al., 1980, p. viii)

Psycholinguistics provides an approach to understanding how students read and how they succeed or fail at extracting information from passages. Smith (1978) has written an excellent book on understanding reading that is a useful reference for this topic, and Holland (1981) discusses psycholinguistic alternatives to readability formulas. A review by Bormuth (1977) listed over one hundred reasonable linguistic variables which might be used to predict passage difficulty. Some are very simple and mechanical such as average word size; others involve counting deep linguistic transformations and would require a skilled linguist for measurement. For practical purposes, a few simple variables have been found to account for most of the variation in the difficulty of ordinary textual materials. Further development and research on readability and comprehension is needed to examine new variables and to test their performance. Traditional readability formulas are not producing valid results for the wide range of materials to which they are applied.

The nature of readability and associated formulas has been examined in relation to producing materials at the desired reading ability levels and to modifying existing text material. However, a second issue is apparent in this type of work. Instruments such as the IPC are usually developed to produce a set of standardized administrative conditions and associated norms for interpretation purposes. Such procedures are intended to ensure that reliable and valid scores are obtained when using an instrument. If the items

are rewritten, one needs to determine that equivalent scores are derived from use of the initial version and the modification. In this sense, the user must be assured that both instruments have comparable validities and that similar interpretations would result from the appropriate use of either instrument.

Within the adult education community, it is desirable to have procedures and instruments relevant for use with the ABE learner. A new test assessment formula should include the following factors: sentence length, vocabulary difficulty, personal interest, and comprehension. Development in this direction will assist adult educators in better servicing an increasing ABE population.

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