Algerian EFL Students' Reading Comprehension Skills across Paper and Screen: A Sociocultural Approach

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Abstract: Reading comprehension is a complex activity that requires a variety of skills in handling documents. This paper investigates the effects that the reading environment may have on reading comprehension. It aims at comparing reading comprehension skills of urban and rural Algerian EFL students in paper-based and screen-based environments. Accordingly, the leading approach to the raised issue is sociocultural. To accomplish the aim, an experimental reading comprehension test has been conducted at Mouloud Mammeri University. Ninety six Participants living in urban and rural areas participated in the study. Two tests were used to investigate whether their reading comprehension skills are the same or different in paper-based and screen-based environments. The collected data have been analysed by means of inferential statistical analysis. More to the point, a one-way analysis of variance (ANOVA) and paired-samples t-tests have been employed to measure the impact of the environment on the participants' scores. Findings indicate that the reading environment has a significant impact on Algerian EFL students' reading comprehension. Their reading abilities on paper and on screen are not the same. However, no discrepancy is noticed between participants living in urban or rural areas. This suggests that the urban-rural dichotomy is shallow in the Algerian context in terms of EFL students' reading skills.

Introduction: In an educational environment, and more precisely in an EFL context, reading is viewed as the most crucial skill for knowledge acquisition and academic accomplishment. It plays an important role in *"promoting social awareness and growth*" (Dechant, 1991, p. vii).

Understanding the nature of the reading process is a real challenge for researchers. Various views and perceptions have emerged during the last decades as an attempt to bring a systematic conception of the reading process. The traditional perception that considered reading as a decoding process has been broadened to

include the psychological and the cognitive and even the sociocultural dimensions of reading. The latter is no longer viewed as a set of skills used by learners to decipher texts. It is rather an interwoven and complex process that learners go through to reach understanding and comprehension of texts.

EFL students live in an increasingly digital world. They are overwhelmed by the amount of information they are confronted with. They use their mobiles, laptops, or tablets for academic or recreational reading. So, screen-based reading has become a part of their daily lives. In order to construct meaning from screen-based texts, learners need to develop appropriate reading comprehension skills. This is what led some scholars to explore screen-based reading from different perspectives in a variety of contexts (Coiro, 2003; Coiro and Dobler, 2007).

Technological progress triggers a variety of discussions over screen reading practices. The focus of most current research has been directed toward cognitive aspects of reading namely, electronic reading strategies. However, few studies have focused on sociocultural factors which are likely to influence the development of reading skills. Researchers are only at the very early stage of discovering changes in reading patterns in the screen-based environment and more empirical studies in various contexts are crucial to provide a broad picture of screen reading by taking into consideration sociocultural variables. To fill this gap, the present research attempts to investigate reading comprehension abilities on paper and on screen of university students of English in Tizi-ouzou, a middle sized town 100 kms East of Algiers, Algeria. By the same token, it also attempts to analyse the impact of geographical location on EFL reading comprehension skills. Indeed, little research has focused on this factor which is likely to affect EFL learners' reading practices. In the Algerian context, due to important sociological changes, the distinction between rural and urban

population is particularly significant for research in social sciences. The dichotomy is going to be used for sociocultural comparison.

Two research questions are raised in the present paper:

- To what extent does the environment impact Algerian EFL students' comprehension abilities?
- Is there a significant difference between urban and rural students in terms of reading comprehension abilities in both paper and screen-based environments?

Reading comprehension

Reading is a complex, cognitive, internal and invisible activity that takes place inside the mind of the reader (Bernhardt, 1991). Understanding the characteristics of the reading process and what it entails is crucial for any researcher in the field of reading. In the words of Marva Barnett (1989), a better understanding of the reading process implies a clearer picture of the way reading can be taught and measured.

Early definitions of reading focused on grasping the author's message by understanding the main idea of the text (Widdowson, 1979, cited in Carrell et al., 1988). In a word, reading is a decoding process of reconstructing the author's intended meaning (Carrell et al., 1988). Shaw (1959) states that reading is a communicative activity in which the reader is "*thinking with the author, absorbing his ideas*" (p. viii). However, more recent definitions emphasise the individual interpretation of texts (Carrell et al., 1988; Grabe, 2009). Getting meaning from a text is the result of the interaction of the information presented in the text and the specificities of readers' background knowledge. Reading then may be considered as a result of the interplay of a variety of cognitive, psychological and sociocultural factors functioning altogether.

Scholars in the field of reading claim that the comprehension process may be divided into three levels: literal level, inferential level, and critical level. Each level refers to a set of reading skills. The first level relates to what the text states. It is the basis for more advanced

understanding. It does not involve determining the connotation of words. Grasping the main idea of a passage is the basic reading skill needed at this level of understanding (Thomas & Robinson, 1977). The inferential level is the process of going beyond the stated information to get deeper interpretation of textual information on the basis of the reader's background knowledge. It is mainly based on drawing inferences by trying to understand implicit information (Barrett, 1976). The third level is the critical level which is also known as evaluative level. The reader analyses the information presented in the text in order to draw some conclusions and implications which are not directly stated in the text. Judging the suitability of the material for particular purposes and distinguishing between facts and opinions are the main reading skills involved at this level of reading.

Paper-based and Screen-based Reading

In the digital era, one of the questions raised and reported in the literature turns around the differences that lie between reading a print or an electronic version of a text. Many studies have been conducted in an attempt to bring an answer. As a matter of fact, a plethora of research articles have been published during the last decade drawing mainly form neuroscience. Attempts are made to explain the effects of reading medium on the brain activity. Results of various studies reveal that a substantial cognitive difference exists between the process of reading on screen or on paper in terms of brain activation, level of attention, cognitive focus, comprehension and reading speed (e.g. Gudinavivius, 2016; Chu et al., 2014). The physical characteristics of a paper make of it a fixed and autonomous support. On the other hand, the digital document is characterised by its transience; this can make of the two ways of reading different even though the writer's message is the same.

It has been demonstrated that reading on screen is slower than reading on paper. In addition, readers tend to select extracts instead of reading whole texts, they often stop reading. Consequently, reading on screen is viewed as less efficient for readers mainly in academic

contexts (Carr, 2011). Conversely, other scholars perceive reading on screen as more beneficial for readers since it helps them develop new cognitive and interpersonal communication skills (e.g. Shirky, 2010).

The Sociocultural Approach

The sociocultural theory is one of the various theories incorporated within the social learning perspective. It suggests a large perspective to the study of second and foreign language developmental processes and pedagogies including the combination of 'cognition' and 'social context'. Cognitive development is influenced by individuals' participation in culturally-organised practices as well as their daily activities. James P. Lantolf (2004) explains that the sociocultural approach emphasises the *"role that social relationships and culturally constructed artifacts play in organizing uniquely human forms of thinking*" (as cited in Lantolf & Thorne, 2006, p. 01). It has been highly inspired by social constructivism and its application to language acquisition research. It explains the learning process as socioculturally organised. It is mainly based on the causal relationship between social interaction and cognitive development. The strong connections between culture, language, and cognition have been investigated within social sciences for over a century.

According to Vygotsky (1978), many factors such as social, cultural and historical contexts are involved in the learning process. Said differently, social interactions, learners' cultural background and historical context are factors which are likely to influence the mental functioning of the individual and the learning process including language learning.

Vygotsky' s social constructivist theory highlights the first seeds of the sociocultural approach. Yet, a slight distinction is to be drawn between the two concepts. While social constructivism focuses on knowledge constructed by individuals in society, the sociocultural approach emphasises the implicit impact of the social and cultural systems on learners.

Methodology

Data collection

Two reading comprehension tests, designed following the same format, are used to compare the participants' reading abilities on paper and on screen. Several reading comprehension tests are to be found in the literature permitting the assessment of various reading constructs. Gap-filling, multiple-choice tests, constructed-response tests, among others, are examples of reading comprehension tests. Each design has a specific purpose and has its strengths and weaknesses. Alderson (2000) claims that there is no best format for testing reading.

The study took place at Mouloud Mammeri University of Tizi-ouzou. The target population under investigation were Algerian EFL students preparing their master degree in English. From the whole population, a sample was selected. Criterion sampling is the strategy followed to select participants. They were master II students considered as skilled in print-based reading and experienced in using their laptops and internet.

The two reading comprehension tests have been selected from Cambridge ELT for advanced learners. Each designed test is composed of three parts as it is shown in the following table:

Print-based reading comprehension test	***Screen-based reading comprehension test***	***Time allotted to each part***
Part 1: Cloze Test Text entitled "is coffee really the devil's brew?"	**Part 1**: Cloze Test Text entitled "the future of food"	10 minutes
Part 2: Key word transformation. The students are asked to rewrite three sentences by using the suggested word.	**Part 2**: Key word transformation. The students are asked to rewrite three sentences by using the suggested word	5 minutes
Part 3: comprehension practice. A text is followed by nine	**Part 3:** comprehension practice. A text is followed by nine	25 minutes.

multiple-choice questions: - Literal comprehension - Inferential comprehension - Critical comprehension	multiple-choice questions: - Literal comprehension - Inferential comprehension - Critical comprehension	

The procedure followed to collect data is experimental since our objective is to assess and compare the participants' reading abilities on-print and on-screen. The participants sit for two reading comprehension tests. Each participant used his/her own laptop. The purpose of the test was explained prior to the test administration.

Data analysis

Quantitative data arising from reading comprehension tests have been analysed using the statistical method. Descriptive and inferential statistics have been used in a complementary way. Statistical Package for the Social Sciences (SPSS) version 2.0 is used. The latter is the most commonly software used in educational research.

The first step of the analysis is coding the collected data in a data file by defining the various variables and assigning values to each possible response. The coding frame varies according to the question type. The second step consists in selecting specific statistical procedures that fit the purpose of the research. Indeed, the analysis procedures have been determined by the types of the collected data, the type of the variable, and the question items.

Then, the results have been interpreted using score interpretation suggested by Oxford and Burry-Stock (1995):

- Mean of 3.5 or higher = High
- Mean of 2.5 to 3.4 = Medium
- Mean of 2.4 or lower = Low

In order to compare between the different categories of participants, inferential statistics have been employed. The aim is to validate the obtained results, to perform reliability analysis, and to

generalise the results from the sample to the whole population. In social sciences, a result is typically considered as significant when the probability coefficient (P-value) is smaller than 0.05.

Two inferential statistic procedures have been employed: ANOVA and paired samples T-tests. ANOVA is used to compare the participants' scores in the comprehension tests. It sets out the relation between two different variables: nominal and quantitative. In other words, it depicts the impact of geographical location on the participants' scores. As regards paired-samples t-tests, they are used to compare the means of the participants on the basis of the environment where the test takes place. More to the point, the aim is to set the differences that lie between the participants' abilities in screen-based and paper-based environments.

Findings: Once the test papers were handed back, they were corrected. The marks of each participant were stored in a data file created in SPSS. The analysis consisted in a quantitative analysis through the two statistical procedures presented earlier. The results of the analysis are displayed in tables following the APA style.

Participants' Profile

	Rural	Urban	Total
#	51	45	96
%	53%	47%	100%

Table 1 Identification of the Participants

Ninety-six (96) EFL students participated in the present study. Fifty-one (51) participants representing 53% of the sample live in rural areas. As regards the other half of the sample, it is composed of forty-five (45) students representing 47%.

In order to analyse the effects of geographical location on the participants' scores in paper-based and screen-based environments, an ANOVA test was performed.

Test item	Geog. Loc.	M	SD	Sig.
Cloze test	Urban	3.25	0.44	0.11
	Rural	2.75	0.84	
Key word transformation	Urban	3.75	0.72	1.00
	Rural	3.50	0.72	
Comprehension Questions	Urban	2.50	1.14	0.32
	Rural	3.25	0.44	
Inferential comprehension	Urban	4.00	0.72	1.00
	Rural	3.75	0.72	
Critical comprehension	Urban	2.25	0.44	0.12
	Rural	2.25	0.44	

Table 2. Results of Paper-based Reading Comprehension Tests: ANOVA

Test item	Geog. Loc.	M	SD	Sig.
Cloze test	Urban	3.00	0.72	0.27
	Rural	2.50	0.84	
Key word transformation	Urban	3.25	0.84	0.32
	Rural	2.50	0.88	
Comprehension Questions	Urban	1.50	0.51	1.00
	Rural	1.50	0.51	
Inferential comprehension	Urban	2.00	0.72	0.15
	Rural	2.25	0.44	
Critical comprehension	Urban	1.25	0.44	0.60
	Rural	1.25	0.51	

Table 3 Results of Screen-based Reading Comprehension Tests: ANOVA

The above tables display the results of the experimental reading comprehension tests. The means of the different items range from 1.25 to 4.00.

In the print environment, the mean of 'key word transformation' is ranked at the hi-level category. The means of 'cloze test', 'comprehension questions', and 'inferential comprehension' are

ranked at the medium level. It is to be observed that, the scores obtained for 'critical evaluation' are ranked at the low-level.

In the screen-based environment, the scores of the participants are ranked at the medium-level in 'cloze test', 'key word transformation', 'literal comprehension questions'. It is worth to note that, 'inferential comprehension questions' and 'critical comprehension questions' are ranked at the low-level.

Regarding the two environments together, there is a difference between paper-based and digital-based scores. On the basis of the samples-paired t-tests, it has been found that the means of the two groups vary according to the environment. Indeed, their scores decrease in the screen environment.

Discussion

Answer to Research Question # One:

Print-based Vs. Screen-based Reading Comprehension

Also known as 'gap-filling', the first test item was 'cloze test'. It is a well-known reading exercise which is widely employed in language teaching and testing. The students were presented with a text with several gaps. Then, to fill in each gap, they were asked to select the most appropriate term out of three choices. This kind of tests is very useful in proficiency testing. In addition, being multiple-choice, it is well suited for statistical analysis.

Cloze tests, as used in EFL contexts, aim at demonstrating the extent to which learners do understand vocabulary in context. It allows the students to demonstrate their inferential abilities while reading texts. The scores obtained by the students in both environments are ranked at the medium level. This suggests that Algerian EFL students' ability to understand words in their appropriate contexts is medium. In addition, the environment in this case did not impact on this skill. In short, at the word level, the comprehension process on paper or on screen is more or less the same.

The second test item relates to 'key-word transformation'. It is a reading and writing exercise. The students were asked to re-write a sentence by using a prompt word. So, the learners had to read and

understand the first sentence so as to be able to write another by using a key-word. The meaning of the two sentences was the same. Two reading skills were targeted through this exercise. The First was the literal meaning of sentences, and the second was exploiting formal schemata in comprehension. The students could not transform a sentence which was not well-understood.

Similarly, the third test item aimed at checking the participants' literal comprehension of texts. It was a set of questions directly related to the text. Like the second item, the mean of the students' score ranked at the medium level on paper, but decreased on screen since it ranked at the low level.

The findings of item two and item three suggest that the first level of reading comprehension, namely the literal one was easily reached in print comparing to screen. The explanation that seems plausible is the 'cognitive focus' that varies across paper and screen. There is a common agreement among researchers that comprehension levels were lower on screen due to browsing and lack of cognitive focus (e.g. Hou et al., 2017).

The fourth item was intended to check the participants' inferential comprehension. Also known as deep comprehension, it relates to a highly, richly integrated and coherent understanding. Readers associate the information presented in the text to their background knowledge to build deeper understanding of the text (McNamara, 2007). A disparity in participants' scores is noticed across paper and screen. While their level in inferential comprehension was high on paper, it was low on screen.

Indeed, during the reading process, readers construct cognitive maps representing the physical location of the information within a text. It has been claimed that in order to depict a particular piece of information, readers regularly recall where it appears in the text (Jabr, 2013). In addition, the human brain processes each piece of information within its context and associates it to the background knowledge (Li et al., 2013). This is, indeed, what makes of reading an interactive process. So, the physical characteristics of print-based texts

help the construction of mind maps. Conversely, the screen-based text lacks the physical rigidity preventing readers from constructing coherent cognitive maps.

The fifth item focuses on critical comprehension of texts. It requires the participants to understand both the content and contexts of production of the text in order to be able to give their own opinions. The scores obtained by the participants on paper are ranked at the medium level. However, on screen, the results are ranked at the low level.

Critical comprehension relates to higher-order skills; it requires developed cognitive skills from the part of the students. So, considering the results of the previous items, the scores obtained for this item are not surprising.

No common agreement is reached among researchers as regards critical comprehension. The results reported in the literature show that some studies found that critical comprehension from print texts is better than screen reading (Singer and Alexander, 2017); findings which are similar to the results of the present study. Conversely, other studies reported no significant comprehension difference between readers using either medium (Muter & Maurutto, 1991).

All in all, the environment does not matter for reading comprehension at the word level or some literal comprehension questions. However, a discrepancy across paper and screen is noticed among the participants' scores in terms of inferential and critical questions. Comprehension is significantly better when the students read print-based texts. The following table displays the summary of the findings of the paired-samples t-tests

	Mean on paper	Mean on Screen	Sig.
Literal Comprehension	3.2	2.15	0.04
Inferential Comprehension	3.8	2.12	0.01
Critical comprehension	2.25	1.25	0.02

Table3. Paper-based Vs. Screen-based Reading: Paired-samples t-tests

Answer to Research Question # Two:

The second research question raised in the present paper addressed the impact of the participants' geographical location on their reading comprehension skills. This independent variable is of less frequency among researchers in the field of education. Yet, working within the context of urban-rural inequalities in the Algerian context, our aim was to identify the possible differences between rural and urban EFL students' reading comprehension across paper and screen.

The interest shown to research in rural sociology goes back to the beginning of the 20th century in the United States. Studies focused on the integration of agricultural producers into a capitalist economy within an industrial society. Generally defined by opposition, each category is distinguished from the other economically, culturally and even ideologically. The advantage is generally given to the urban areas, symbolically identified with an image of domination through the power exercised over geographical space, but also as a dispenser of civilization. On the other hand, the rural areas remain assimilated to the lack of civilization and life commodities.

The results of the present study, reported earlier in table 1 and table 2, indicate that the P-value for the different test items is superior to 0.05. Accordingly, it can be stated that no significant difference is observed between the urban and rural students.

Algeria has known a movement of rural displacement to cities just after independence. The urban areas have been the target of many rural inhabitants looking for better life conditions and better economic opportunities. Similarly, many rural areas have been urbanised. They are increasingly benefitting from the advantages traditionally associated with the city and the forms of urbanity is develops.

One of the subjects investigated within the framework of urban and rural sociology is learning. Researchers were mainly interested in the inequalities between learners from urban and rural areas. Indeed, it is not easy to draw a clear cut distinction between rurality and urbanity. The approach can be different depending on whether one speaks of

rural territory as a geographical stance, as a social entity which is culturally circumscribed, or economically considering that the city (the urban) is synonymous with trade and the countryside (the rural) is related to agriculture. As far as the Algerian context is concerned, the findings of the present study sustain that the urban-rural dichotomy is shallow in terms of reading comprehension skills. No disparity is observed between students living in urban or rural areas.

Conclusion: Algerian EFL students, like their counterparts in different parts of the world, are increasingly integrating technology into their everyday lives. This leads them to gradually develop screen-based reading behaviour. A phenomenon, that needs a thorough investigation and examination in the field of reading research.

The aim of this study was to compare Algerian EFL students' reading comprehension abilities across paper and screen with much focus on urban-rural dichotomy. The adopted approach is the sociocultural one where reading is perceived as a cognitive and a social practice. It has been found that screen-based reading is still in its first steps in the Algerian context. The students' scores decrease in screen-based environment mainly in terms of inferential and critical comprehension. This implies that Algerian EFL students need to develop new literacy skills in order to cope with the digital age.

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