Effect of Readability on Farmers' Knowledge: An Assessment of some Agricultural Extension Pamphlets

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Abstract: Readability of agricultural print materials is rarely considered as an important variable on farmers' behaviour. The purpose of this study was to examine the readability of some extension pamphlets and measuring the relationship between farmers' knowledge level and readability of these pamphlets. The pamphlets were tested on a systematic random sample of (83) farmers from Talkha and Aga districts in Dakahlia Governorate of Egypt. Cloze test was conducted to measure the readability level of the pamphlets studied. Pre-test and Post-test were used to determine the knowledge gain level of farmers. The readability level of the farmers reflected the frustration level on Cloze test scale; where farmers unable to read and understand the text even with the assistance from the extension worker. The study also showed that there is a significant difference at the level of 0.01 between pre and post exposure related to farmers' knowledge levels on each pamphlet tested. Moreover, there is a significant relationship between readability level of each pamphlet and farmers' knowledge level. Proposed guidelines were recommended to assist agricultural extension organizations to modify the upcoming materials to significantly improve readability while maintaining content for farmers with low education literacy.

Keywords: Agricultural extension, farmers, knowledge, pamphlets, readability

1. Introduction

Information is a vital key to the success of the knowledge management processes in the different agricultural organizations (Tamoutsidou, 2013). For this reason, agricultural extension agencies depend on providing the extension messages to solve problems of rural people, technology transfer, and facilitation/networking between farmers and agricultural organizations (G. Orikpe and E. Orikpe, 2013). Based on Sani et al. (2014) the multiplicity of channels for information access has been playing a critical role in disseminating agricultural information. To a large extent of information exchange, mass media channels can be characterized as valuable tools for agricultural development (Ariyo *et al.,* 2013; Uzezi, 2015).

According to the Egyptian agricultural context, extension workers still widely use traditional extension methods of mass media mainly print materials (EL-Gamal, 2015). In this regard, Farooq *et al.,* (2007) reported that the form and content of print media should be designed with the needs and interest of the audience. The agricultural extension can use printed materials along with other communication channels to reinforce the learning process of farmers because of low cost, accessibility, and ease of distribution (Tian *et al.,* 2014). Thus, different forms of print media such as pamphlets, leaflets, magazines, factsheets..., etc. can mainly be useful for literate farmers, but their effectiveness could be limited if

farmers haven't ability to read or understood (Farooq *et al.,* 2007). It is assumed that farmers can be literate when they are required to understand and explain the unfamiliar context in a different setting (Joubert and Githinji, 2014).

Although the capability of reading is essential for agricultural literacy, it is not the only aspect that contributes to understanding (Chaka, 2003); Various factors should be considered for printed information material to be usable and efficient during planning, implementation, and evaluation phases including the cheap methodology to produce, technical quality, information accuracy, and readability (Garnweidner-Holme *et al.*, 2016; Synman, 2004). Kondilis *et al.,* (2010) referred that improving the quality of written material by enhancing the layout, graphics, and cultural suitability without prompting readability is likely to meet limited success. Readability of printed materials is considered an important factor in overall agricultural literacy (Mokwatlo, 2005).

Zamanian and Heydari (2012) described that the term readability is the ease of reading, understanding, and comprehension of written materials. Readers' ability to adequately understand the author's intended message required that texts not exceed the reading ability of readers (Badgett,2010). Readability measures depend on several factors including the word and sentence length, style of writing, grammatical complexity, the number of new words contained, and

some of the new words contained (Howes et al., 2014; Svider et al., 2013; Tian et al., 2014).

Different tools were suggested to measure the readability of texts for a target audience (Corcoran and Ahmad, 2016; Vallance *et al.,* 2008). The most frequently used computerized tools are the Flesche Kincaid index, Flesch grade level, while hand calculated tools include Cloze Procedure (CP), the FOG method, the Fry formula, and the Simple Measure of Gobbledygook (SMOG) (Hadden *et al.,* 2016; Kondilis *et al.,* 2010; Svider *et al.,* 2013). Previous studies are employing the use of these tools to the English language. In spite of the importance of Arabic language which ranked 5th of the top ten most spoken languages worldwide with more than 1.5 billion followers, only Cloze Procedure (CP) was successfully tested as a measure for readability (Al-Tamimi *et al.,* 2014.).

The cloze procedure (CP) aims to help learners to get the textual meaning by consisting of deletions of content or grammatical words at fixed intervals in the text to enhance the power of comprehension (Siok, 2008). According to Sadeghi (2014) the power of the Cloze Test as a measure of readability becauseof the accuracy score of reading comprehension, and possibility to correlate cloze results with other prediction instruments.

The literature review showed that the overwhelming majority of readability research were applied in the accounting and health disciplines. At the same time, Readability of testing written agricultural materials has received little attention (see, for example, Chaka, 2003; Mokwatlo, 2005). Many agricultural extension pamphlets are developed and disseminated in the Egypt. However, the evaluation of these pamphlets for their effectiveness was not conducted in a systematic manner.

The purpose of our study was to evaluate the readability and usefulness of three agricultural extension pamphlets targeted to small-scale farmers in Egypt. This study hypothesized that there is a significant difference between the farmers in the pre-test and the post-test regarding their knowledge levels of the production practices. Also, there is a significant relationship between the farmers' knowledge levels and their readability to the text passages of the pamphlets studied.

2. Materials and Methods

The study was conducted at Talkha and Aga districts, Dakhalia governorate in the Northeast of Egypt. These Districts was selected due to cultivating the largest areas of Maize, Potato, and Citrus in the governorate during the agricultural season 2015/2016. Three villages in the two districts were randomly selected for data collection. The authors chose a

systematic random sample of thirty farmers in each crop. Due to multistage of this study and different circumstances of the sample farmers, four potato farmers and three citrus farmers were excluded from the sample. Thus, the total sample was eighty three farmers in the three crops.

The similarity of farmers as much as possible was given into consideration before data collection depending on their educational status. Based on that, only farmers who finished their elementary school were selected to represent literacy of the majority of farmers in the study area. The authors choose pamphlets titled 'Cultivating Maize in Old Lands', 'Potato Production', and 'Serving Citrus Trees' which produced by Agricultural Research Center (ARC) – Ministry of Agriculture of Egypt in 2015. Data were collected during the period from May to June 2015 by personal interview.

Cloze Test was used as a procedure for measuring the readability of the pamphlets studied. This test relies on identifying the exact words that belong in the deleted passages of a text after carefully reading and comprehension the context. Depending on Guillemete (1989) the learner is asked to fill in the blanks. If the learner fills in all the blanks with appropriate words, it means that he understand the short test (Independent Level). If the learner cannot complete one or two blanks with the appropriate words, it means that he understand much of the text, but will need some extra help to achieve full understanding (Instructional Level). If the learner cannot fill in numerous blanks with an appropriate word, it means he is at (Frustration level) and is not ready to read the text. The cloze test was conducted for farmers in this study before exposure to the pamphlets. The authors prepared a cloze test from a pamphlet's content. The test consists of five text passages covered the primary sub-titles of the pamphlet.

The protocol of using Cloze Test procedure to score material included the following steps: omitting every 7th word and replacing it with a blank space for the farmer to write the answer, keeping the first and last sentences in each passage to help farmers understand the context, instruct farmers to write only one word in each blank and try to fill in every blank, leaving equal space length in all blanks, guessing is encouraged, and advice farmers that misspellings will not count as errors. The scoring in most instances involved that exact word must be restored, the spaces that rely on memorizing as numbers or scales are not counted, and misspellings are counted as correct when the response is deemed accurate in a meaning sense. The total number of blanks were sixty-seven words in the test.

To ensure that the passages of the test represent the diverse content of the pamphlets studied and consisted of procedures of preparing Cloze Test, the test was presented to twelve experts whose majors are in the field of the pamphlet. They were asked to give their response on the clarity and relevance of the text passages. Moreover, the experts judge the extent to which the test adequately represent the procedures of preparing Cloze Test and make amendments to the wording of statements, if necessary. The authors considered this result sufficient to achieve the content validity. Reliability of the test was assessed by

applying it to a sample of 10 farmers to ensure that the instructions were clear and for determining the time allowed for farmers to answer of the test. Cronbach's alpha coefficient for internal consistency was used to assess the reliability of the test. Findings, as shown in Table 1, referred that Cronbach's alpha coefficient for the pamphlets of Cultivation of maize, Potato production, and Serving citrus trees was 0.88, 0.84, and 0.88 respectively. Moreover, alpha values for the five passages ranged from 0.78 to 0.94. This result was an indication of internal consistency.

Table 1. Reliability scores for the five text passages of the Cloze Test

Pamphlets	Passage's Number	Text	Cronbach's Alpha
Cultivation of Maize	1	Land preparation	0.94
	2	Mineral fertilizer	0.93
	3	Irrigation	0.89
	4	Late wilt disease	0.91
	5	Downy mildew disease	0.81
	Overall		0.88
Potato Production	1	Land preparation	0.86
	2	Seeds teatment	0.89
	3	Irrigation	0.84
	4	Fusarium dry rot disease	0.84
	5	Late blight disease	0.78
	Overall		0.84
Serving Citrus Trees	1	Hoeing	0.9
	2	Irrigation	0.91
	3	Nitrogen fertilization	0.92
	4	Brown fruit rot disease	0.85
	5	Die back disease	0.81
	Overall		0.88

The total time of the test was 60 minutes to answer all the (5) passages. The numeric values for the readability were assigned as 1 for the correct answer, 0 for afalse answer. Thus, the maximum score of readability per respondent was (67), while the minimum was (0). The readability scores are converted to percentages to easily grouped into levels of the Close Test as follows: Independent level (61-100), Instructional level (40-60) and frustration level (less than 40).

Farmers' knowledge level of the production practices was operationalized by designing two tests:
(1) Pre-test: This test involved different aspects of the pamphlet. Ten questions were formulated to assess knowledge of the farmers before exposure to the pamphlet. The total score of the Pre-test was 25 points. The responses were categorized into three groups depending on mean and standard deviation: low-level (less than 10), moderate level (10-17), and high level (18-25) with assigned scores of 1, 2, 3 respectively.
(2) Post-test: This test conducted after two weeks from

exposure and includes the same questions of the Pre-test. This test was used to measure knowledge gain (Post-test- Pre-test). The knowledge gain was classified into (4) groups: No gain (0), low (1-5), moderate (6-10), and high (11-16). Frequences, percentage, arithmetic mean, standard deviation, correlation coefficient, and (t) test were used for data analysis and presenting the findings.

3. Results and Discussion
The readability level of the farmers for the pamphlets studied. In Table 2, the results show that the farmers' readability level of 70%, 96.2%, and 66.7% in the pamphlets of maize, potato, and citrus respectively was within frustration level, while 23.3% of maize farmers and 33.3% of citrus farmers were classified in instructional level. Only 6.7% of the maize farmers were grouped as independent depending on their score on the Cloze Test. The total average of the farmers' readability level was less than 41% in the three pamphlets. From data, it is evident

that the readability of the pamphlet is not suitable for majority of the sample. This result reflects that farmers frustrated, discouraged, and intimidated by the difficulty of what they read. It means that the farmers still need practice and assistance from the extension worker.

Table 2. Distribution of respondents depending on their readability level

Pamphlets	Readability Level	N	%	Mean	S.D	Min.	Max.
Cultivation of Maize	Frustration Level	21	70	1.33	0.43	12	54
	Instructional Level	7	23.3				
	Independent Level	2	6.7				
	Total	30	100	33.06	10.12		
Potato Production	Frustration Level	25	96.2	1.03	0.19	3	48
	Instructional Level	1	3.8				
	Independent Level	-	-				
	Total	26	100	22.65	11.65		
Serving Citrus Trees	Frustration Level	18	66.7	1.33	0.48	13	57
	Instructional Level	9	33.3				
	Independent Level	-	-				
	Total	27	100	33.85	12.29		

The text passages of the pamphlets were different from each other according to the readability level as shown in Table 3. The text passages of late wilt disease and downy mildew disease in the pamphlet of "Cultivation of Maize" were the most difficult (frustration level) with percentages of 38.33% and 31.49% respectively. While, the text passages of Fusarium dry rot disease and Late blight disease in the pamphlet of "Potato Production" were the most difficult with percentages of 28.07% and 23.34% respectively. Brown fruit rot disease and Die back disease were the most difficult paragraphs in the pamphlet of "Serving Citrus Trees". Nevertheless, seven text passages were within the instructional level in all pamphlets tested. However, the farmers were able to read the text passage of "Mineral Fertilizer" in the pamphlet of "Cultivation of Maize" without any help with a percentage of 65.41%. This result indicates that the pamphlets contain a different sequence of difficulty sections inside it.

Table 3. Readability scores of the text passages of a Cloze Test

Pamphlets	No.	Text	Mean	S.D	Rank
Cultivation of Maize	1	Land preparation	60.74	17.4	2
	2	Mineral fertilizer	65.41	14.18	1
	3	Irrigation	57.22	18.23	3
	4	Late wilt disease	38.33	24.23	4
	5	Downy mildew disease	31.49	32.07	5
Potato Production	1	Land preparation	32.69	17.33	3
	2	Seeds Treatment	44.63	26.78	1
	3	Irrigation	43.68	26.14	2
	4	Fusarium dry rot disease	28.07	24.98	4
	5	Late blight disease	23.34	18.16	5
Serving Citrus Trees	1	Hoeing	48.82	25.08	2
	2	Irrigation	60.84	19.15	1
	3	Nitrogen fertilization	44.23	18.9	3
	4	Brown fruit rot disease	35.55	17.64	5
	5	Die back disease	39.37	18.89	4

Farmers' knowledge Level of production practices. Table 4 showed that 80% of maize farmers, 80.8% of potato farmers, and 74.1% of citrus farmers had a moderate knowledge level of production practices in the pre-test. However, for more than half of the maize farmers (53.3%) had a high knowledge level in post-test followed by moderate (46.7%). While, 61.5% of potato farmers and 59.3% of citrus farmers had a moderate level in the post-test followed by high with percentages of 34.6% and 40.7% respectively. It can be summarized from this table that farmers had a higher score on post-test than pre-test. These results are supported by Kassem (2014) who found that extension publications are a better extension approach

in terms of increasing knowledge of new agricultural innovations.

Table 4. Classification of respondents based on their knowledge level

Pamphlets	Knowledge Level	Before Exposure		After Exposure	
		N	%	N	%
Cultivation of Maize	Low	3	10	-	-
	Moderate	24	80	14	46.7
	High	3	10	16	53.3
Potato Production	Low	2	7.7	1	3.8
	Moderate	21	80.8	16	61.5
	High	3	11.5	9	34.6
Serving Citrus Trees	Low	4	14.8	-	-
	Moderate	20	74.1	16	59.3
	High	3	11.1	9	40.7

Table 5. Distribution of respondents depending on their knowledge gain level after exposure to the pamphlets

Pamphlets	Knowledge Gain Level	N	%
Cultivation of Maize	Low	20	66.7
	Moderate	7	23.3
	High	3	10
	Total	30	100
Potato Production	No gain	7	26.9
	Low	13	50
	Moderate	6	23.1
	High	-	-
Serving Citrus Trees	Low	17	63
	Moderate	7	25.9
	High	3	11.1

The changing of farmers' knowledge after reading the pamphlet is presented in Table 5. The findings indicated that 66.7 % of maize farmers had gained a low level of knowledge, followed by moderate (23.3%), and high (10%) categories. Half of potato farmers had gained a low level of knowledge, followed by no gain (26.9%), and moderate (23.1%) levels. Most of citrus farmers had low gain level of knowledge (63%), whereas 25.95% had moderate level of knowledge gain.

The independent t-test was applied to determine the differences in farmers' knowledge level between pre-test and post-test. The results shown in Table 6 referred that there are significant differences in farmers' knowledge level between pre and post-test (t= 5.5, 3.5, 6.39, p<0.01) for the pamphlets of maize, potato, and citrus respectively. Thus, the null hypothesis of no significant difference was rejected. From the data, it can be concluded that the pamphlets had a significant effect in increasing the knowledge of farmers after reading it.

Table 6. Differences between averages of farmers knowledge level before and after exposure

Pamphlets	Tests	Mean	S.D	t	p
Cultivation of Maize	Pre-test	13.66	3.38	-5.5**	0.001
	Post-test	17.93	2.47		
Potato Production	Pre-test	13	3.6	-3.5	0.001
	Post-test	15.88	3.05		
Serving Citrus Trees	Pre-test	12.07	3	-6.39**	0.00
	Post-test	17.88	2.6		

** Significant at 0.01 level

The relationship between knowledge gain level and the reaability level was measured using Spearman coefficient. Table 7 showed that there was a significant relationship between Farmers' knowledge gain level and the readability level of the text passages of the three pamphlets. This indicates that easily reading the pamphlet played a major role in increasing their levels of knowledge and awareness. Based on

that, the null hypothesis of no significant difference was rejected. Thus, it is important to note that improving readability of the pamphlets through applying the Cloze Test is a strong catalyst for enhancing knowledge and adoption of agricultural practices.

Table 7. Correlation between readability level of the pamphlets studied and farmers' knowledge gain level

Pamphlets	r	p
Cultivation of Maize	0.38**	0.004
Potato Production	0.23*	0.04
Serving Citrus Trees	0.31**	0.01

** Significant at 0.01 level * Significant at 0.05 level

Conclusion

This study introduces the readability problems in reading agricultural extension pamphlets among farmers. This paper illustrated the use of the cloze procedure by examining the readability on three agricultural extension pamphlets. A cloze test was used to accuracy determine the suitability of given materials to the farmers' ability. Results indicated that the majority of the farmers failed to reach the level associated with suitability for independent reading and comprehension. As well as, there are differences in readability levels among the text passages of the pamphlet. Furthermore, the cloze scores significantly correlate with farmers' knowledge level. One of the limitations of this paper is using one method for measuring readability. More research is needed to develop measures more suitable with Arabic texts, and explore the role of agricultural extension agencies in the different stages of designing agricultural extension pamphlets before distribution.

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