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An in-depth Insight into EFL University Students' Cognitive Processes of C-Test and X-Test: A Case of Comparison

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Abstract

The literature on C-test and Cloze test in a second language provides us with few accounts of the real mental processes that test-takers are involved in, which in fact indicate the real nature of what these tests measure. However, the literature leaves researchers with little attention to the cognitive processes involved in X-Tests. Therefore, the purpose of this study was to discover the extent to which the C-Test and the X-Test tap participants' use of mental strategies. In doing so a C-Test and an X-test were administered to eight subjects who were EFL learners in Mashhad, Iran. They all took part in introspective methods of think-aloud and retroactive interviews throughout the test administration. Think aloud protocol was used to collect the required data. The results showed that both tests were similar to each other regarding mental processes, except in using two strategies that participants applied only for filling out the gaps of the X-Test. Moreover, it appeared that the X-Test was more difficult for the subjects.

Keywords: C-test, X-test, Think Aloud Protocol, Cognitive Correlates

1. Introduction

One of the chief questions for psycholinguists in the field of language and language testing is to what extent tests prompt reliable and valid language behavior from the participants and what goes on inside a test taker's mind when they take a test. To answer these questions a deep investigation of test-taking processes are required. The issue of mental processes of test takers is directly linked to the validity issues. In fact the test measures what it activates in learners' minds. Grotjahn (1986) recommends three possible methods to this aim: statistical item analysis, text linguistic item analysis and analysis of individual performance. With reference to the third approach, this paper detects the psycholinguistic processes involved in test taking of English C-test and X-test and provides evidence derived from an in depth cognitive analysis of participants' responses and their mental strategies while engaging in filling out an English C-test and an X-

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test. Observing test takers' mental operations when they are trying to solve a test item can contribute to our understanding of why a test taker has answered an item or why they have failed to do so. This is the reason why researchers have focused on finding out the cognitive processes going on in respondents' minds while they are working on a C-Test, for many years. (Baghaei, 2008a; Grotjahn& Stemmer, 1985; Feldmann& Stemmer, 1987; Stemmer, 1991, 1992).

Schellings and Broekkamp (2011) stated that in recent years students are progressively challenged with more informative and educational texts. Among them C-Test could be considered as a means to reach instructional objectives when students continue their education. Therefore, making students aware of the essential strategies for text-based learning is an important educational goal. Moreover, helping students improve the ability to manage their reading comprehension and apply strategies to direct or facilitate their understanding is the intent behind the think aloud protocol.

Think-aloud strategy requests students to say out loud what they are thinking about, when reading, or answering questions asked by teachers. Making learners familiar with the habit of thinking aloud enhances classroom discourse, give learners a chance to learn how to learn, and provides teachers an important diagnostic tool concerning students' strengths and weakness. Moreover, the role of teacher in think-aloud protocol is of utmost importance as Abuya and Ngware (2016) declared teachers are the most important assets to children in the classrooms. Furthermore, understanding the cognitive processes underlying the test helps researchers and students discover what the test actually measures, and also helps us in using the C-Test for educational purposes as a task. Moreover, this metacognitive alertness (being able to think about one's own thought) is a critical component in learning, since it empowers learners to monitor their level of comprehension and modify their strategies for better success (Oster, 2001).

Thus, to be aware of probable, underlying cognitive strategies which may be used in C-Test and X-Test taking, data were collected by using introspective and retrospective methods on the assumption that C-Test and X-Test solving is a cognitive process. Accordingly, the study provides in-depth insights on the use of different cognitive strategies in test taking.

1. Review of Literature

There are many studies in the literature which attempt to measure learning strategies in different contexts with various data gathering procedures (Schellings, 2011; Scott, 2008). One of these strategies which has been frequently applied and specifically related to learning from text is think aloud (Caldwell & Leslie, 2010 Fox, 2009; Greene, Robertson, &Croker Costa, 2011).

Think-aloud protocol (or thinking aloud) is a means to gather data in psychology and social sciences. It was developed according to the techniques of protocol analysis by Ericsson and Simon (1987, 1993).Protocol analysis is a psychological research method that draws participants' verbal reports and is used to study thinking in cognitive psychology (Crutcher, 1994), cognitive science (Simon & Kaplan, 1989), and behavior analysis (Austin & Delaney, 1998), in surveys and interviews (Sudman, Bradburn& Schwarz, 1996), educational psychology (Pressley &Afflerbach 1995; Renkl, 1997) and design research (Gero& McNeill 1998) .

Baumann, Jones and Seifert-Kessell (1993) proposed that think-aloud strategy are usually used to make predictions, create images, and relate information in text with prior knowledge. They stated that when reading aloud, participants mostly use questioning, predicting, clarifying,

making connections, re-reading, visualizing, summarizing, and commenting as some cognitive strategies.

Besides, Kuusela and Paul (2000) proposed that there can be two different types of experimental procedures in think-aloud protocol. Concurrent think-aloud protocol, which aim at collecting data during the task and retrospective think-aloud protocol that gather data after the task usually prompted by a tape/video recording of subjects. There are advantages and shortcomings for each approach, however a concurrent protocol may be more complete.

2.1 C-Test

The C-Test, designed by Raatz and Klein-Braley (1981), is a test in which the second half of every second word is deleted and the student's mission is to restore the deleted parts.A complete sentence at the beginning of the test and at the end of the test are left intact. However, in the C-Test, the second half of each word must be deleted, if the deleted word consists an even number of letters, such as "b o o k" (4 letters). For a word with an odd number of letters, its larger part must be deleted, such as “n e c e s sa r y” (9 letters).

A C-test battery normally contains four to six passages, each with 20 to 25 blanks (Baghaei, 2011a, 2011b). To avoid the problem of locally dependent items each passage is entered into analysis as a super-item or test let with 25 ordered categories (Baghaei, 2011c). Over the years, various evidence of validity including invariance of item parameters (Baghaei, 2010), independence of items (Eckes&Baghaei, 2015), fit to latent trait models (Baghaei&Grotjahn, 2014a, 20114b;Baghaei, 2008b; Baghaei, 2014c;Eckes&Grotjahn, 2006), and correlational evidence have been accumulated for C-Test (see Sigott, 2004).

One of the most central questions about a language test for the psycholinguist is how far the test prompts authentic language behavior from the test subject. One way of searching for the C-Test takers’ behavior is the investigation of test-taking processes using think-aloud procedures. There is no doubt that the analysis of these protocols has significantly improved our understanding of what goes on inside the subject during test-taking.

In this regard, Connelly (1997, cited in https://www.ukessays.com),reinforced using the C-test for assessing general language proficiency by studying the English C-Test in Bangkok Thailand with non-native postgraduate learners. Furthermore, Mehrpour (2012) asserted that the order of deletion of letters in a test affects the comprehension of the Test. Moreover, Boonsathorn (1987; cited in Boonsathron, 1988) paralleled the C-Test with the X-Test to find out the strategies that L2 learners used in answering the C-Test and The X-Test. The outcomes showed that the C-Test and the X-Test were essentially different functionally and structurally, and it seemed that the X-Test was more difficult and discriminated L1 and L2 subjects better than the C-Test because more of the normal reading process is required for the X-Test than for the C-Test. It is also revealed that the ESL learners taking the X-Test required more strategies than when they taking the C-Test.

2.2 X-test

The Modified C-Test (the MC-Test), also known as the X-Test and left-hand deletion was introduced by Boonsathorn, (1987, cited in https://www.ukessays.com). In contrast with the C-

Test, the first half of every second word in the X-Test is deleted and test takers are asked to fill in the deleted blanks. One of the reasons of invention of the X-Test was the problem of poor discrimination of C-Tests which was emphasized by Cleary (1988) through using a Modified C-Test. The results of the study revealed that the discrimination of the C-test could be improved by left-hand deletion.

Reliability and validity of the X-Test in assessing grammatical competence is shown by some researchers such as Prapphal, (1996); moreover, Boonsathorn, (1987, cited in https://www.ukessays.com) reported high reliability and validity for the English language proficiency of non-native-speakers. However, Sigott and Köberl (1993, cited in https://www.ukessays.com) emphasize the difficulty of the X-Test for EFL test-takers.

In a study of comparing the X-Test with the C-Test in evaluating English language proficiency, Boonsathorn (1987, cited in https://www.ukessays.com) reported that although both tests were highly reliable for native and non-native learners of English, the X-Test was more challenging and had more discrimination power over the C-Test.

In view of that, this research is designed to apply think aloud protocol to compare the original C-Test with the original X-Test in measuring eight EFL University students' using cognitive strategies in Mashhad, Iran.

Consequently, the study addresses the following major research question:

- Is there any significant difference in the use of specific cognitive strategies in answering C-test vs. X-test?

2. Method

3.1 Participants

Participants of this study who were eight EFL learners from Mashhad, Iran were selected based on purposive sampling, from Applied-Science University in Mashhad. They were both males and females and aged between 20 and 27 years old (50% females; mean age = 24.62 years, SD = 2.62). They were all Persian native speakers. Their homogeneity with respect to language proficiency was identified through their final scores of their General English course. Thus, the sample looks to have homogeneity regarding age, English language background, L1 background and educational level.

3.2 Materials

The data were gathered through the application of two standardized C-Tests and X-Tests using think-aloud protocols. Both tests were extracted from http://www.ukessays.com. The reliability and validity of the tests were demonstrated by Boonsathorn, (1990) and Wonghiransombat (1998) and the result showed the reliability and validity of the tests.

3.3 Procedure

In this study, eight participants (four males and four females) who were all Iranian ELT university students from Mashhad, Iran were selected (Mean age = 24.62 years, SD = 2.62). For collecting the data, both tests were administrated in the form of pencil and paper. Collecting data started in October 2015 and lasted for about three weeks because data were collected individually from each subject.

The task was introduced by the researchers to students by saying, "I want you to think aloud as you solve the task", then asked students to express whatever comes into their mind as they complete the task including what they are looking at, thinking, doing, and feeling. This gives observers, insight into the participant's cognitive processes (not only their final product). Simultaneously, subjects' verbalizations were recorded using a tape recorder and then transcribed following the procedures provided by Camps (2003) and Ericsson and Simon (1984). The needed time for completing the tests was 12 minutes, 6 minutes for each test. If students forget to think aloud, researchers asked open-ended questions: "What are you thinking about now?" and "Why do you think so?"

After the think-aloud, researchers informally interviewed students to clarify any misperception that might have happened throughout the process of think-aloud. For example, "Can you explain what you meant when you said…?"Therefore, the subjects answered questions raised by the investigators, clarified remaining doubts and uncertainties, or added comments if necessary.

Lastly, a rubric was used as a tool to analyze each student's think-aloud. The researchers then attempted to infer from the protocols the mental processes which were activated by the tests or by individual test items.

3. Result

A rich source of data was provided by the subjects in the responses to the C-Test and the X-Test. The analysis of the results of this research focused on discovering any significant use of different cognitive strategies using think-aloud protocol. Within this domain, there were several quantifiable data to report such as data relating to making prediction, summarizing, reflecting, etc.

In this section, a summary of the findings related to significant use of different cognitive strategies through think-aloud are presented. Then, selected think-aloud transcriptions from the participants are presented and discussed as examples.

After analyzing the recordings, the qualitative analyses revealed the following seven cognitive strategies: (a) making prediction, (b) summarizing, (c) using "like a…", (d) using fix-ups, (e) making questions, (f) identifying a problem, and (g) reflection.

While all of the strategies were detected by almost all participants in answering X-Test, just five of them were used by respondents of the C-Test. This indicated that there were similarities in the use of strategies in filling out the gaps of the C-Test and the X-Test except in the use of two strategies namely "summarizing" and "making questions". This is in contrast with Boonsathorn (1987; cited in Boonsathron, 1988) who paralleled the C-Test with the X-Test to find out the strategies that L2 learners used in answering the C-Test and the X-Test. The results indicated that the C-Test and the X-Test were essentially different functionally and structurally.

Some selected think-aloud transcriptions from the participants in C-test could be as following:

One of the respondents used the technique of making prediction and said "I think that this word is Discover". He also used "connections" and said "this word is like things". Additionally, he identified a problem by verbalizing "I'm not sure, but this word could be Do".

Another one identified a problem and said "I'm confused about the word food" and used the technique of fix-ups "I'll reread this word and it is find".

Regarding X-test another respondent used technique fix-ups and said "I reread this word and now I know it is Sails". She also make question and said "is it watch?"

The statistical findings of the study proposed that for completing the gaps of C-test respondent used 68% "make prediction" strategy, 18.5% "use a like…" strategy, 7% tried "identify a problem" strategy, and 2.5% "use fix-ups" approach. While in filling the gaps of the X-test respondents not only applied these above four strategies, but also used two other strategies of "summarizing, 4.5%" and "making question, 5%". (Table 1)

Table 1: Statistical Frequencies

Technique: Test	Making prediction	Summarizing	Use "like a …"	Used fix-ups	Making Q	Identify a problem	Reflecting
Sum c-test	68%	0%	18.5 %	2.5%	0%	7%	4%
Sum z-test	56%	4.5%	12%	5%	5%	10.5%	7%

To summarize, the study revealed the use of the same kind of cognitive strategies in answering both tests, however the subjects applied two more cognitive strategies "Summarizing" and "Making questions" in answering X-Test. This finding is in accordance with Boonsathorn (1987) that revealed the learners taking the X-Test required more strategies than those taking the C-Test.Furthermore, Mehrpour (2012) asserted that the order of deletion of letters in a test affects the comprehension of the Test, which make it seems reasonable that students may use different strategic solution in X-testing versus C-test taking.

4. Discussion and Conclusion

Different research surveys have been focused on observing the mental processes involved in C-Test taking in a second language (Boonsathron, 1988;Stemmer, 1991/1992;Wonghiransombat, 2013). For nearly a decade the Bochum project on C-Test, stressed on discovering the cognitive processes going on in students' minds, when they are engaged in a C-Test. Moreover, to realize "how" the learners solve C-Tests, introspective and retrospective approaches and a model of analysis that focused on the assumption that, C-Test is a cognitive task was applied on the

subjects who participated in the Bochum project. The results showed that the C-Test is a cognitively demanding task (cited in Grotjahn and Stemmer, 2002).

Besides, Stemmer (1991, 1992) tried to achieve more direct access to mental operations in C-Test taking by using think-aloud protocol. The results of her study not only displayed different cognitive strategies involved in C-Test taking but also revealed variations in the efficiency of strategies regarding various texts.

However, there are still gaps in the literature regarding the learners' mental processes involved in the X-Test. Therefore, the purpose of this study was to discover and compare the extent to which the C-Test and the X-Test tap participants' use of mental strategies to develop a better understanding of students thinking while engaging in the C-test and the X-Test solving and to provide insight into problem solving processes. These implications are in line with Grotjahn and Stemmer (2002) who declared that one cannot realize what a language test assesses without an understanding of individuals' cognitive processes and mental operations on which the observed scores depend.

On the initial examination of the data, it became clear that respondents engaged in applying the same kind of cognitive strategies in answering both tests, which support findings of Babaii and Ansary (2001) as well as Rahimi and Saadat (2005) in that C-test taking includes processes such as "using references" and "using co-text".

Moreover the findings revealed that the subjects applied two more cognitive strategies in answering X-Test which were "summarizing" and "making questions". Using more strategies in an X-Test taking is in close confirmation with the study of Prapphal (1994) that showed, in a study of the order of presenting the C-Test and the X-Test, the X-Test looked to be more closely connected to the cognitive and academic skills than the C-Test.

The results also indicated that the strategy associated with making prediction by the use of co-text was strongly highlighted during the study regarding both tests.

Additionally, it is also revealed that the X-test was more challenging, as one participant stated that "In c-test the existence of the beginning of the words itself helped us in finding the word", which is in fact in accordance with Spolsky' principles of reduced redundancy (1968, 1969).

To summarize, researchers should state that first, based on the statistical analysis it was found that four similar cognitive strategies were used by participants in answering both C-test and X-test. Second, respondents applied two strategies of "summarizing" and "making questions" just for filling out the gaps of the X-test, therefore, there was a significant difference between the two tests regarding these two strategies of "summarizing" and "making questions".

IMPLICATIONS AND SUGGESTION FOR FURTHURE STUDIES

This study suggests that think-aloud provides a wealth of information about student thinking and differentiate them during problem solving exercises. The study also encourages the use of multiple approaches for assessing learners' skills specially reading skill due to individual differences in the use of cognitive strategies. The study can contribute to teachers, learners, researchers and even syllabus designers' understanding of why a test taker has answered an item or why he or she has failed to do so.

Moreover, the study encourages further work in this area to investigate the other factors associated with filling the gaps of these two test especially regarding to subjects' gender and different level of proficiency.

(De)LIMITATION OF THE STUDY

This study had certain limitations among them and the most important one would be the setting under which all the participants in the study were selected. They all were selected from universities from Mashhad, Iran. Therefore, this study did not focus on English learners in language institutes. Thus, it can be claimed that the findings of this research could be well fit with University EFT students.

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