Review Article

Theoretical Orientation for Readability Assessment in Bengali Language of Extension Literatures Related to Farming

ABSTRACT

Readability of a text generally refers to how well a reader can comprehend the content of a text, through reading. Readability is closely related to the understandability of the messages. Extension education is an applied behavioural science. Its main purpose is to bring about desirable changes in human behaviour usually through different strategies and programme of change and by applying the latest scientific and technological innovations where extension messages are sent largely through text. In Bengali language, only a few works on readability is found but their study is restricted to broad range of documents like newspaper article, short stories, interviews, and blogs to philosophical articles but there is no such research done on readability of Bengali extension literatures targeting the farming community. So, there is a need for studying on readability of Bengali extension literature for promotion of agricultural education. Assessment of readability of Bengali extension literatures is an imperative task for promotion of agriculture education among the millions of farmers who speaks and read in Bengali language across this subcontinent and Bangladesh with a view that the text messages become more understandable to the target audience. In this context the present theoretical orientation had been prepared with the objectives to measure the readability of Extension literatures in Bengali Language related to farming along with the analytical tools or procedures uses in readability assessment of a Bengali text associated with farming extension literature.

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Keywords: Readability, Bengali Language, Extension Literature, Farming~~ers~~.

1. INTRODUCTION

Extension Education is an applied behavioural science. Its main purpose is to bring desirable changes in human behaviour [1] usually through different strategies and programme and by applying the latest scientific and technological innovations [2]. In addition, extension is defined as a social responsibility and an approach to provide service, transfer knowledge, and improve quality of lives of the community [3]. Thus, the concept of extension is evolving as a result of tradition and policy context reflective of institutional goals [4].

For this reason, communication between extensionists/~~the~~ innovators and the users in the community is very much essential [5~~3~~]. Among different types of communication, printed media play~~s~~ an essential role. There are different types of printed media such as newspaper,~~;~~ magazine, bulletins, leaflet, folder, rural journals, farm journals, etc, and they are mainly for the literate section of the people [6~~4~~]. With the increasing literacy rate, the number of readers is also increasing day by day [7~~5~~].As huge cost, effort, time is required in preparing the printed forms, so it must be made sure that the right information should reach the right audience at right time [8~~6~~]. Extension has a concern to percolate the right message

to the right audience. Reading the message and understanding it properly is related to the readability of the specific communication text. The purpose of printed communication media will fair if the message is not readable to the audience [7]. A text is generally made to provide some information or ideas to the readers. So, readability of the text is very much important as it determines ~~will decide~~ the success of given information [8]. If the text is not readable to the readers, the purpose of writing the text ~~will~~ fails. The readers feel~~will be~~ bored, confused and frustrated when they ~~will~~ try to read a poorly prepared document. A hard, difficult text can create an adverse and negative effect to the readers. Therefore, assessment of readability through numerous formulas can help to understand the readability of the text. Generally, most of the readers have an average to poor readability. So, before ~~going to be~~ publishinged a text if the text's readability is checked, the popularity of the document can be understood. Readability formulas do not require the readers to first go through the text to decide if the text is too hard or too easy to read. By using readability formulas, the writer can easily understand whether the readers can understand his/her text. Readability formulas help the text creators to convert the document into plain language if the readability levels are low or high. Using readability formulas to perfect a document can help readers to increase their retention, comprehension, and speed of reading. This, in turn, smoothens out the work-schedule of the readers. These formulas can save time and money at a time. A readable text always attracts a larger reader-base [9]. A lot of efforts have been made to develop and standardise readability formulae for English, French, Japanese, Western European languages and others. In India, some researches on readability have been made on Kannad [10]; Malayalam [11]; Hindi [12] and in other local languages. In Bengali language, only a few works on readability is found but their study is restricted to broad range of documents like newspaper article, short stories, interviews, and blogs to philosophical articles [13] and most of the respondents were highly educated (Post- graduate & Graduate fellows). But there is no ~~such~~ research yet ~~has been~~ done on readability of Bengali extension literatures targeting the farming community. So, there is an imperative need for studying assessment of readabilities of Bengali literature for promotion of agricultural education.

2. CONCEPT OF READABILITY:

The term readability was conceptualized in three ways: (i) to indicate legibility of either hand writing or typography, (ii) to indicate ease of reading due to either the interest value or the pleasantness of writing, and (iii) to indicate the ease of understanding or comprehension due to style of writing [14]. As the Literacy Dictionary points out "Text and render variables interact in determining the readability of any piece of material for any individual reader" [15]. The purpose of readability assessment is to affect a 'best match' between intended readers and texts. Thus, optimal difficulty comes from an interaction among the text, the reader, and his/her purpose for reading [16]. Language experts also calculate readability through producing a score by different readability formulas. The formulas are widely used to match texts with die reading level of the audience. Extensive research has shown that the popular readability formulas are not 100% accurate, but they give a "good rough estimate" of the reading skill required to read a text. The readability formulas have greatly benefited millions of readers throughout the world in many languages. If there is any problem with the formulas, it is that they are not used enough [14, 17-18].

3. DIFFERENT DEFINITIONS OF READABILITY:

Reading helps learning and enjoyment. So, what we write should be easy to understand [19]. Readability always would go with understand ability [6]. The term readability usually described the stylistic factors in writing, which would make it easier to read [20]. Style of

writing commonly eases the understanding or comprehension of a text [14]. Thus, out of many issues such as content, coherence, and organization, writing style is important one. The readability can also be explained as the level to which a given class of people find certain reading matter convincing and understandable [21]. Here the interaction between the text and a class of readers of unknown characteristics such as reading skill, prior knowledge, and motivation is highlighted. UNESCO explained that ~~readability as~~ a piece of written material is ~~said to be~~ readable if it could be read and understood by the reader for whom it was intended [22]. Agricultural publications used the term readability to denote reading comprehension, reading efficiency and readers' judgement of readability [23]. Readability furthermore visualized as transforming of information into words and sentences that the average reader would understand and enjoy [24]. Moreover, readability also can be considered as the characteristic of the material that determines how difficult or easy it is to read and understand [25]. They further indicated that, the effectiveness of printed materials depends on a variety of factors including (i) readability, (ii) comprehension and (iii) the amount and type of information presented [26]. The definition of Dale and Chall may be the most comprehensive: "The sum (including all the interactions) of all those elements within a given piece of printed material that affect the success a group of readers have with it [27]. The success is the extent material which they understand it, read it at an optimal speed, and find~~s~~ it interesting. Table 1 comprises different Readability formulas used in different languages worldwide.

4. PURPOSE OF READABILITY:

Since 1940's researchers had developed many readability formulae. The formulae are mainly to assess the text readability of English, French, Spanish, Japanese, and Dutch. Mainly these are Western European languages. But there exists no quantitative study of readability on any Indian Language excepting a study on Bengali language. The need for making readability Index for Bengali is quite natural. This index when applied on a sample document would estimate the grade or the level for which the document is prepared. This would naturally be very helpful for the screening of texts from huge samples. Moreover, the readability formulae for English may not be directly applicable for the colloquial language such as Bengali. This is because European scripts are pseudo-phonetic while Bangla is a syllabic script with graphemes representing clusters and ligatures. There are certain features or parameters in Bangla which need to be incorporated in the index to give better scores for Bangla Text [39].

3. FACTORS INFLUENCE READABILITY:

Readability indicates ~~to~~ all the factors ~~those~~ affecting the readers to be successful~~eded~~ in reading and understanding a text [7]. While writing a text, an article, a work-sheet or an examination paper, author's intent is to transmit information to the reader [8]. Whether the writer can convey his ideas will depend on the readability of the text. Readability is concerned with the problem of matching between reader and text [8]. A good reader feels~~will be~~ bored by simple repetitive texts with less information; on the other hand, a poor reader ~~will soon~~ loses his attention if he found~~inds~~ the text too difficult to read ~~fluently~~. Fig. 1 represents various factors influencing~~e~~ readability in general.

Table 1: Readability formulas used in different tracts worldwide:

Sl. No.	Chronological Year	Readability Formulae	Salient Features	Language	Reference
1.	1948	Flesch Reading Ease	---	English	[28]
2.	1948	Flesch Kincaid	Most reliable when used with upper elementary and secondary materials	English	[28]
3.	1952	Gunning Fog	Widely used in the health care and general insurance industries for general business publications.	English	[29]
4.	1953	Spache Readability Index	Up to 3rd grade level students.	English	[30]
5.	1958	Powers-Sumner-Kearl	Primary / early elementary level materials	English	[31]
6.	1958	Kandel & Moles	For French Texts (Modified Flesch Reading Ease)	French	[32]
7.	1966	Bormuth Index	For Academic Documents	English	[33]
8.	l 967	Coleman-Liau	4th grade to college level readers	English	[34]
9.	1967	Automated Readability Index (ARI)	Technical documents and manuals	English	[35]
10.	1968	Laesbarheds index (LIX)	Readability assessment for Western European Languages	Western European Languages	[32]
11.	1964	SMOG Index	Simple Measure of Gobbledygook - For Healthcare	English	[36]
12.	1973	Forcast Index	Focuses on functional literacy, questionnaires, forms, text that is not in narrative form	English	[32]
13.	1974	Kane Index	Readability assessment for Mathematical purpose	Mathematics	[37]
14.	1977	Raygor Readability Estimate	Readability assessment for newspapers and journals	English	[32]
15.	1979	Hull formula	Readability assessment for Technical Writings	English	[32]
16.	1986	Fry Graph	For elementary assessment through college and beyond	English	[19]
17.	1992	Hayashi	Readability assessment for Japanese Texts	Japanese	[32]
18.	1995	New Dale-Chall	For upper elementary through secondary materials	English	[16]
19.	1996	Douma	For Dutch Texts (Modified Flesch)	Dutch	[38]
20.	2004	McAlpine EFLAW	For ESL (English as a Second Language)	English	[32]
21.	2006	Strain Index	Readability assessment for general text	English	-

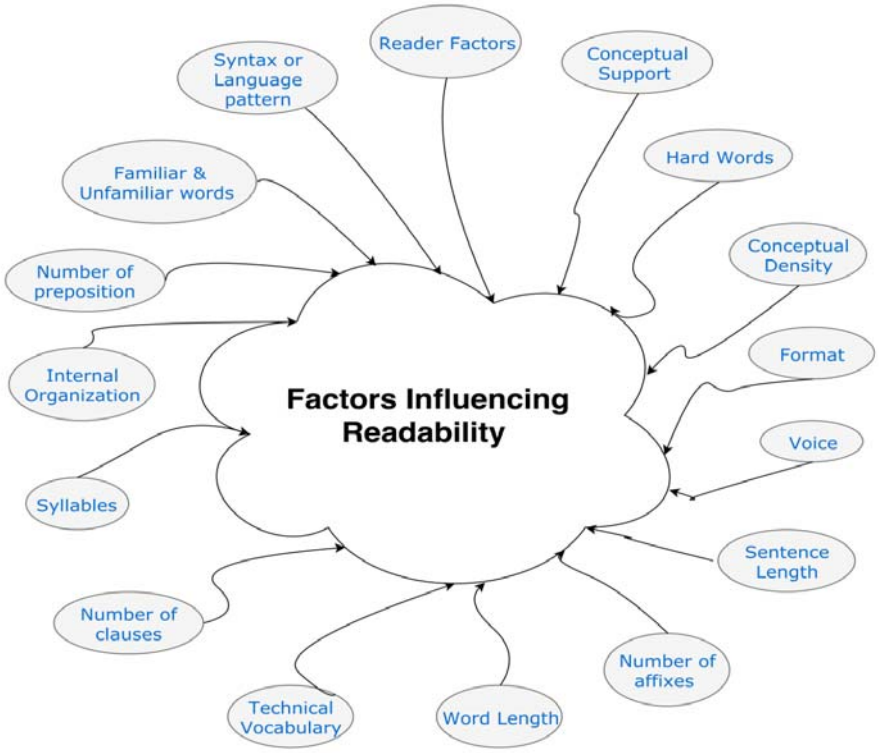

Fig. 1: Factors influencing readability

Different factors have been identified to determine the readability of a text. They are as follows:

3.1 Sentence length:

Variation in sentence length is desirable. Shorter sentences tend to be less difficult to read because they contain fewer ideas and fewer connections between ideas, but a text contains only short sentences becomes monotonous to read. A text that contains only long, complicated sentences is difficult to read[40].Sentence length or words per sentence was taken as a factor in the formulae such as Flesch Reading Ease [28], Flesch-Kincaid [28], Gunning Fog [29], Fry Graph [19], New Dale-Chall[16], Power-Sumner-Kearl[31], Spache[30], Automated Readability Index (ARI) [35], Bormuth Index [33]. McAlpine EFLAW [32], Laesbarheds index (LIX) [32], Douma [38], Das and Roychudhury [39]. Average number of sentences was taken in Raygor Readability Estimate [32] and by Das and Roychudhury [39].

3.2 Word length:

Word length was taken as a factor in Powers-Sumner-Kearl[31], Automated Readability Index (ARI) [35], Bormuth Index [33]. In Raygor Readability Estimate [32] number of words containing 6 or more letters, in McAlpine EFLAW [32], high proportion of mini words (words containing 1, 2 or 3 letters) and in Laesbarheds index (LIX) [32] number of long words (over

six characters) were taken to measure readability. Das and Roychudhury [39] took length of words (in characters), numbers of words of 6 or more characters.

3.3 Syllables:

Total syllables per word were taken as factor in Fiesch Reading Ease [28], Douma [38], Das and Roychudhury [39] and Forcast [32]. Das and Roychudhury [39] counts number of monosyllabic words whereas in Fry Graph [19] number of syllables in 100 words sample and in Kane [37] Das and Roychudhury [39] number of different words with 3 or more syllables were taken as readability factor. Generally, the fewer syllables a word has, the more readable it is [40].

3.4 Hard words:

Number of hard words present in a text was taken as a readability factor in Gunning Fog [29], SMOG [36], Spache [30].

3.5. Unfamiliar and familiar words:

In New Dale-Chall [16] unfamiliar word and in Bormuth Index [33] familiar words per word were taken as factors to measure text readability.

3.6 Number of prepositions:

Number of prepositions present in the text was taken as a factor by Das and Roychudhury [39] in measuring the readability of a text.

3.7 Words:

Unfamiliar, abstract, and difficult-to-decode words tend to make for difficult reading [41].

3.8 Syntax or language patterns:

Repeated sentences or phrases make for easy reading. Long, complex sentences and sentences written in passive voice are more difficult to read [41].

3.9 Number of affixes (suffixes and prefixes):

Words with suffixes and prefixes tend to be harder to read because they add another element of meaning that readers must understand [40]. This factor was taken by Das and Roychudhury [39].

3.10 Internal organization:

The clarity (or lack) of presentation of ideas affects readability. Well organized expository texts with clear statements of purpose followed by complete discussions of key points are easier to read than texts organize in some other way [41].

3.11 Contextual support:

Textbook-like texts may have (or lack) features such as headings, graphics, illustrations etc. which can affect the readability of a text [41].

3.12 Format:

Front size, length, and even the appearance of the text on a page can cause a text to look difficult to read [41]. The major factors affecting readability relate to the relative proportions of horizontal to vertical space; line width, type, size, space between lines, words and letters [42].

3.13 Number of clauses:

Sentence containing more than one clause are harder to read, since the reader must be able to understand the connection between the thoughts contained in the various clauses [40].

3.14 Voice:

Passive verbs make a sentence more complex. Passive constructions not only require more words but also obscure the real source of the action [40].

3.15 Technical vocabulary:

Many words have meanings that are used in a specialized field of study or vocation. These words are important for those who are in those fields, but they communicate poorly to those who are not [40].

3.16 Concept density:

Concept density refers to the number of ideas contained in an expression. A sentence that contains many ideas is harder to read because readers must spend extra energy for analysing the text. Sentences with fewer ideas are more readable [40].

3.17 Reader factors:

Reader factors such as prior knowledge, reading ability, and motivation of the reader affect readability of the text [43].

3.18 Number of pronouns:

Number of pronouns present in the text was taken as a factor by Das and Roychudhury[39] in measuring the readability of a text.

4. DIRECTIONS FOR READABILITY ASSESSMENT OF FARMING EXTENSION LITERATURES:

Any readability formula~~e~~ can be used in different perspective of communication and education of the target audience. In this respect, a variety of people may use the formulas for their own purposes. For this instance, a guideline~~s~~ or direction become essential for the benefit of the users to be dealt with farming extension literatures. Without knowing the clear-cut ideas, the measurement of variables or steps involved in calculating the readability would be extremely difficult. Therefore, the steps to be followed to calculate the readability of farming extension literatures are:

4.1 Selection of Samples:

Based on the circulation, leading newspaper(s) or magazine whichever, published agricultural news was~~will be~~ selected. Next, from a corpus of publications a single article on agriculture was~~will be~~ selected randomly from the texts.

4.2 Sampling of readers:

Each selected text wa~~i~~s subjected to test to a group of informants coming from similar academic background and social status [44]. Selection of sample respondents through a proper sampling technique has been shown in **Fig. 2.**

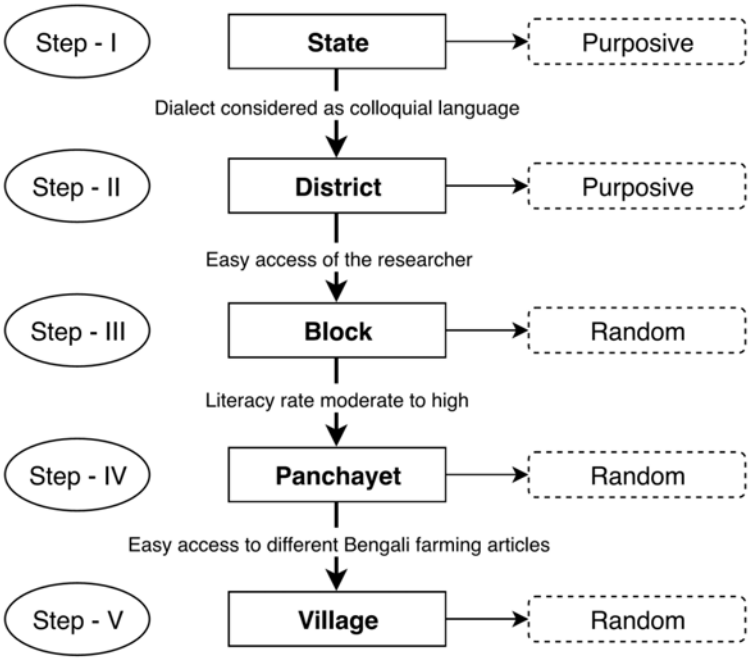

Fig. 2: Sampling frame for selection of readers.

4.3 Identification and finalization of variables:

From the existing literature on readability an inventory of variables was developed from available documents and universe of variables were developed and listed accordingly. Out of those variables a few variables which were not related to Bengali language were excluded. Therefore, variables responsible for readability in Bengali extension literature can be identified and finalized. The list of variables recognised were summed up in Table 2.

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Table 2: List of readability variables for Agricultural extension literature and their measurement.

Sl. No.	Readability variables	Measurement
1.	Sentence in an article	Total number of sentences counted in an article
2.	*Juktakkhar*	Total number of *jukta-akshars* in a text. It is an important feature for Bangla because each of the clusters has separate orthographic and phonemic (in some cases) representation than the constituents consonants.
3.	Letter in an article	Total number of letters counted in an article
4.	Bold Text in an article	Number of bold texts divided by total number of words
5.	Total number of syllables	Total number of syllables counted in each article.
6.	Number of Punctuation	Total number of punctuations divided by total number of sentences.
7.	Technical vocabulary	Total number of technical vocabularies divided by total number of words.
8.	Number of Pronoun	Total number of pronouns divided by total number sentence
9.	Number of Passive Voice in an article	Number of passive voices used divided by total number of sentences.
10.	Use of Prefix suffix in an article	Number of prefix suffix divided by total number of words.
11.	Number of paragraph/stories	Number of paragraphs in an article.
12.	Total Number of Words	Total number of words in an article.
13.	Total Characters	Total character implies number of letters, punctuations, typescripts, space, and letterings in an article.
14.	Complex words	Number of complex words in an article (*Tatsama* words with more than 2 syllables is considered as complex words)

4.4 Extraction of parameters:

Content analysis [45] could be administered to extract the selected parameters based on the standardized quantitative technique for the selected communicating material. The procedure should be gone through objectively and systematically. The process of Content analysis has six main stages: selecting content for analysis, units of content, preparing content for coding, coding the content, counting and weighting and drawing conclusions.

4.5 Collection of data:

The selected texts were~~would be~~ provided to the farmers and they were~~ill be~~ asked to read them carefully under the supervision of the researcher. Then the readers were~~ill be~~ requested to mark the text into 10-point scale i.e. Very easy to very difficult [39].

4.6 Statistical analysis:

Different statistical techniques and methods are used to understand the complex relationship amongst different readability factors. Some of such important statistical analysis techniques, generally used in readability analysis were summarized in **Table 3**.

Table 3: Statistical analysis used in readability study

Sl. No.	Statistical Tool	Purpose
1.	Mean	Mean is the arithmetic average and is the result obtained when the sum of the of value of individual in the data is divided by the number of individuals in the data
2.	One-way ANOVA	The one-way analysis of variance (ANOVA) is used to determine whether there are any statistically significant differences between the means of two or more independent (unrelated) groups.
3.	Canonical Discriminant Analysis	Canonical discriminant analysis is a dimension-reduction technique that is related to principal component analysis and canonical correlation. Given a nominal classification variable and several interval variables, canonical discriminant analysis derives canonical variables (linear combinations of the interval variables) that summarize between-class variation in much the same way that principal components summarize total variation.
4.	Content Analysis	Content analysis is a research technique used to make replicable and valid inferences by interpreting and coding textual material.
5.	Backward regression Analysis	In regression methods, Backward elimination or regression involves starting with all variables, testing the deletion of each variable using a chosen model fit criterion, deleting the variable (if any) whose loss gives the most statistically insignificant deterioration of the model fit.
6.	Factor Analysis	Factor Analysis is a method for modeling observed variables, and their covariance structure, in terms of a smaller number of underlying unobservable (latent) “factors.”

4.4 Assimilation:

Assimilation is the step where all the obtained inferences in the various steps were~~ill be~~ integrated. In this step the set of parameters was~~ill be~~ included in the regression model.

4.5 Model building:

Model building is a purely statistically procedure where the technique of multiple regression [46] was~~ill be~~ used. Least Square Method was~~ill be~~ employed to estimate the various parameters in the model.

5. SCOPE OF THE STUDY:

The researcher and extension personnel can use this procedure to determine whether the information through a printed media they want to spread out among the readers is suitable to their level or not. Agricultural news publishing agencies can use this modus operandi for adjusting the difficulty level of their publications to the reading ability of readers. Among corpus of variables, after proper statistical analysis the key variable was~~ill be~~ identified. These key variables also can be considered as Minimum Data Set (MDS) for the succeeding study. With an enormous effort and a vast survey of the farming community, a guideline~~s~~ or formula can be prepared for later use. This guideline not only helps to check the readability status of a farming extension article but also serves the writer in creation of newer piece of writing related to Bengali extension literature for farming community.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

CONSENT

All authors declare that 'written informed consent was obtained from the patient (or other approved parties) for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editorial office/Chief Editor/Editorial Board members of this journal.

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