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THE READABILITY OF ABSTRACTS AND SOURCE DOCUMENTS

A DISSERTATION

SUBMITTED TO THE GRADUATE FACULTY

in partial fulfillment of the requirements for the

degree of

DOCTOR OF PHILOSOPHY

BY

GLADYS BARRETT DRONBERGER

Norman, Oklahoma

1973

THE READABILITY OF ABSTRACTS AND SOURCE DOCUMENTS

APPROVED BY

DISSERTATION COMMITTEE

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CHAPTER I

INTRODUCTION

In the literature of educational research there is
much information that could make a difference in the class-
room. The problem is to make the information accessible to
the practitioners who can move it from the realm of theory
to reality. One segment of the literature, readability re-
search, has traditionally been concerned with enhancing the
efficiency of information transfer within the classroom. An
exploration of the accepted principles of readability may
provide new input into the problem of transferring informa-
tion from educational research to educational practice.

Readability Research

Readability research may be defined as an attempt to
discover and measure those elements which cause reading mate-
rial to be more or less comprehensible. Of all the factors
studied, vocabulary and sentence length were explored most
frequently and finally proved to be the most useful in the
prediction of readability. The research resulted in over
thirty readability formulas; perhaps a half-dozen are in cur-
rent use (Spache, 1970).

Applications of readability formulas were reviewed
by Chall (1958). She indicated that early in this century
the interest was in assessing textbooks and supplementary
material for the school grades; in the 1930's the needs of
adult education promoted study of ways to identify easy read-
ing for adults, and in the 1940's journalists and others con-
cerned with mass communication joined in this kind of research.

Klare (1963) reviewed readability studies and used
the information to support the application of readability re-
search in readable writing. The principles outlined by Klare
are concerned with three facets of the writing problem.
First, the audience must be defined: the writer must specify
whether the material is to be read by a wide audience or a
specialized group of readers. To reach a wider audience, ma-
terial must be written at a lower level of readability. The
second facet of readable writing is the careful use of reada-
bility principles to produce a desired reading level. Klare
emphasized that the writing should be done according to reada-
bility principles compiled into a set of guidelines. Rating
represents the third facet; a formula should be used to rate a
piece of writing only after it has been written.

Abstracts and Readability

Within educational literature is an application of
the principles for writing suggested by Klare. It is the body
of abstracts which are published monthly in the journal,

<u>Research in Education</u> (RIE), which is the primary access to
the documents stored by the Educational Resources Information
Center (ERIC) of the United States Office of Education. The
abstracts are prepared for a wide audience which has been de-
fined by Central ERIC in its Operating Manual (1967). The
manual also provides guidelines for those who write the ab-
stracts. The guidelines incorporate the two most frequent
factors of readability formulas: vocabulary and sentence
length.

It is the focus of this study to explore the applica-
tion of readability principles in the preparation of ERIC-RIE
abstracts. The method of preparation of abstracts follows
closely Klare's recommendations; therefore, the abstracts
should be more readable than the documents upon which they
are based. The production of the source documents was not
subject to the same system of control and so might be expected
to be less readable than the abstracts. Rating abstracts with
a readability formula and comparing their readability level
with that of source documents can provide an evaluation of
the use of readability principles in the preparation of ab-
stracts. Abstracts that are difficult to read could be an ef-
fective barrier to the transfer of information stored by ERIC-
RIE. Busy teachers and administrators who find the abstracts
difficult to read would not benefit from the information in
the abstracts nor would they be likely to go to the source
documents. It should be pointed out that information not

retrieved does not justify its cost. Within the context of education the statement can be made that information not easily accessible to practitioners cannot make a difference in the classroom.

Assumptions and Limitations

The idea that principles discovered through readability research can be used to facilitate the transfer of information from theory to the reality of the classroom rests on several assumptions about readability and about the information system to be used for the investigation. Support for the statements is found in the literature of readability research and in the goals projected for the ERIC information system; both are reviewed in Chapter II. The assumptions may be stated as:

> Assumption 1.--A readability formula is a reliable and valid technique which can be used to estimate the reading difficulty of written material.

> Assumption 2.--An audience of readers can be defined in terms that will allow the specification of the difficulty of reading material.

> Assumption 3.--The estimate provided by the formula and the definition of the audience are stated in terms of a comparable scale; therefore, judgments can be made about the suitability of the material.

> Assumption 4.--The system of ERIC-RIE abstracts is designed for dissemination of information to a wide audience of practitioners in the field of education.

Limitations

Although there are many information systems whose principal means of access is the abstract, the findings of

this study can be generalized only carefully to them because their goals are different from the goal of wide dissemination proposed for the ERIC-RIE system. For example, another information system is published in the journal, Contemporary Psychology; it's function is described by its first editor, E. G. Boring, as a journal of critical reviews designed to tell psychologists about one another (Sanford, 1967). An audience of psychologists would be defined as a small, specialized group.

Purpose of the Study

Working from the first assumption, this study proposes to use a readability formula to measure the reading level of abstracts and their source documents. The purpose of the study is to test the hypothesis that abstracts have a lower readability level than source documents. This general hypothesis is based upon the other assumptions: ERIC has designated a wide audience which can be better reached by using a lower reading level for abstracts than is found in the source documents.

The use of a readability formula to rate RIE abstracts is one way to evaluate their effectiveness as communicators of the information stored in the ERIC system.

CHAPTER II

REVIEW OF RELATED LITERATURE

The review of the literature is organized to lend
support to the assumptions stated in the first chapter. The
thrust is to bring the principles discovered in readability
research to bear upon the problems of information transfer
from the ERIC information system to practitioners in the field
of education. The two sections of the literature review focus
upon the two: readability and the ERIC system.

Readability

Two comprehensive reviews of the literature of reada-
bility are widely quoted. They are essentially in agreement;
Klare (1963), the second reviewer, makes extensive use of
Chall's (1958) work. A third reviewer, Carrol (1971), pro-
vides an analysis of the newer directions in readability re-
search. As in any field, there are divergent viewpoints;
these, too, will be considered. Other studies not included
in the reviews will be reported.

The first three assumptions upon which this study is
based were that a readability formula is a reliable and valid
measurement, that an audience of readers can and should be
defined, and that the two measurements can be compared.

Literature supporting these assumptions will be discussed in the following sections.

Readability Formulas
(Assumption 1)

In Klare's review the studies which lend support to the reliability or validity of the most widely used formulas are grouped separately. Very few reliability studies were available; those few report test-retest coefficients ranging from .95 to .99. However, reliability is rarely questioned; it is validity that causes most concern.

Validity is usually established against the criterion of comprehension. Formulas are composed of some measurement and mathematical combination of word difficulty and syntactic complexity, usually sentence length. Validity coefficients of .70 are reported for the most widely used formulas. Those who criticize formulas say that much more is involved in the difficulty of reading material than can be measured by analyzing and counting words. Critics point out that formulas do not rate the important factors of content, organization, concept load, format, imagery; nor do they measure the interaction of the reader with the material (Koenke, 1971). They do not consider his reading ability, interest, critical evaluation, esthetic enjoyment or, as pointed out by Tibbetts (1973), what he had for breakfast.

Since the inception of readability formulas, careful attempts have been made to incorporate more of the factors

of language. As early as 1928, Vogel and Washburne examined ten variables and used regression techniques to select four for their formula. Others who developed formulas followed much the same procedure. They found that addition of language variables produced only a slight increase in predictive power which did not justify the additional labor in clerical work and computation. Two factor analytic studies of multiple language indexes (Brinton and Danielson, 1958; Stolorow and Newman, 1959) confirmed that word difficulty and sentence length were the most parsimonious predictors of passage difficulty. Martin (1962) points out that generally, research shows additional elements added to the evaluation do not add enough predictive power or reduce enough from measurement error to justify their inclusion.

Readability formulas cannot do everything but they are justified and valid for specific purposes. They indicate the average reading ability needed for adequate comprehension of reading material (Spache, 1970). Within their limitations formulas are accepted as useful tools. But there are still criticisms of the use of formulas to write readable prose.

Typical of the criticisms is Bormuth's (1968) statement that rigid adherence to style specifications derived from readability formulas must inevitably result in short, choppy sentences but not necessarily in materials that are easier to comprehend. Smith and Mason (1972) say that the

control of vocabulary is responsible for stilted prose.
Botel and Granowsky (1972) say that sentence length does not
always indicate complexity; for example, Shakespeare's "To
be or not to be," would be rated very easy by a formula; by
the standards of literature or philosophy it must be rated
very difficult. At an esthetic level of evaluation, Chambers
(1971) says that the controlled vocabulary book may serve a
purpose but is simply not children's literature. He deplores
putting children's classics on "literary surgical tables."

Some of those who criticize the use of formulas for
writing offer new techniques of linguistic analysis supported
by computer technology as an improvement over the older read-
ability formulas. The problems with at least one of the newer
approaches are well outlined by Carrol (1971): (1) The re-
search relies on the "cloze" technique (deletion of every nth
word) which provides a complex score not yet defined in terms
of what is being measured. (2) Analysis of linguistic vari-
ables promised to result in a more efficient predictive for-
mula, but the formula has not materialized. (3) Cloze tech-
niques involve testing a group of readers; a readability
formula can be directly applied by the user.

Those who advocate syntactic analysis at greater
depth than sentence length (Botel and Granowsky, 1972) pro-
vide a complex system for rating sentence complexity but do
not have empirical evidence that their procedure ranks ma-
terials according to difficulty of reading.

A readability formula remains the most reliable and valid predictor of reading difficulty as determined by empirical evidence. Its use as a basis for construction of reading materials is challenged but newer approaches have not produced a method more effective or research-based than Klare's suggested methods: write according to readability principles and rate the material with a formula only after it is written.

The remaining problem concerning formulas is the selection of one from the many available. Klare listed thirty-one and others have been developed since 1963. Klare stated and others (Koenke, 1971; Dulin, 1971) have since agreed that when accuracy is of greater importance than ease of computation the Dale-Chall or Flesch Reading Ease (RE) formulas should be used. The Dale-Chall formula is reported to be slightly more accurate if the Powers-Summer-Kearl (1958) recalculation is used. However, the recalculation was computed against a criterion with less variability in reading levels than was the original formula. The more difficult materials were not used. This would seem to make it less appropriate for adult materials than the original formulas.

Another factor in the selection of a formula focuses on technical vocabulary. The Dale-Chall formula uses as a measure of vocabulary difficulty a count of all words which do not appear on a list of commonly used words. The abstracts and documents in the ERIC system could be expected to include large numbers of words particular to education which might

spuriously inflate readability as measured by the Dale-Chall
formula. Martin (1962) points out another limitation of
word lists: they may become dated and need revision and val-
idation.

Empirical evidence that the Flesch RE would be more
suitable for technical materials was the finding of Caylor,
et al. (1973) that the most efficient indicator of the read-
ability of technical materials for the Army was the number
of one syllable words in a sample of 150 words, a measure
which correlated .98 with syllable count. The Flesch RE does
not count one syllable words but it does count syllables.

The Flesch RE formula seems most useful for estimat-
ing the readability of abstracts and source documents. One
characteristic of the formula should be kept in mind. Flesch
(1948) points out that beyond seventh grade level the formula
underrates grade level to an increasing degree.

Readership (Assumption 2)

Readership is a term used to indicate the number of
readers who elect to read an article or other reading material.
Readership depends on several factors and is an important con-
cern if the goal of writing is dissemination to a wide audience.

Klare used the readability research available in 1963
to support the idea that the size of an audience of readers
depends to a large extent on the readability of the writing.
The basis for the notion was the analysis of studies which

indicated that more readable materials resulted in better comprehension, increased reading rate and higher rates of selection of material by readers. The findings held true for readers of different educational levels and with different amounts of background.

Readability studies have usually been concerned with the transfer of information within the classroom. Some of these not reviewed by Klare, which focused upon the factors influencing readership, are reported in the following paragraphs.

Selections from three sixth-grade science textbooks were rewritten to third-grade level (Williams, 1965). Sixth graders of all ability levels were randomly assigned to either the sixth or the third grade versions of the texts. Speed and comprehension were greater with the third grade version for both high and low ability students but low ability students showed the greatest increase. High ability students did better than low ability with both versions of the textual material.

Drake (1967) used technical and non-technical materials written at fifth and tenth grade reading levels. He found that rewriting did not aid comprehension, retention or reading rate. Girls achieved better with non-technical materials; the boys achieved better with technical materials.

Moore (1961) prepared science units at a fifth-sixth grade reading level from textbooks which had been rated at

ninth-tenth grade level. Junior high students who used the experimental unit achieved higher scores than those who did not.

Watson (1971) rated students in an urban community college according to their verbal ability. He then prepared written materials at grade levels of sixteen, eleven and seven. Comprehension tests indicated that the high-verbal group scored highest with all materials; the eleventh grade materials resulted in the highest comprehension scores for high and medium verbal ability groups; but no version was better than another for the low ability group.

Sellman (1972) modified a correspondence course by controlling readability and by adding illustrations and audio supplement. Comprehension scores were higher for students who received materials modified only by reducing readability from grade level 13.4 to 9.6. Reading rate was also higher but not as high as the rate of those who used materials with visual and auditory supplements. Comprehension was slightly higher when the supplements were used but students required a greatly increased amount of time for completion of the material.

Some studies have surveyed the readability of materials for adults. Information transfer in these studies is placed within a different context: information cannot be transferred if readers do not elect to read the materials.

Kern (1970) measured the readability level of printed
materials used in military occupational specialties and the
relatively lower reading ability levels of men assigned to
the specialties. He suggested that the low on-the-job use
of printed materials by the men is related to the difficulty
of the reading tasks.

Moshey (1972) surveyed the reading choices of retired
professionals. The subjects did not report readability as
a factor in the selection of books to read. However, the
books they listed as read in the previous six months had a
mean readability level of 8.3; more books had a readability
level of 7.0.

Kinnunan (1958) compared articles from the Readers
Digest with the original versions of the articles. She found
no differences in comprehension but a slightly better delayed
recal for the digest versions. A surprising result was that
original versions were read faster. Readers liked originals
best although they reported the digest versions easier to
read.

Felix (1968) sought to develop and evaluate a pre-
scription for more readable reporting of research. He selected
two articles which had been accepted for publication in the
Personnel and Guidance Journal and rewrote them according to
the factors in a readability formula. The versions were sent
to 200 subscribers. The rewritten version did not receive
higher ratings than the original version. Comprehension

scores were not higher for the rewritten version, but there were only twenty-five returns of the comprehension test.

Of the studies which used comprehension as an indicator, only Drake reported no increase in comprehension when the reading level was lowered. Of the studies using selection as an indicator, readers seemed either to prefer the more readable materials or to report no preference in ratings. The trend of all the studies reviewed is to support Klare's findings that comprehension and selection are increased when readability is lowered.

Readability research continues to emphasize that readable writing will reach a wider audience. But the audience must be defined so the most suitable reading level can be determined. In most instances it would be impossible to test the reading ability of an audience; Klare suggested that educational level is a usable estimate of ability.

Comparability (Assumption 3)

When reading materials have been rated and the audience defined there remains the question of whether the two estimates can be compared. In this study the comparison will be made between two readability measurements. However, it would be very useful to make a direct comparison between the readability of abstracts and the reading ability of their intended audience.

Comparing the two may be justified when the comparison is at a judgmental rather than statistical level. Both

measurements refer to a common metric, grade level, which is widely accepted even though it lacks the support of a standard which is empirically defined or governmentally established. One of the criticisms leveled at readability formulas may actually be a justification: most formulas, including the Flesch RE, were standardized on the McCall-Crabbs Standard Test Lessons in Reading (Popp, 1973). The test lessons have been in constant use since 1926 to measure reading ability in terms of comprehension; those who criticize formulas insist that their standardization on the McCall-Crabb's series makes them both outdated and interdependent. Critics may have overlooked the fact that the standardization has provided not only a common basis for many readability formulas but a basis long rooted in reading comprehension which lends some support to the idea that comparisons can be made between readability, a predictor of comprehension, and reading ability, usually measured in terms of comprehension.

The Information System

If readability principles are to make an input to the ERIC information system, the structure of the system must be examined, its goals identified, and its method of operation outlined. The relationships between these factors will determine the influence that readability can have upon the transfer of information from educational literature to the classroom.

ERIC

In a paper presented at a conference on Information Retrieval, Smith (1970) gave a short, informative description of the organization of ERIC.

The Educational Resources Information Center (ERIC) is a nationwide decentralized information system designed to help advance research and development on educational problems and processes and to accelerate widespread adoption of research-based educational programs. ERIC consists of four major interrelated components:

1. Central ERIC Headquarters staff in the Office of Information Dissemination, USOE, is responsible for developing, managing and coordinating the system.

2. The network of 20 clearinghouses. Each clearinghouse focuses on a specific topic or field.

3. An ERIC Facility, currently operated under contract by Leasco Systems and Research Corporation, to provide centralized document processing activities as well as computer, lexicographic and technical services. This contractor prepares the magnetic tape for the issues of Research in Education (RIE), the major abstracting and indexing publication of the Office of Education, as well as all other major output products which are computer-generated using the ERIC files.

4. The ERIC Document Reproduction Service (EDRS) is operated under contract by the National Cash Register Company, 4936 Fairmont Avenue, Bethesda, Maryland, 20014. ERDS sells the full text of documents cited in RIE at nominal cost.

From the description it should be noted that ERIC is the designation for the total system which is directed by Central ERIC. ERIC Document Reproduction Service (EDRS) is responsible for the storage and dissemination of source documents and Research in Education (RIE) is a journal which

publishes each month the abstracts whose purpose is access

to the source documents. Since the 1970 conference the opera-

tion of EDRS has been relocated and is now under contract by

Leasco.

Goals of ERIC (Assumption 4)

General goals were stated by Smith. They clearly in-

dicate that ERIC seeks to transfer information from research

and development to educational programs.

Smith also described a unique goal of the ERIC system:

It actively solicits fugitive literature which is not usually

published in professional educational journals. Technical re-

ports, conference proceedings, reports of state and local

studies, bibliographies, curriculum studies, are all available

through ERIC.

The audience sought by the ERIC system is explicitly

defined in the Operating Manual (1967) provided by Central

ERIC.

> The users of the ERIC system are generally pro-
> fessionals (teachers, researchers, and administrators)
> from many different fields of education. But, there
> is a large audience of potential users (new teachers,
> graduate students, librarians, personnel at different
> information centers, or people who have only a re-
> lated interest in the field but still want to be in-
> formed) who may not be familiar with sophisticated
> ideas or technical jargon.

The goals of ERIC are to make fugitive but potentially

useful materials accessible to what can be described as a wide

audience of users.

Methods of Operation

Documents stored by EDRS have been described as fugitive documents of many kinds. They have been produced by many different writers with different purposes and using different guidelines. Variability in reading level could be expected as a function of these differences.

Abstracts published by ERIC-RIE are produced at several clearinghouses located in most instances at colleges or universities. The number of clearinghouses has varied from fourteen in 1967 to twenty in 1970 and to eighteen in 1973. Each clearinghouse has been primarily responsible for the processing of documents produced in a specific area of education. Central ERIC developed and disseminated to each of the clearinghouses an Operating Manual with guidelines for abstracting. Some abstracting has been done by permanent employees but many have been done by graduate students whose tenure was limited by the completion of their studies. Thus the continuity and the uniformity of abstracts can be attributed either to the guidelines or to the administration of the clearinghouses.

The guidelines used in abstracting documents not only describe the audience; they specify how an abstract should be written and provide examples of good abstracts. They state that no abstract should be so narrow in outlook or use language so indigenous to one particular field that it cannot be read with understanding by all users of the system. The guidelines

are also specific about length; an abstract should be approximately 200 words. Sentences are to be varied in length but none should be overlong or too complex. Vocabulary should include the key words from the original; new or technical terms should be defined. It should be noted that the guidelines rely on the two factors used in readability formulas but include specifications which should control the negative effects of rigid adherence to formulas. The guidelines as recommended by Central ERIC are presented in Appendix A.

Hypotheses

The purpose of the study has been stated as a comparison of the readability of ERIC abstracts with readability of the corresponding source documents. The use of readability principles in the guidelines for abstracting suggests that abstracts will have a lower reading level than source documents (Hypothesis 1).

Of course it could be argued that the clearinghouses or their assigned areas of educational literature may have a greater impact on abstract readability than the guidelines from Central ERIC. A clearinghouse may consistently process documents that are difficult to read and also produce abstracts difficult to read (Hypothesis 2). Or the opposite may be true; the clearinghouse which processes readable documents may produce abstracts more difficult to read (Hypothesis 3).

If a difference is found among the materials processed by different clearinghouses, useful information will be

provided by identifying the clearinghouses. There may be a difference between the reading levels of abstracts from different clearinghouses (Hypothesis 4) or between source documents processed by different clearinghouses (Hypothesis 5).

The different kinds of documents stored by EDRS have been described. Their variability may be a factor which denies the production of consistently readable abstracts. Unusual variability in the reading level of abstracts produced by a clearinghouse may identify a localized problem which needs attention. It is hypothesized that there is a difference in the variabilities of abstracts and source documents (Hypothesis 6).

The hypotheses to be tested are:

Hypothesis 1.--Abstracts have a lower reading level than the original documents.

Hypothesis 2.--The reading level of material produced in one area of education is different from that of other areas.

Hypothesis 3.--The clearinghouse which produces abstracts of lowest reading level processes documents of the highest reading level.

Hypothesis 4.--Different clearinghouses produce abstracts of different reading levels.

Hypothesis 5.--There is a difference among the reading levels of the documents abstracted by different clearinghouses.

Hypothesis 6.--There is a difference in the variability of the reading levels of the materials processed by different clearinghouses.

The null form of the hypotheses will be stated and the statistics used to test them will be described in Chapter IV.

CHAPTER III

METHODOLOGY

To compare the reading level of abstracts with that
of the original documents, a readability formula was applied
to a random sample of abstracts and their corresponding docu-
ments. The methods used for selecting the sample, applying
the formula and collecting data are discussed in the follow-
ing sections of this chapter.

Sample

Two aspects of the sampling procedure are discussed
in the following paragraphs. First, the method of determin-
ing sample size is discussed and second, the method for se-
lecting the sample.

Sample Size

The number of clearinghouses and the number of ab-
stracts precluded sampling abstracts from each clearinghouse.
It was necessary to limit both the number of clearinghouses
and the number of abstracts to be sampled. At the time the
study was initiated there were eighteen clearinghouses and
approximately 70,000 documents. Some rationale was needed
to establish the size of sample necessary to yield signifi-
cant results. Parten (1966) pointed out that the emphasis

in earlier issues of ERIC-RIE and clearinghouses in continuous
operation were assigned the number which appears beside ten of
the clearinghouses in Table 1. These ten were eligible for
selection. The four selected were:

Adult Education
Educational Management
Educational Media and Technology
Rural Education and Small Schools

TABLE 1

ERIC-RIE CLEARINGHOUSES LISTED IN RESEARCH
IN EDUCATION, APRIL, 1973

No.*	Clearinghouse	No.*	Clearinghouse
1	Adult Education		Reading and Communication Skills
2	Counseling and Personnel Services	8	Rural Education and Small Schools
	Disadvantaged		
3	Early Childhood Education	9	Science, Mathematics, and Environmental Education
4	Educational Management		Social Studies/Social Science Education
5	Educational Media and Technology		
	Exceptional Children		Teacher Education
	Higher Education		Tests, Measurement and Evaluation
6	Junior Colleges	10	Vocational and Technical Education
7	Languages and Linguistics		
	Library and Information Sciences		

*Numerals indicate Clearinghouses which have been in contin-
uous operation since the beginning of ERIC-RIE in 1967.

A list of all the abstracts produced by each of the
four clearinghouses was secured from the cumulated indexes to

ERIC-RIE. A table of random numbers was used to select a representative sample of abstracts from the list. Abstracts identified were required to have at least 100 words in narrative form; abstracts consisting of lists of terms or topics were not used in the study because they inflate readability estimates. Characteristics of source documents also imposed restrictions on selection. Excluded from the sample were those abstracts for which the original document was not available in the ERIC Document Reproduction Service (EDRS) because the study focused on the ERIC system. Also excluded from the sample were abstracts which described curriculum guides or bibliographies. Although the abstracts may have been appropriate for readability research, the original documents were not appropriate for readability measurement.

After the abstracts were selected, the corresponding original documents were located. The documents were available on microfiche. Copies were made of the abstract and the first page, last page, and the center page from each document, a sampling procedure suggested by Dulin (1971). The only restrictions placed upon the selection of pages was that the first or last page not be a reproduction of the abstract and that there must be 100 consecutive words of narrative. If the selected page was composed of tables or other inappropriate material the preceeding page was used.

Application of the Formula

One modification was made in the Flesch RE to increase accuracy. The only sources of variability in the application of the RE formula are human counting errors and differences in the way syllables are counted. Human errors were controlled by double checking; syllable errors were controlled by counting the number of letters in 100 words and dividing by 3.1127 to obtain the number of syllables. Syllable counts using this method have been shown to correlate .98 with actual syllable counts (Coke and Rothkopf, 1970; Felsenthal, Shamo and Bittner, 1971).

The Flesch RE is usually reported on a scale of 1 to 100 with 100 being the easiest reading level. For the purpose of this study it seemed more useful to report readability in terms of grade levels. Actually the only difference between the two versions is an inversion of the constant used in the final step of the formula (Flesch, 1948). Both versions are presented in Appendix B. Also included are the counting rules used in the application of the formula.

Collection of Data

Readability scores were computed for each of the abstracts and the original documents. Scores for each abstract were based on one sample. Scores for each article were based on samples taken from each of the first, last and middle pages; the readability score was computed by adding the counts of syllables, words or sentences and dividing by three. Thus the

readability of a source document is not an average of three
readability scores but is a readability score based upon a
larger and more representative sample of reading material.

The readability scores of each of the selected abstracts
and source documents are listed by clearinghouse and ED number.
The scores are included as Appendix C. The readability scores
were used in the comparison of abstracts with source documents.
The description and analysis of the scores are discussed in
Chapter IV.

CHAPTER 4

RESULTS

Several hypotheses have been stated about the readability levels of abstracts and source documents. The hypotheses were designed so that statistical tests would provide information about the relationships between the readability levels of abstracts and the source documents to which the abstracts serve as primary access.

The data are described in the first section of this chapter; selection and application of test statistics to the data are included in the second section.

Data Description

Initial inspection of the data suggested that the relationship between the readability scores of abstracts and source documents might be high enough to influence the selection of test statistics. To determine the degree of relationship a Pearson product moment correlation coefficient was computed for abstracts and documents within each clearinghouse. The resulting coefficients are presented in Table 2. Only one of the correlations for clearinghouses reached the magnitude required for significance at the .05 level of probability. However, the correlation for the total sample, across

clearinghouses, was .785 which was significant at the .001

level of probability. Therefore, the degree of relationship

between the readability of abstracts and source documents was

considered in the selection of test statistics.

TABLE 2

CORRELATION BETWEEN THE READABILITY SCORES
OF ABSTRACTS AND SOURCE DOCUMENTS

Clearinghouse	df	r
Adult Education	10	.401
Educational Management	10	.488
Educational Media	10	.568
Rural Education	10	.740*
Total	46	.785**

*p < .05
**p < .001

Central Tendency
and Variability

Data were also described in terms of their central

tendency and variability. Means and standard deviations were

computed for abstracts and source documents processed by each

of the clearinghouses. Examination of means and standard de-

viations presented in Table 3 reveals several relationships.

Immediately apparent is the fact that the means of the reada-

bility levels of abstracts are different from the means of

the readability levels of the source documents but not in the

expected direction. Abstracts have higher levels of

readability. Another relationship of interest is that the clearinghouse for Educational Management has the lowest mean readability score for source documents and the highest for abstracts.

TABLE 3

MEANS AND STANDARD DEVIATIONS OF
ABSTRACTS AND SOURCE DOCUMENTS

Clearinghouse	Abstracts		Source Documents	
	Mean	S.D.	Mean	S.D.
Adult Education	11.765	1.536	11.602	.704
Educational Management	12.780	1.125	11.193	.747
Educational Media	12.190	1.382	11.238	1.075
Rural Education	12.194	1.142	11.296	1.078

Statistical tests described in the next sections will establish the significance of these differences.

Analysis of the Main Effects

The central hypothesis to be tested in this study was that abstracts have different readability levels than source documents. A second main hypothesis was that differences might exist among the materials processed by different clearinghouses. A third hypothesis was concerned with the interaction between clearinghouses and the readability levels of abstracts and source documents. A two-way analysis of variance provided tests for the two primary hypotheses concerning the main effects and the interaction between the two main effects.

The Main Effects

The effect of a difference in readability between abstracts and source documents is stated in the first null hypothesis. Although it was expected that abstracts would have a lower readability level, there was no empirical evidence for a directional hypothesis. The first hypothesis is stated in the following terms:

H_O1: There is no significant difference between the mean reading levels of abstracts and the mean reading levels of source documents.

The effect of differences among materials processed by clearinghouses might occur in different ways: the readability of source documents might differ, the readability of abstracts might differ, or both could be true. The effect of differences among clearinghouses is stated in the second null hypothesis:

H_O2: There is no significant difference among the mean reading levels of materials processed at the four clearinghouses.

Another possibility might contribute to the differences between abstracts and source documents. There might be some systematic relationship between the clearinghouses and the materials they processed. The clearinghouse which processed documents with the lowest readability level might produce abstracts of highest readability. The effect of an interaction between clearinghouses and readability levels is stated in the third null hypothesis:

$H_0$3: There is no significant interaction between clearinghouses and the reading levels of the materials they process.

The Mixed Effects Model

The mixed effects model for the analysis of variance (Hays, 1963) was considered most appropriate as a test of the first three hypotheses because it allowed for the materials processed by different clearinghouses to be treated as the random effect. Thus, results can be generalized to materials processed by other clearinghouses. The difference between abstracts and source documents was treated as the fixed effect.

An additional consideration in the selection of a model was the degree of relationship between abstracts and source documents. The documents were selected not randomly but because they were the source documents for the abstracts. The relationship between readability levels is indicated by the correlation of .785 between the total sample of abstracts and source documents. Correlated data introduces a systematic source of variance which can be removed by the partitioning of the variance to allow for the rows sums of squares (Winer, 1962). The model for the mixed effects analysis of variance for correlated data is diagrammed in Figure 1.

In the computation of the mixed effects model for correlated data, the error term for the random effect was the mean square error for rows which is the systematic variance due to correlated data. For both the fixed and interaction effects

the error term was the mean square within groups with the systematic variance removed.

FIGURE 1

MIXED EFFECTS MODEL FOR THE ANALYSIS
OF VARIANCE OF CORRELATED DATA

		Fixed Effect	
		Abstracts	Source Documents
Random Effect	Adult Education	12	12
	Educational Management	12	12
	Educational Media	12	12
	Rural Education	12	12

Results of the Analysis

The results from the computation of the analysis of variance are summarized in Table 4. It should be noted that the F ratio for the materials processed by clearinghouses, the random effect, did not reach the level required for significance. However, the F ratio for the difference between the readability of abstracts and source documents did reach the magnitude required for significance at the .001 level of probability. Thus, it was possible to reject the null hypothesis of no difference between the readability levels of abstracts and source documents and state with 99.9 percent

confidence that abstracts have a higher readability level than source documents. The F ratio for interaction reached the magnitude required for significance at the .001 level of significance. Thus, it was possible to reject the null hypothesis of no interaction between clearinghouses and the materials they process.

TABLE 4

SUMMARY TABLE FOR THE ANALYSIS OF VARIANCE

Source	SS	df	ms	F
Fixed Effect (Abstracts and Documents)	19.44	1	19.44	694.28**
Random Effect (Clearinghouses)	1.38	3	.46	.18
Interaction	5.43	3	1.81	60.33**
Error for Rows	111.80	44	2.54	--
Error within	1.25	44	.03	--
Total	139.30	95		

**$p < .001$

Post Hoc Comparisons of Means

Hypotheses four and five were concerned with differences that might exist among the readability levels of the source documents or the abstracts processed by different clearinghouses.

Hypotheses

Stated in null form hypotheses four and five are as follows:

$H_0 4$: There are no significant differences among the means of the reading levels of the abstracts produced by the clearinghouses.

$H_0 5$: There are no significant differences among the means of the reading levels of the source documents abstracted by the clearinghouses.

The analysis of variance did not detect a significant difference among the means of the reading levels over all the materials processed by different clearinghouses. However, it was possible that significant differences might exist between one or more pairs of means from either abstracts or source documents. Tests of significance were needed to answer this question.

Additional questions were raised by the significant F ratio for the difference between abstracts and source documents. Valuable information could be gained by comparing the mean of the abstracts with the mean of the source documents for each clearinghouse. The significant difference detected by the analysis of variance might have been the result of a very large difference between abstracts and source documents at only one of the clearinghouses, or several clearinghouses might be responsible for the significant difference.

The significant F ratio for interaction indicated that some clearinghouses were processing documents of low readability

levels and producing abstracts of high readability while for other clearinghouses the reverse might be true. Comparing the means of source documents with the means of abstracts would identify which clearinghouses were responsible for the significant interaction effects.

Two general questions needed to be answered. First, were the significant F ratios due to large differences between abstracts and source documents processed by only one or two clearinghouses or were the differences distributed across all the clearinghouses in the sample? Analysis of variance indicates that differences exist; it does not locate the difference. Second, were the differences detected actually significant in terms of the error of measurement of the formula? Or were they merely a result of the high level of power as described in Chapter III? If differences between means were not only statistically significant, but also larger than the error of measurement of the Flesch RE, they could be considered of practical value. For the purposes of this study, a practical difference is one that is larger than the error of measurement and thus may be reflecting a true difference in reading levels.

To clarify the relationship between the means of abstracts and source documents for the clearinghouses they were arranged on a scale of readability levels (see Figure 2). Examination of the graph suggests that the significant differences for the fixed effect might be due to the large

difference between the abstracts and source documents from
the clearinghouses on Educational Management. The relation-
ship between source documents, abstracts and clearinghouses
suggests that the significant interaction effect might be at-
tributed to the clearinghouses for Educational Management and
Adult Education.

FIGURE 2

MEANS OF ABSTRACTS AND SOURCE DOCUMENTS
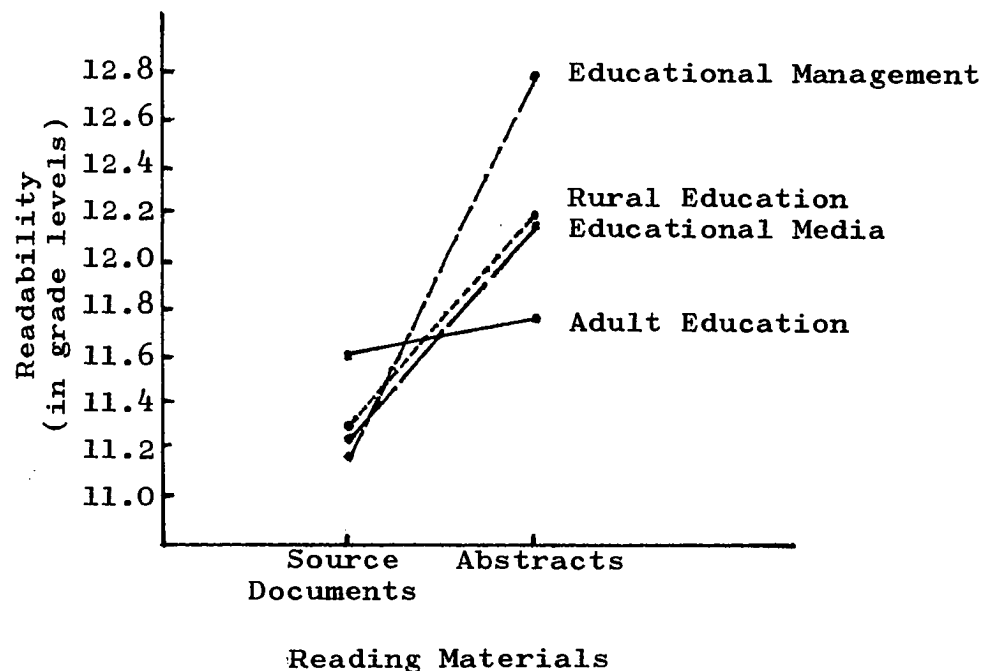
Reading Materials

The range of means for abstracts suggested that al-
though the F ratio for differences among materials was not
significant, the difference among the means of abstracts might
have been large enough to achieve significance. A procedure
for testing the significance of all possible pairwise

comparisons would test hypotheses four and five and provide answers to other questions suggested by the significant F ratios.

Results of the Comparison of Means

Tukey's Honestly Significant Difference (HSD) test was used for the test of significance. Kirk (1968) recommended use of the HSD when all possible pairwise comparisons between means are to be made. All pairwise differences between means are listed in Table 5. Differences larger than the HSD (.259) are significant at the .01 level of probability. However, only those significant differences are marked which are larger than .850, the error of measurement of the Flesch RE; differences marked with an asterisk are both significant and practical.

Examination of the table reveals one significant and practical difference between the means of abstracts. Thus it is possible to reject the null hypothesis of no differences among the means of the abstracts. The mean readability level of abstracts produced by the Clearinghouse for Educational Management is significantly higher than the mean of abstracts produced by the Clearinghouse for Adult Education; but it is not significantly higher than the mean readability level for the other two clearinghouses.

Although there are significant differences among the means for source documents, the differences are not of practical

magnitude. Null Hypothesis five may be rejected at a statistical level but not at a practical level.

TABLE 5

PAIRWISE COMPARISONS OF DIFFERENCES AMONG MEANS

	Means	Differences						
		$\bar{X}_2$	$\bar{X}_3$	$\bar{X}_4$	$\bar{X}_5$	$\bar{X}_6$	$\bar{X}_7$	$\bar{X}_8$
$\bar{X}_1$	11.193	.045	.103	.409	.572	.997*	1.001*	1.587*
$\bar{X}_2$	11.238		.058	.364	.527	.952*	.956*	1.542*
$\bar{X}_3$	11.296			.306	.469	.894*	.898*	1.484*
$\bar{X}_4$	11.602				.163	.588	.592	1.178*
$\bar{X}_5$	11.765					.425	.433	1.015*
$\bar{X}_6$	12.190						.004	.590
$\bar{X}_7$	12.194							.586
$\bar{X}_8$	12.780							

*$p < .01$; HSD = .259

Source Documents: $\bar{X}_1$, Educational Management; $\bar{X}_2$, Educational Media; $\bar{X}_3$, Rural Education; $\bar{X}_4$, Adult Education.
Abstracts: $\bar{X}_5$, Adult Education; $\bar{X}_6$, Educational Media; $\bar{X}_7$, Rural Education; $\bar{X}_8$, Educational Management.

Questions raised by the significant F ratio for differences between abstracts and source documents may also be answered by examination of Table 5. Reading levels for abstracts from all clearinghouses, except one, are significantly different from reading levels for all source documents. The single exception is the difference between the mean reading level of abstracts and source documents produced by the Clearinghouse

for Adult Education. The difference between the means for
abstracts and source documents from Adult Education was not
significant; however, the direction of the difference was the
same as for other clearinghouses. Abstracts for all clearing-
houses had higher mean reading levels than source documents.

Examination of Figure 2 and Table 5 also provides a
description of the source of the significant F ratio for in-
teraction between clearinghouses and materials. Although all
differences were in the same direction, two clearinghouses
had different patterns of change in reading levels. The
Clearinghouse for Adult Education had the highest mean read-
ing level for source documents and the lowest mean for abstracts
while for the Clearinghouse for Educational Management the re-
verse was true. Source documents had the lowest mean reading
level and abstracts had the highest.

Comparison of Variances

A sixth hypothesis was concerned with the variances of
abstracts and source documents. It was hypothesized that vari-
ances of source documents would be larger than variances of
abstracts. The many kinds of source documents were expected
to result in variability of the reading levels. Stated in
null form the hypothesis is:

> $H_0 6$: There are no significant differences among the
> variances of the reading levels of the documents pro-
> cessed or the abstracts produced by the clearinghouses.

Hartley's F_{max} test for homogeneity of variance was
used to test the sixth hypothesis. The ratio between the

largest and smallest variance did not reach the magnitude required for significance at the .05 level which resulted in a failure to reject the hypothesis of no significant differences among the variances. Variances for abstracts and source documents from each of the clearinghouses are listed in Table 6.

TABLE 6

VARIANCES OF ABSTRACTS AND SOURCE DOCUMENTS

Clearinghouse	Variances	
	Source Documents	Abstracts
Adult Education	.499	2.359
Educational Management	.558	1.266
Educational Media	1.155	1.911
Rural Education	1.163	1.303

F_{max} = 2.359/.499 = 4.727
df = 11
K = 8

Summary of Results

The expectation that abstracts have lower mean readability levels than their source documents was not confirmed. In fact, abstracts had significantly higher readability levels. Abstracts produced by every clearinghouse were less readable than their source documents. All but one difference, that for the Clearinghouse on Adult Education, was large enough to achieve significance at the .01 level. The three significant differences were of practical value; they were larger than

the error of measurement of the formula and thus could be considered true differences.

Differences among materials processed by clearinghouses were not significant except for one difference between the mean reading levels of abstracts. The Clearinghouse for Educational Management produced abstracts with the highest mean reading level; the mean was significantly different from the mean for abstracts produced by the Clearinghouse for Adult Education but not from the other two clearinghouses.

The Clearinghouse for Educational Management produced abstracts of highest reading level from source documents with the lowest reading level. This, combined with the significant but smaller differences for Rural Education and Educational Media, and the non-significant difference for Adult Education accounted for the significant interaction between clearinghouses and the materials they process.

The expected large variability in the readability of source documents and relatively smaller variability in the readability of abstracts was not confirmed by the data analysis. It is interesting to note that the largest variance was for the abstracts from the Clearinghouse for Adult Education; the smallest variance was for the source documents from the same clearinghouse.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

ERIC-RIE abstracts were rated with a readability for-
mula and their readability levels were compared with the read-
ability of source documents to provide an evaluation of the
use of readability principles in the preparation of abstracts.
Both the estimates of readability and the comparisons resulted
in some unexpected findings.

Abstracts and Source Documents

First, abstracts were consistently less readable than
source documents. Three of the differences were larger than
the error of measurement of the readability formula, and the
overall difference was significant. A process of random selec-
tion was used to identify abstracts for the study, thus results
should be generalizable to other abstracts within the ERIC-RIE
system which meet the stated criteria. Abstracts of at least
100 words which are narrative in style rather than being a
list of terms can be expected to have reading levels similar
to those found in the study.

Second, there was a remarkable consistency among the
reading levels of all the areas sampled. It was evident in
both the measures of central tendency and variability; only

one significant difference was found among means and none were found among variances.

Further definition of the analysis of the mean readability levels indicated that neither abstracts nor documents differed among areas. The areas, or clearinghouses, sampled were also a result of a process of random selection; therefore, it should be possible to generalize to all clearinghouses which meet the stated criteria. All which have been in continuous operation since 1967 may be expected to process materials of similar reading levels. There is a pattern of homogeneity among the readability levels of both source documents produced by many different writers, and abstracts produced within the ERIC system. The results indicate that technical educational materials stored in the ERIC system rather consistently have an eleventh grade mean readability level, and that abstracts rather consistently have a twelfth grade mean readability level.

Further analysis of the variability of the reading levels indicated that the range of documents produced in one area of education was not significantly different from that produced in other areas. Also, the range of difficulty of abstracts produced by one clearinghouse was not significantly different from other clearinghouses.

The striking consistency of the variance in readability from area to area rather obscures the fact that there is variability within each set of materials. And the variability

for abstracts is greater than for source documents, a result
which although not statistically significant is contrary to
expectations. The situation might be summarized by saying
that the production of abstracts has resulted in consistently
variable readability levels.

Recommendations

It must be concluded that the use of readability prin-
ciples in a set of guidelines does not result either in lowered
readability or in uniform levels of readability. Klare (1963)
suggested that the application of a formula would provide the
feedback necessary to determine whether written material had
met the desired reading level. He also suggested that if the
estimate indicated that a reading level is too high, closer
attention must be given to vocabulary difficulty and sentence
length. In the production of abstracts it would seem that
every effort should be made to make them at least as readable
as their source documents and the results of this study indi-
cate that application of a formula is a necessary part of the
process.

Special attention may be needed in two areas. The ab-
stracts produced by the Clearinghouse on Educational Manage-
ment were significantly less readable than the source docu-
ments in that area of the literature. Administrators, by vir-
tue of their position of leadership, should have more impact
on educational practice than some other practitioners. And

yet they seem to have less promise of efficient access to the literature which could increase their effectiveness, than those in other areas of education.

A second area of the information system which causes some special interest is the wide variability from a grade level of 8.58 to 14.10 within the abstracts produced in the area of Adult Education. The range in readability within this area encompasses almost the entire range of the abstracts used for the study. The situation may reflect the wide range of content within the area of Adult Education, a field whose concerns span programs for adult basic education to doctoral level programs. Although it is interesting, it should be pointed out that the range in this area was not significantly larger than those in other areas when a statistical test was applied.

Information Transfer

What, then, has been learned through the application of readability principles to the problems of information transfer? That abstracts are less readable than source documents has been established and recommendations have been made toward facilitating the production of more readable abstracts. But how readable should abstracts be? A further application of readability principles may outline a solution to the problem.

The idea of a defined audience, from the literature of readability research, allows the definition of a scale

against which the readability estimates can be viewed. The
audience defined for the ERIC information system included
teachers, researchers, and administrators, all of whom have
completed at least four years of higher education. Klare sug-
gested educational level as a useful approximation of reading
ability; therefore, the audience for the ERIC system may be
defined as having a grade level of 16.0.

The estimated grade levels of abstracts ranged from
8.58 to 14.59. Even the most difficult would be within the
expected ability of the audience. But it should be remembered
that estimates of the readability of adult materials using
the Flesch Reading Ease formula are low. Allowances must be
made when grade level comparisons are being considered.
Another factor in the comparison should be differences in
reading ability. Not all college graduates would achieve
grade level 16.0 on a test of comprehension. It has been sug-
gested by those who have applied readability formulas in the
field of journalism (Flesch, 1949; Gunning, 1952) that read-
ing material should be written for the lower reading abilities
within the defined audience. Readers with better skills can
read easy materials but the opposite is not true; difficult
materials cannot or may not be read by those with less skill.

Readability research offers some help to answer the
questions of how readable abstracts should be. Comprehension
studies showed better comprehension when reading level was
lower than the ability of the audience. Another readability

principle should also be considered; readership, whether the
reader elects to read the material, is a function of reading
rate as well as comprehension. A larger audience may elect
to read through a set of abstracts if the task can be accom-
plished quickly. The fact that the reading level seems to be
within the readers' ability does not guarantee selection. If
there is no selection, there is no possibility for informa-
tion transfer. The ideas about comprehension, reading rate
and readership as well as the characteristics of the readabil-
ity formula suggest that the readability grade levels of 13.0+
and 14.0+ should be avoided. Abstracts of these readability
levels diminish the probability of a larger readership.

Readability research has provided a rationale for the
establishment of a standard for the readability of abstracts.
It can also aid in setting limits for the variability from
the standard. Measurement presumes variability; the problem
is to determine how much is acceptable. At least two factors
that should be considered are errors of measurement and, again,
readership. If the standard were established at grade level
11.0, abstracts at grade level of 10.0 and 12.0 could be con-
sidered within the range; the error of measurement of the for-
mula is almost one grade level. The problem of readership,
or selection by the reader, influences the amount of variabil-
ity that is desirable. Studies have indicated that readers
preferred original versions of materials with reading levels
not controlled by readability formulas. These factors suggest

that a rigid standard with no provision for acceptable vari-
ability would not be reasonable in terms of the precision of
measurement, nor would a rigid standard produce abstracts
readers would elect to read.

Implications

The exploration of the readability of abstracts and
source documents has provided input into the problem of trans-
ferring information from educational literature to educational
practice, within the framework of the ERIC information system.
The results of the study have suggested that if RIE abstracts
are to be an effective means of access to the large ERIC data
base, greater attention should be given to the readability
levels of the abstracts. The exploration has strongly sug-
gested that if abstracts are to be made more readable it will
be necessary to make use of a formula to provide a quantita-
tive check on readability levels.

Application of readability formulas will require some
planning for time and resources. The formula used for this
study is appropriate for computer application, a method which
could give accurate analysis over a wide range of abstracts.
But the computation of readability scores will not guarantee
desired results. Sub-scores for syllables and sentence length
should be provided to point out areas where improvement can
be made most effectively. The analysis should give descrip-
tive statistics by clearinghouse and by abstractor to identify

localized problems. To be effective, readability analysis should be designed as an information system which provides feedback to the abstractors.

Principles from research on readability and the results of this study offer additional suggestions for the information system. From readability research comes the notion of a defined audience as a basis for a usable reading level. Also from readability research comes the tool for measurement and the scale against which the reading level of abstracts can be measured. From the results of this study comes the idea that reading levels of abstracts are higher than reading levels of source documents; therefore, they may not have the potential for reaching a large audience. And a note of caution can be drawn from the results of this study; although there were differences in reading levels among areas of educational literature, the differences were not larger than might be expected by chance. An information system seeking to identify localized problems should be so constructed that the information generated is a result of statistically significant differences. Errors of measurement and the possibility of differences due to chance should be considered when individuals or organizations are being identified.

An information system designed to help make abstracts more readable might be the means by which readability principles provide input into the problem of transferring information from educational research to educational practice.

More readable abstracts may make educational information more accessible to the practitioners who can move it from the realm of theory to reality.

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APPENDICES

APPENDIX A

ERIC GUIDELINES FOR ABSTRACTING

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Two parts of the ERIC Guidelines for Abstracting are pertinent to the thrust of this paper. Part I-D describes the audience for abstracts and Part V-A,B,C,D lists specific guidelines for the style of abstracts. They are reproduced as they appear in the ERIC Operating Manual, 1967. Although the Manual has had some revision since 1967, none of the revisions pertain to the section dealing with Abstracting (W. T. Brandhorst, personal communication, May 24, 1973).

Part I. GENERAL INFORMATION

D. Audience

The users of the ERIC system are generally professionals (teachers, researchers, and administrators) from many different fields of education. But, there is a large audience of potential users (new teachers, graduate students, librarians, personnel at different information centers, or people who have only a related interest in the field but still want to be informed) who may not be familiar with sophisticated ideas or technical jargon. No abstract, then, should be so narrow in outlook or use language so indigenous to one particular field that it cannot be read with understanding by all the users of the system. Yet the abstractor should assume that the readers share a basic core of knowledge (most readers will know much more, of course); therefore, an abstract should not dwell unnecessarily on background information or on commonplace ideas. An abstractor should remember, nevertheless, that he is writing for a user who has not seen the document and does not know what he knows.

Part V. SPECIFIC GUIDELINES FOR ABSTRACT STYLE

A. Length

Abstracts ordinarily are limited to approximately 200 words. Within this limitation their is no fixed length for

an abstract because the appropriate length is determined by
the contents of the document.

B.   Paragraphs

An abstract is only one paragraph long. The accepted
rules about paragraph writing must be followed, especially
those concerning coherence and unity. A coherent paragraph
contains connected sentences, each following the other in
logical order. An abstractor can avoid writing a paragraph
that is nothing more than a series of sentences, each one sum-
marizing a separate topic in the document, by the intelligent
use of transitional words and phrases.

A paragraph should have a topic sentence, some central
statement of the document's major thesis, from which the rest
of the sentences can develop. (This is especially important
in an informative abstract.) Generally, the topic sentence
is the first sentence of the abstract, and, because it occu-
pies this strategic position, it should be as full and accu-
rate a statement as possible of (1) what the article says,
(2) what the author's conclusion is, (3) what the total sub-
ject and scope of the document is, or (4) what the author's
purpose is in writing the document.

C.   Sentences

Sentence length should vary as much as possible to
avoid the unpleasant effect of a series of short, choppy sen-
tences. Be terse, not telegraphic. Use complete sentences,
omitting neither verbs nor conjunctions. Avoid the overlong,
complex sentence in which the abstractor piles up clauses and
phrases, especially qualifiers and modifiers, in an attempt
to include as much as possible in one sentence.

Every sentence should have high information density
and, without being cryptic, convey a maximum amount of infor-
mation in a minimum number of words.

Because at the moment the ERIC system precludes the
use of semicolons and colons, abstractors must be careful to
avoid comma splices and run-on sentences.

D.   Language and Vocabulary

An abstractor should try to incorporate into his ab-
stract the key words in the article, especially if they are
repeated often, but he should avoid direct quotations; they

usually do not carry enough information to be excerpted. However, single words or short phrases should be quoted if the author has coined a new phrase that is seminal to his whole study and if failure to call attention to it would be misleading. New or technical terms should be defined briefly. Also, polemical or exceptionally suggestive words should be placed within quotation marks.

The abstractor should not repeat monotonously a series of sentences starting with "It was suggested that . . .," "It was found that . . .," or "It was reported that . . . ." Abstracts in which most sentences end with "are discussed" and "are given" similarly are ineffective.

APPENDIX B

THE FLESCH READABILITY FORMULA

COUNTING RULES USED IN THE APPLICATION OF
THE FLESCH READING EASE FORMULA TO
ABSTRACTS AND SOURCE DOCUMENTS

The following rules are based upon those recommended by Flesch (1949).

1. Count 100 words

   a. Begin with the first complete sentence.
   b. Count numbers in or out of parentheses as one word (473).
   c. Count acronyms as one word, ESEA.
   d. Count hyphenated words as one word.
   e. Check by counting words twice.

2. Count the number of words to the end of the sentence closest to 100; the number may be more or less than 100.

3. Count the number of sentences. A sentence must be a complete thought that may end with a period, colon or semicolon. Each must have a subject and predicate.

4. Count the number of letters in 100 words. Each numeral is counted; no punctuation such as a question mark or parentheses is counted. Do not count reference numerals. (For example: Smith[2])

METHODS FOR COMPUTATION OF READABILITY USING
THE FLESCH READING EASE FORMULA

The following versions of the formula were introduced and described by Flesch in 1948. The first formula predicted in terms of grade level. It read:

$$C_{75} = .0846 \text{ wl} + .1015 \text{ sl} - 5.6835$$

where

C_{75} = 75% comprehension

wl = syllables per 100 words

sl = average sentence length or words/sentence

The formula that is more widely used was placed on a scale of 0 to 100. A score of 100 predicts that a child who has completed fourth grade will be able to answer three-quarters of the test questions to be asked. This formula was called the Reading Ease and was derived by reversing the signs and changing the grade level constant. It reads:

$$RE = 206.835 - .846 \text{ wl} - 1.015 \text{ sl}$$

APPENDIX C

READABILITY SCORES OF ABSTRACTS

AND SOURCE DOCUMENTS

TABLE 1

READABILITY OF ABSTRACTS AND SOURCE DOCUMENTS
FROM THE CLEARINGHOUSE ON ADULT EDUCATION

Sample Number	ED* Number	Clearinghouse Number	Readability Level	
			Abstract	Source Document
1	ED023955	AC002639	12.05	11.06
2	ED031644	AC004964	14.10	11.68
3	ED025732	AC003637	9.48	11.35
4	ED031616	AC002746	12.88	11.00
5	ED012870	AC001347	11.39	11.44
6	ED054429	AC010746	8.58	10.23
7	ED033289	AC005453	12.73	12.01
8	ED030838	AC004965	11.63	12.53
9	ED049437	AC010202	12.45	12.62
10	ED012875	AC001379	11.73	12.35
11	ED020469	AC002182	13.10	11.77
12	ED023986	AC002904	11.07	11.19

*The ED number enables the location of the document or abstract within the ERIC-RIE system.

TABLE 2

READABILITY OF ABSTRACTS AND SOURCE DOCUMENTS FROM
THE CLEARINGHOUSE ON EDUCATIONAL MANAGEMENT

Sample Number	ED* Number	Clearinghouse Number	Readability Level	
			Abstract	Source Document
1	ED028529	EA002129	12.21	10.42
2	ED029365	EA002145	14.36	11.98
3	ED044825	EA003179	12.27	11.81
4	ED028512	EA002109	11.60	11.71
5	ED050448	EA003439	12.13	10.36
6	ED053487	EA003720	14.59	11.68
7	ED030185	EA002250	11.95	10.30
8	ED038760	EA002839	11.48	11.12
9	ED062716	EA004300	13.02	11.53
10	ED050471	EA003494	12.01	10.38
11	ED053481	EA003714	14.28	10.63
12	ED041392	EA002952	13.47	12.40

TABLE 3

READABILITY OF ABSTRACTS AND SOURCE DOCUMENTS FROM THE
CLEARINGHOUSE ON EDUCATIONAL MEDIA AND TECHNOLOGY

Sample Number	ED* Number	Clearinghouse Number	Readability Level	
			Abstract	Source Document
1	ED042355	EM008348	10.60	9.78
2	ED014902	EM006002	10.73	12.83
3	ED025154	EM006887	10.89	10.81
4	ED056477	EM009331	14.24	12.28
5	ED031088	EM007235	13.04	10.69
6	ED069155	EM010568	11.54	10.62
7	ED039710	EM008043	14.01	11.97
8	ED020659	EM000237	12.10	10.58
9	ED054627	EM009214	11.43	11.12
10	ED049608	EM008847	14.11	12.93
11	ED064952	EM010198	10.95	9.76
12	ED040591	EM008175	12.64	11.49

TABLE 4

READABILITY OF ABSTRACTS AND SOURCE DOCUMENTS FROM THE
CLEARINGHOUSE ON RURAL EDUCATION AND SMALL SCHOOLS

Sample Number	ED* Number	Clearinghouse Number	Readability Level	
			Abstract	Source Document
1	ED042560	RC004630	12.15	11.44
2	ED032156	RC003586	12.55	11.41
3	ED024480	RC002508	13.34	11.02
4	ED067206	RC006472	13.04	12.21
5	ED039984	RC004385	12.97	12.14
6	ED067198	RC006457	12.44	10.45
7	ED042541	RC004592	10.50	10.27
8	ED067174	RC006418	13.19	11.93
9	ED021653	RC000245	12.59	12.43
10	ED012190	RC000208	12.53	12.87
11	ED054875	RC001945	11.45	9.89
12	ED059807	RC005963	9.58	9.50