An Inquiry into the Reading Comprehension Strategies of Good and Poor Readers through Think-aloud Procedure

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Abstract:

This article presents a qualitative and quantitative investigation designed to provide a concrete picture of the reading comprehension processes and strategies used by ten students majoring in Microbiology in their academic reading. The subjects' think-aloud reports were collected as evidence of the strategies they used and subsequently analyzed to ascertain whether there were any differences in strategy use between poor and good readers.

The study addresses the following questions: (i) What is the relationship between reading performance and the quantity of strategy use? and (ii) What is the relationship between reading performance and the type of strategy use? Findings of this study indicated that good readers used more strategies and had better monitoring of strategy than poor readers.

Henceforth, strategy monitoring is significantly related to reading performance in the sense that good readers favoured global processes, i.e., those having to do with background knowledge, inferences, and predictions; whereas, poor readers employed more localized processes, i.e., those having to do with word meaning, and text details.

الملخّــص:

يتمثل هذا العمل في دراسة من الجانب الكمي والنوعي من شأنها أن تقدم صورة حقيقية للصعوبات التي تواجه في فهم النصوص المكتوبة وكذا الطرق والإستراتجيات التي يتبعها عشرة طلبة من معهد البيولوجيا اختصاص ميكروبيولوجيا أثناء القراءات التي يقومون بها في القسم.

لقد اعتمدنا في دراستنا هذه على القراءة الموجهة بهدف معرفة الإستراتيجية التي يجب إتباعها من طرف الطالب في وضعية خاصة وإن كان حقيقة يطبقها أثناء قراءته.

أما نتائج الدراسة فهي تبين أن التحكم في الإستراتيجية مرتبط بقوة بأداء القراءة. ولهذا فان الطلبة المتقدمين يعتمدون على المعلومات السابقة والاستنباط ولتأويل بينما الطلبة الآخرين يلجئون إلى طرق محصورة الوضع سيما معنى الكلمة وتفاصيل النص.

Introduction

Second language (L2) researchers are increasingly interested in the process of extracting meaning from text. Consequently, in the three last decades, one of the innovations in L2 research is the investigation of the reading strategies using learners' verbal reports. This technique, more commonly known under the name of 'think-aloud' procedure, has increased in popularity among researchers as an empirical instrument to uncover informants' cognitive processes involved in second language reading.

In this study, we adopted a think-aloud procedure to develop knowledge of the learners' actual strategy use in a specific reading situation and of the actual execution of online strategies during reading. The study addresses the following questions: (i) What is the relationship between reading performance and quantity of strategy use? (ii) What is the relationship between reading performance and the type of strategy use? To answer the above questions, we examined the reading activities of ten Microbiology students while reading an English expository text. The subjects were administered a think-aloud task. Their protocols were analysed by a coding system that captured two perspectives of the reading process: the reader perspective and the text perspective.

1. Think-aloud Procedure

1.1. Definition

Think-aloud procedure asks subjects to tell the researcher what they are thinking and doing i.e., everything that comes to mind while performing a task. While reading, the informants are instructed to

keep thinking aloud, acting as if they are alone in a room speaking to themselves; they are prompted to talk when a long period of silence occurs, and asked to try not to plan out what they say or try to explain what they are saying. In other words, think-aloud refers to "stream of consciousness disclosure of thought process while information is being attended to" (Cohen, 1983). Think-aloud verbalizations are tape and/or video recorded and then transcribed. Then they are content-analyzed and in many cases coded for specific categories which have previously been developed by the researcher.

1.2. Objectives

Think-aloud protocols have been widely used in both L1 and L2 reading research both as an exploratory methodology with the aim of obtaining the mental processes of readers in different situations and as a means to test hypotheses about reading. According to Pressley and Afflerbach (1995), the suitability of the method to the different areas of investigation within the wide discipline of reading has provided rich description and understanding of reading. Due to the complex nature of the readers' thoughts and actions, many studies focused on single aspects of reading and on particular reader, process and strategy. Examples of such studies include determining main ideas (Afflerbach, 1990), summarizing texts (Brown and Day, 1983), and demonstrating awareness of text cohesion (Bridge and Winograd, 1982).

1.3. Methodological Issues in Using Think-alouds

The aspects of the verbal report methodology demanding careful attention in the design and execution of research based on protocol analysis involve such components as informant training, characteristics of informants, the selection of the reading text, and language of verbalization.

Because the think aloud procedure is usually unfamiliar to most subjects, it can prove advantageous if not necessary to introduce the informants to the thinking-aloud task before they can be expected to perform it. This involves familiarisation with the method itself and the reason for conducting the study. Training is useful for subjects in that it provides them with feedback from the researcher before they start and helps ensure consistency of the thought reports across subjects.

As for subject characteristics i.e., how many and what kind of informants serve as verbal reporters, Rankin (1988) suggests that subjects should be chosen according to criteria set by the purpose of the study. If a study aims at examining strategies used by readers of different levels of proficiency, it is not uncommon to have different levels of subjects in think aloud research. On the other hand, the number of subjects may be limited because of the practical constraints of transcribing and analysing the protocols. Nevertheless, the selected subjects should not only be representative of the research population, but they should also exhibit the characteristics under investigation (Rankin, 1988).

Like subject selection, the selection of reading passages should also reflect the aim of the study. Criteria for text selection involve text

length, difficulty and content. Passage length should be considered in the selection. Passages should be long enough to allow for subjects to get involved in reading, but they should not be so long that the subjects get tired by the demands of thinking aloud for a long period of time. The second criterion to consider in text selection concerns the level of difficulty. In this respect, when the cognitive load of the passage is too high it would make it difficult for subjects to think aloud. On the other hand, a passage that is below the subjects' ability will be dealt with only superficially, thus requiring little strategy use. Pressley and Afflerbach (1995: 14); however, state that "active and strategic efforts at meaning construction only occur in reaction to more challenging texts", and that when texts are difficult, reading is slower and consciously controlled, resulting in "substantial verbalization of information not explicitly given in the text" (Ericsson and Simon, 1988: xxxvi, cited in Pressley and Afflerbach 1995). Finally, the subjects' familiarity with the topic of the passage is an important factor to take into account. The subjects' responses to the passage may be biased if its subject matter requires prior cultural knowledge.

Another problem that may face the researcher using think-aloud procedure is the language of verbalization of think-alouds: should it be in first (L1) or in second language (L2)? Advocates of the use of L2 give the argument that when L2 readers use their L1 to think aloud, it "may interfere with the way in which they perform the learning task" (Ellis (1994: 55). To minimize unwanted L1 interference, he suggests

that participants use L2 as the sole means for verbalizing their abstract thoughts as reading the passage. On the other hand, a second group in favour of L1 use suggests that in cases where all subjects share the same native language, it is more practical to give them a choice of language to verbalize since it would be difficult for less proficient subjects to do the task in the target language and verbalize in that language at the same time. This difficulty might distort the reading process and make the report counterproductive (Green, 1998). In Rankin's (1988) studies, the subjects were also allowed to verbalize in whatever language they felt most comfortable using.

1.4. Analysis and Interpretation of Think-aloud Data

The data is analyzed in forms of protocols using a coding system and assigning each case of strategy use to a category. Here, the researcher may design his/her own categories. S/he may also borrow and/or adapt strategies found in research on learning strategies, systems developed out of particular theories of reading, or from other disciplines as cognitive psychology. Protocol coding is, thus, an interpretive act in the sense that the same data could be subjected to quite different coding systems, hence yielding quite different results according to different researchers with different assumptions. An important task for the researcher is then to thoroughly understand the theory underlying the study, delineate his/her own approach to the data and devise a coding system that corresponds to the investigation and describes the processes his/her theory anticipates. Criteria for protocol coding, thus, vary tremendously from study to study and a

clear description of categorization in the coding system is vital (Rankin, 1988).

As far as the interpretation of think-aloud data, there are no clearly established means of reporting protocol data. In most protocol studies, researchers rely on few participants from whom to draw their results. Consequently, verbal report protocols are analyzed qualitatively, i.e. interpretatively without data quantification. In exceptional cases, however, when the size of the sample is large enough, the data will be quantified and subjected to statistical analysis in the same way as in any other normal experimental studies.

1.5. Limitations of Think-aloud Protocols

Although verbal report data may emerge as useful research tools, their application has raised concerns related mainly to two aspects: the subjects' ability to reflect on their cognitive behaviour i.e. the subjects may use strategies they fail to report (Cavanaugh and Perlmutter, 1982), and the truth value of the reports. In other words, the issue that remains problematic is whether verbal reports are genuine description of the actual processes the learners are involved in, or whether they are intelligent guesses based on the product. (Baker and Brown, 1984)

2. Method

2.1. Subjects

Ten subjects participated in this experiment; they are all fourth year Micro-biology students. The subjects are all in their final year of study and they have to prepare a dissertation on their speciality; much of the documentation is written in English; thus, they need to read extensively in English. The choice of the subjects for think-aloud

procedure was based on the scores they obtained in a reading comprehension test. The subjects were arranged in a rank order based on their achievements in the test into: 05 high achievers or those who obtained the highest scores and 05 low achievers or those who obtained the lowest scores.

2.2. Materials

The study is based on an authentic text, i.e. one whose original form has been kept intact, the reason being that it is the sort of texts the subjects would read in their speciality and eventually for their dissertations. Furthermore, the topic of the text was not random. In fact, a list of topics was proposed to the subjects including: environmental microbiology, clinical microbiology and food microbiology. All the students chose a text from the second topic. It is entitled: "*Therapeutic Uses of toxins*". The topic, being chosen by the subjects, would motivate them and generate more interest in the information contained in the text. The length of the text -680 words- was motivated by the fact that it should be long enough for for subjects to get involved in reading and make substantial verbalization.

2.3. Procedure

The experiment was divided into two parts. In the first part, students were submitted to a reading comprehension test which is part of a Ph. D thesis undertaken by the writer of the present article. The test is made up of two reading passages followed by the following tasks: guessing words from context, determining word function, finding opposites, finding synonyms, reading for main ideas, reading for details, information transfer, multiple-choice exercise, matching,

and gap-filling [1]. In the second part, on which our experiment is based, students were asked to think-aloud while reading a text.

Before the actual experiment, a number of exercises were prepared to familiarize subjects with the think-aloud task; all the exercises involved thinking aloud while doing the activity. In the first exercise, the subjects were asked to solve anagrams. The second type of exercises gets the students to mentally multiply numbers. The third exercise was a dictionary search of unknown words. After the completion of the above activities, the subjects were given six examples of think-aloud responses taken from Olshavsky's (1976-77) study and translated into Arabic. Finally, the subjects practised the technique on two texts which they selected from the list of topics.

Three sessions were conducted before the real experiment. Each training sessions lasted between one to two hours, and all the sessions were practised on a daily basis. After one hour break and at the subjects' request, the recording of the actual experiment followed the third training session. In order not to disrupt the reading task and bias reports, the subjects were not prompted by the researcher as they read. As for the language of verbalization, because the sample includes successful and less successful readers who may not be able to verbalize in English, choice was given to subjects to verbalize in whatever language they want Algerian Arabic, French, or English.

2.4. Identification and categorization of the strategies

After collection, the audio-recorded think-aloud protocols were transcribed in the original language which is a mixture between

Algerian Arabic and French; then translated by the researcher. The next step consisted in matching the verbal protocols with the corresponding sentence in the text. Finally, each protocol was analyzed in order to identify strategies.

To make sense of the text, readers construct meaning by interacting with the reading materials using strategies which refer to operations or actions that are deliberately employed by readers to accomplish the reading task and enhance learning. In the think-aloud data, the strategies have been categorized under these two broad categories: text-initiated (bottom-up) and reader-initiated (top-down) strategies.

Text-initiated strategies include problem-solving skills which rely mostly on the visual signs and focus more on the structural aspects of text. The strategies grouped under this category involve word-level, sentence-level, and text-level strategies. Reader-initiated strategies, on the other hand, focus primarily on the readers' reactions to the text content including invoking prior knowledge, predicting, evaluating comprehension progress, inferencing. While doing this, readers utilize more information from within themselves rather than directly obtainable from the visual text. In this study, 27 strategies have been identified and used as a template for analyzing the reading behaviour of the subjects.

3. Results of the Think-aloud Procedure

After the collection of data, and the identification and categorization of the strategies, the verbal protocols reported by the subjects are analyzed quantitatively −subjected to statistical analysis

including frequencies and percentages− then they will be analyzed qualitatively, i.e. interpretatively in terms of the categories of strategies used.

3.1. Quantitative Data Analysis

The frequencies and percentages for strategy use by the two sub-groups are displayed in the tables below.

Table 01: Frequency of Strategy Use (High-achievers)

Students	01	02	03	04	05	Total B	%
Text-initiated Strategies							
(i) word-related							
Analyzing the grammatical form	09	03	19	06	11	48	04.38
Translating word into French	30	26	40	22	20	138	12.58
Translating word into Arabic	-	02	01	01	09	13	01.20
Relating word with English word	01	-	08	04	13	26	02.37
Using context	03	01	05	05	08	22	02
Skipping	-	03	11	01	01	16	01.46
Questioning (word-related)	02	05	14	-	07	28	02.55
Stated Failure to understand word	24	20	43	28	20	135	12.31
Expressing need for a dictionary	22	11	22	13	04	72	06.57
Sub-total (1)	**91**	**71**	**163**	**80**	**93**	**498**	
Percentage	**41.18**	**49.66**	**51.10**	**42.33**	**41.33**	**45.40**	
(ii) Sentence-related							
Rereading	19	19	40	31	41	150	13.67
Relate sentence with what Precedes	02	03	02	-	-	07	00.64
Questioning (idea-related)	02	01	09	-	06	18	01.64
Reading word by word	-	01	-	-	-	01	00.09
Reading aloud	-	01	-	-	-	01	00.09
Sub-total (2)	**23**	**25**	**51**	**31**	**47**	**177**	
Percentage	**10.41**	**17.48**	**15.99**	**16.40**	**20.90**	**16.14**	
(ii) Text-related							
Expressing need to reread Paragraph/Text	03	02	01	03	01	10	00.91

Linking title with text	01	00	01	-	-	02	00.18
Sub-total (3)	**04**	**02**	**02**	**03**	**01**	**12**	
Percentage	**01.80**	**01.39**	**0.62**	**01.58**	**0.44**	**01.09**	
	118	98	216	114	141	687	
B) Reader-initiated Strategies							
Guessing	16	02	03	07	10	38	3.46
Rejecting or Confirming guess	03	02	08	02	07	22	02
Inferencing	07	01	08	05	02	23	2.10
Invoking prior knowledge	27	01	20	23	19	90	8.20
Addition of information	06	03	07	03	04	23	2.10
Reading on	14	14	19	04	12	63	5.74
Evaluating comprehension Progress	30	21	33	25	28	137	2.49
Predicting	-	-	03	06	01	10	0.91
Paraphrasing	-	01	02	-	01	04	0.36
Adjusting the reading rate	-	-	-	-	-	-	-
Expressing feeling	-	-	-	-	-	-	-
Sub Total (4)	**103**	**45**	**103**	**75**	**84**	**410**	
Percentage	**46.61**	**31.46**	**32.28**	**39.68**	**37.33**	**7.37**	
Total (A)	221	143	319	189	225	1097	

Table 02: Frequency of Strategies Use (Low-achievers)

Students	06	07	08	09	10	Total B	%
Text-initiated Strategies							
(i) word-related							
Analyzing the grammatical form	01	09	04	07	02	23	02.58
Translating word into French	04	06	05	09	05	29	03.25
Translating word into Arabic	01	09	10	13	05	38	04.26
Relating word with English word	03	01	01	-	02	07	00.79
Using context	04	02	02	01	-	09	01
Skipping	-	-	-	-	-	-	-
Questioning (word-related)	02	04	29	03	08	46	05.15
Stated failure to understand word	24	55	35	25	53	192	21.52
Expressing need for a dictionary	-	22	26	25	28	101	11.32

Sub-total(1)	**39**	**108**	**112**	**83**	**103**	**445**	
Percentage	**34.51**	**54.27**	**57.73**	**41.91**	**54.78**	**49.88**	
(ii) Sentence-related							
Rereading	14	30	10	33	20	107	12
Relate sentence with what Precedes	01	-	-	01	01	03	00.33
Questioning (idea-related)	-	-	03	01	08	12	01.35
Reading word by word	-	06	03	02	01	12	1.35
Reading aloud	01	-	08	01	11	21	2.35
Sub-total (02)	**16**	**36**	**24**	**38**	**41**	**155**	
Percentage	**14.16**	**18.10**	**12.37**	**19.19**	**21.81**	**17.38**	
(ii) Text-related							
Expressing need to reread Paragraph	03	01	01	01	02	08	01.31
linking title with text	-	-	-	-	-	-	-
Sub-total (03)	**03**	**01**	**01**	**01**	**02**	**08**	
Percentage	**02.65**	**0.50**	**0.51**	**0.50**	**01.06**	**0.89**	
	58	145	137	122	146		
B) Reader-initiated Strategies							
Guessing	-	07	-	01	05	13	01.46
Rejecting or Confirming guess	01	01	01	02	-	05	00.56
Inferencing	01	-	01	04	-	06	00.76
Invoking prior knowledge	04	05	11	06	05	31	03.47
Addition of information	-	01	06	02	03	12	1.35
Reading on	17	16	05	08	01	47	05.27
Evaluating comprehension Progress	29	24	26	43	20	142	5.92
Predicting	-	-	-	-	-	-	-
Paraphrasing	03	-	01	04	05	13	1.46
Adjusting the reading rate	-	-	04	03	01	08	00.90
Expressing Feeling	-	-	02	03	02	07	00.79
Sub Total (04)	**55**	**54**	**57**	**76**	**42**	**284**	
Percentage	**48.67**	**27.13**	**29.38**	**38.38**	**22.34**	**31.84**	
Total (A)	**113**	**199**	**194**	**198**	**188**	**892**	

Broadly speaking, and based on the subjects' reports, we can say that the text was difficult to participants from both sub-groups. It was linguistically and cognitively demanding, resulting in substantial verbalization of information, by the two sub-groups, but with high-achievers using more verbalization than low-achievers. Out of 1989 instances of strategy use, 1097 strategies (55.16%) were used by high-achievers, against 892 strategies (44.84%) for low-achievers. This first finding is consistent with prior research by Pressley and Afflerbach (1995) who have stated that 'active and strategic efforts at meaning construction only occur in reaction to more challenging texts' (p.14).

3.2. Qualitative Data Analysis

As for the type of strategy use, we can say that both high and low-achievers used bottom-up strategies more than top-down strategies; however, low-achievers relied more heavily on text-initiated 'bottom-up' strategies with 68.16% of overall strategy use, against 62.63% for high-achievers. In fact this finding was expected and it reflects the observation made by other researchers (Alderson, 1984; Bossers, 1991) that lower-proficient readers are seen as having more focus on decoding text-initiated elements of text because their proficiency is not at point where automatic processing of these elements can occur as it does with more fluent readers. It is only when the text-initiated elements are automatically processed that the reader can focus more on retaining contextual clues needed to predict, as well as infer and develop the necessary inferences to gain full understanding of a text.

The question which can now be posed is the following: Do high-achievers and low-achievers process the text similarly or differently? The first element for the answer, based on the above discussion, suggests that they process the text differently, with the latter using less top-down strategies than the former. The second element for the answer relates to the number of strategies which were used almost exclusively by low-achievers; they involve *'reading the sentence word by word', 'reading aloud', expressing feeling', and 'adjusting the reading rate'*. There were only two uses of the two first strategies by high-achievers. Except for the last one, the first two strategies are characteristic of poor reading and they can be said to distinguish the reading processes of the two sub-groups. Other distinctive strategies which are exclusively used by high-achievers concern *'making predictions', 'relating text with table',* and *'skipping'*. Interestingly, all these strategies are characteristic of successful reading. Finally, for the rest of top-down-strategies identified in the study, it is the high-achievers who obtained the higher rates.

Conclusion

Strategies identified through the protocols were analysed in order to examine the reading behaviour of the subjects as they attempted to comprehend the reading text. The analyses have provided clearer understanding on the types and frequencies of strategies used. This in turn revealed how the students went about comprehending the text when asked to think aloud during reading. The findings confirmed that the two sub- groups do not only differ in the quantity of strategies

used, but also differ in the type of strategies (bottom-up, top-down) and in the process of reading.

[1] For more details about the test, see the unpublished PhD thesis by the author of the article.

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