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The Effect of Inference Skills on Reading Comprehension among EFL Learners

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Abstract

The Simple View of Reading (SVR) suggests decoding and linguistic comprehension as the two components involved in reading comprehension. Linguistic comprehension is vital in this process since it supports the comprehension of the written text. Decoding is also fundamental to enable the reader to read the written text; decoding is supposed to become habitual and automatic over a couple of years of schooling for most children. Once the reader can decode effortlessly, other strategies are required to accelerate comprehension; among these, inference skills seem to be very important. Given the importance of reading and inference skills, the current study sought to investigate the relationship between inference skills (lexical and global inferencing) and reading comprehension among English language learners (ELL) in Iran. Additionally, the study aimed at finding the effect of teaching inference skills on reading comprehension performance. One hundred and twenty female high school students from Tehran were selected based on their scores on the Oxford Reading Test, indicating that they were at intermediate levels of English proficiency. The participants were randomly divided into a control and experimental group (each consisting of 60 students). The participants in the control group received conventional instructions of the school, while the participants in the experimental group were also taught inference skills. The participants in both groups were pre- and post-tested on their reading comprehension ability. Additionally, a multiple-choice test of reading comprehension measuring the global and lexical inferencing abilities was given to the participants. The results of the Spearman correlation coefficient indicated that there was a significant relationship between lexical inferencing and reading comprehension as well as global inferencing and reading comprehension. Additionally, the results of the independent samples t-test revealed that teaching inference skills had a significant effect on reading comprehension performance among ELLs. The findings of the study have implications for ESL/EFL contexts concerning teaching reading comprehension in general and inference skills in particular.

Keywords: reading comprehension, inference skills, lexical inferencing, global inferencing

1. Introduction

Text comprehension is essential for modern life. For instance, success in education, finding a good job, being productive and effective in the society all entail being a professional reader who can read rapidly and comprehend what they read using high inference skills (Yuill & Oakhill, 1991). Inference skills are to help readers read purposefully; hence, learning inferencing is an important learning goal, which allows a

reader to gain as much information as possible from the text. Inference makes readers more interested in reading so that readers find themselves as part of the text. Inference is based on what readers read and what they already know (Logan & Johnston, 2009). Concentrating on individual words while reading would make comprehension process laborious, boring, and time-consuming without proper understanding. Therefore, inference skills can be considered very important to improve reading comprehension among readers, particularly English language learners (ELLs) who usually find reading more challenging since they may read English texts and translate them to their first language.

Based on SVR (Gough & Tunmer, 1986), reading comprehension has two main components: decoding and linguistic comprehension. Decoding refers to the knowledge of graphemes (alphabets/letters) and phonemes (sounds of the language) as well as the ability of putting them together. In other words, decoding is an individual's knowledge of reading strings of letters applying grapheme-phoneme correspondence rules. This skill is expected to be taught to children, usually at Grade 1 primary school. Most of the children are supposed to have no problem in this aspect. Linguistic comprehension is another aspect of reading comprehension, which is virtually multifaceted by encompassing verbal skills, syntactic, semantic, and pragmatic knowledge. Reading comprehension is believed to be enhanced through using multiple strategies and higher-level skills of language processing (Tunmer & Chapman, 2012). For example, inference, as a higher-level skill, should help students comprehend the text better (Nassaji, 2007). In learning a new language, learners should first obtain lower-level skills in L2 such as knowledge of phonology, decoding, being able to read fluently, vocabulary, morpho-syntax, etc. the skills that may enhance working memory space, allowing learners to use higher-level skills such as inference to competently comprehend the text.

Given that reading starts from decoding (i.e., entangling printed form of the language), less proficient readers quintessentially focus on decoding and understanding individual words, which undermines their ability to understand the underlying meaning. Decoding should be fluent; otherwise, it may occupy the reader’s working memory, and as a result, the reader cannot make proper communication with the writer’s purposes (Logan & Johnston, 2009; Knudsen, Jensen de Lopez, & Archibald, 2018). However, professional and fluent decoding skill does not guarantee reading comprehension because readers not only need effortless decoding skills (as a lower-level skill), but they also need to be aware of higher-level skills (e.g., comprehension monitoring and inference skills) in reading comprehension (Yuill & Oakhill, 1991). Although most students do not struggle with decoding, they may still have problems in comprehending texts if they do not have enough lexical or syntactic knowledge. Understanding a text is the ultimate goal of

reading. Reading a text word by word is time-consuming and boring, which usually undermines text comprehension. Hence, learning skills that may help readers read and comprehend what they read effectively are crucial to help readers make connections among the words and sentences in the written text and understand the text as a unitary construct.

2. Literature Review

2.1 Reading

Reading is one of the four main skills in learning a foreign language. It is a dynamic process including word-level decoding and language comprehension (Logan & Johnston, 2009). Reading comprehension is a guessing game: the reader tries to reconstruct the message intended by the writer. In fact, reading comprehension involves textual information plus prior knowledge (Spiro, 1980). Reading is mainly aimed at enabling the reader to grasp the meaning and message of the written text (Goodman & Goodman, 1983). During the early years of reading, children's text comprehension depends largely on decoding ability. Following the improvement of readers' reading skills, decoding is expected to become a fluent process. Reading comprehension is assumed to be part of linguistic comprehension too (Catts, Hogan & Adlof, 2005; Knudsen et al., 2018). Reading is a schema-based process meaning, which requires rich knowledge of vocabulary and prior knowledge to comprehend the written text. Reading comprehension also requires lower level and higher-level competencies such as decoding ability, meaning retrieval, knowledge of grammar, the ability to combine syntactic and semantic aspects, and world knowledge to perform complex mental processes such as inference (Silagi, Romero, Mansur & Radanovic, 2014); professional readers are expected to be fluent in most of these areas. Grabe (1991) believed that a number of skills and knowledge are needed to read fluently, including automatic word recognition skill, knowledge of vocabulary and structure, knowledge of discourse structure, world background knowledge, evaluation skill, and metacognitive skills such as monitoring.

2.2 Inference Skill

Inference is a cognitive and mental process involved in comprehension (Logan & Johnston, 2009; Savic, 2018). It is a skill, which draws implicit information to the representation of what is read or heard. Reading is usually a difficult and challenging process, especially in texts that have unknown vocabulary items, complicated structures, and complex patterns. Reader's background knowledge, level of language proficiency, and reading fluency seem to influence reading comprehension. Beginning readers seem to mostly rely on bottom-up processing when they read skipping difficult parts, technical

information, and graphic illustrations. Hence they may experience difficulties during the reading process to derive the underlying meaning of the written text, which may make the recognition of the text's tone or style challenging for them (Nuttal, 2000; Hall, 2016). In order to tackle such problems and comprehend the text fully, readers should learn how to think inferentially and use their reasoning ability. That is, the way someone is thinking can help them to predict and infer the meaning of the text better. Students should make a connection between clues in the text and their background knowledge in order to comprehend the text that they read (Nuttall, 2000; Ribeiro, Cadime, Freitas & Viana, 2016).

Over the years, children should read to learn instead of learning to read (Chall, 1983). This is the stage where inference skill emerges, and readers become professional readers. Successful readers go beyond word decoding and sentence understanding. They also go beyond the text, constructing text meaning based on the state and situation of the text and readers' prior knowledge. All of these are subsumed under the mental model (Kintsch & Kintsch, 2005). The process of decoding or bottom-up procedure becomes automatized, leading to more accessible memory space to accomplish its job (Perfetti, 1985). Inference skills increase with age. Studies show that learners who are in higher grades can use their reasoning ability more competently and, therefore, infer better than their younger peers (Ribeiro et al., 2016).

Some skills such as word decoding (Gough & Tunmer, 1986; Perfetti & Hart, 2001; Shankweiler, 1989), spelling (Shankweiler et al., 1999), and phonological awareness (de Jong & van der Leij, 2002) are believed to predict reading ability. Such skills, known as lower-level skills, are to be learned at the early stages of reading acquisition (Freebody & Anderson, 1983; Landi, 2010). Other skills such as inference making and comprehension monitoring, known as higher-level skills, require readers to become relatively competent in lower level skills so as to have enough space in their working memory in order to achieve high levels of comprehension and recognize coherence in the text and meaningful ties between different parts of the text (Perfetti, 1985; Landi, 2010).

Broek (1997) believed that there are three types of inferences. First, the cohesive inference in which the reader uses linguistic knowledge in order to comprehend the text. Second, knowledge-based inference in which the reader tries to use background knowledge to make text cohesive and to create a mental model of the text. Third, evaluative inference by which the reader uses background knowledge to connect different events in the text in order to understand characters, emotions, motivations, feelings, and goals. Beer (2003) also suggested ten types of inference including comprehending

pronouns' antecedents, meaning of unfamiliar words from clues in the text or lexical inference, grammatical functions of unknown words, intonation of the writer in a text, characters' beliefs, personalities, goals and motivation, relationship between characters and events in a text, details about events and settings of a text, writer's point of view about the world, relationship between what the reader reads and what the reader has known about the world, and finally come to some conclusion from details and clues that the reader has read in a text. Other researchers believe that there are two kinds of inference: bridging and elaborative. Bridging inference is an online gap-filling event that occurs during reading when conceptual gaps occur. This pushes the reader to use bridging inference in order to avoid misunderstanding and incomplete comprehension (Fincher-Kiefer, 1995; Gould, 2008; Graesser & Bertus, 1998). Elaborative (forward) inference is off-line in the text that is related to a deeper understanding of a text. This kind of inference is not essential to coherence or cohesiveness; however, previous experience helps the reader extract extra meaning from text. For example, in the text "Sara stirred her coffee." the reader understands that Sara must have used something like a spoon to stir her coffee (Gould, 2008; Graesser, Singer & Trabasso, 1994).

Bowyer-Crane and Snowling (2005) proposed three kinds of inference to comprehend a text accurately including cohesive inference in which readers use linguistic knowledge to understand a text, knowledge-based in which readers use background knowledge to interpret a text, and evaluative inference in which readers use prior knowledge in order to connect events in a text to understand characters' feelings, motivations, and purposes (Van den Broek, 1997). Kispal (2008) divided inference skills into six types. First, coherence inference, which is known as text-connecting or inter-sentence inference. This kind of inference provides a textual connection. For example, Sara is a student; she goes to school every day. The reader understands that the pronoun "she" refers to Sara. Second, elaborative inference, which is known as gap-filling inference. In this kind of inference, the reader uses his/her general knowledge and life experience to understand the meaning of a sentence. For example: "John shot a ball and the vast dropped. His mother brought towels to clean the floor". Third, local inference thereby a reader understands coherence, role assignment, and antecedent causal in the text. For instance: "Jack ran, leaving his bicycle unchained in the street". The whole sentence has coherence; street is assigned to a location role. The reader guesses Jack was probably in a hurry. It is antecedent causal. Fourth, global inference is related to the whole text using which the reader infers the main idea, theme of text, and, morality in it according to all local coherence in a text. Fifth is online inference, the inference that is drawn during reading automatically. Finally, offline inferences that is strategically drawn after reading.

Lexical and global inference can encompass almost all types of inference skills (Singer, Graesser & Trabasso, 1994). Lexical inference refers to the ability of dealing with unknown items within a text at the word level. Relying on this skill, learners use immediate co-text and linguistic cues to make informed guesses about unfamiliar lexical items (Riazi & Babaei, 2008; Ahour & Ranjbar, 2016; Savic, 2018). Global inference represents the ability of synthesizing distant information within a text, discovering causal relationships, semantic connections, and thematic cues to monitor coherence of the text components to gain full and deep comprehension at the text level (Singer et al., 1994; Shea & Ceprano, 2017).

Studies on inference skills suggest that inference making is more successful in the first language than it is in the second or the additional language, hence it is interesting to examine the role of inference skills in second language setting (Van Zealand, 2014). The present study aims to investigate the relationship between inference skills (lexical and global) and reading comprehension in English (L2) and also the impact of such skills on reading comprehension in English language learners.

3. Method

3.1 Participants

This study initially recruited 180 Persian native speakers from a female high school in the north of Tehran. The participants were learning English as a foreign language for a while. The participants were relatively from similar socio-economical backgrounds and resided in the same neighborhood. They were also relatively similar in their English reading ability assessed by the Oxford Online Placement Test (OPT) (Allan, 2004). Those who scored between nine and 13 (n=120) were selected, indicating that the participants were at intermediate levels of reading proficiency in English. The participants were all girls aged between 15 (n=64) and 16 (n=56) years of age. Table 1 displays the descriptive statistics of the 120 selected participants for the purpose of this study.

Table 1

The Results of the Oxford Placement Test of the Selected Participants

	N	Min	Max	Mean	SD
Oxford Placement Test (reading module)	120	9.00	13	11.38	1.16

Note. SD = Standard Deviation

The participants were briefed that their results were to use for research purposes anonymously and could withdraw whenever they wanted with no penalty. All tests were taken in group sessions in their school. At the beginning of each test, the participants were given a clear instruction. No one could use a dictionary during the test. Before starting the data collection, all instruments were assessed in terms of reliability. While some of the tests were standardized norm-referenced tests, all measures of the study were piloted among 30 participants.

3.2 Procedure

First, the Oxford Online Placement Test (the reading module) was given to the participants, then those who were at intermediate levels of reading comprehension ability in English were selected (n=120) and divided randomly in two control and two experimental groups with thirty students in each group. Then the vocabulary test (Nation & Beglar, 2007) was given to all groups to control the participants' vocabulary knowledge and further ensure there was no difference among the groups. The reading comprehension multiple-choice text was then given to the participants to assess their referential and inferential skills, followed by the reading comprehension cloze test and the passage comprehension measure of the Woodcock-Johnson III Tests of Achievement (WJ III ACH) (Woodcock, McGrew, & Mather, 2001).

After the pre-test, the control groups proceeded with the daily teachings according to the curriculum, while the experimental groups were also taught inferential skills implicitly and explicitly. Intervention sessions included eight sessions (each session took about 30 minutes) over one month. During these sessions, participants were primarily given situations and were asked to guess about the items and events. For example, by simply presenting a sentence, "there are a lot of dirty dishes in the kitchen", the participants in the experimental group were supposed to guess about dish types and relevant events to such a scene. Having made their guesses, they were then explicitly taught how to find contextual clues and think about relevant ideas and how to link them to discover the whole story. Presented situations grew longer and more complicated throughout the intervention sessions to enable the participants to independently find out about facts, characters and their feelings, and possible consequences that were not explicitly mentioned in the text.

After the intervention sessions, the participants in both groups took the two reading comprehension measures as the posttests to measure their potential improvement in reading comprehension skills.

3.3 Instrumentation

In the current study, several English instruments were used including a reading proficiency test of the Oxford Online Placement Test (OPT) (Allan, 2004), the vocabulary test (Nation & Beglar, 2007), and three reading comprehension tests including the reading comprehension cloze test, the reading comprehension multiple-choice test, and the English passage comprehension test (WJ III ACH) (Woodcock, McGrew & Mather, 2001). The English reading proficiency test of OPT (Allan, 2004) was used to examine the participants' reading comprehension ability. The test included a passage followed by 20 multiple-choice questions. Since vocabulary is known to have an important role in text comprehension, the participants' vocabulary knowledge in the current study was controlled utilizing the vocabulary test developed by Nation and Beglar (2007) modified for the purpose of this research. The test included nineteen sentences; each sentence had a word in the bracket with one answer and three distractors.

Three parallel reading comprehension tests were also utilized, including the reading comprehension cloze test, the reading comprehension multiple-choice test, and the passage comprehension measure (WJ III ACH) (Woodcock, McGrew & Mather, 2001). The reading comprehension multiple-choice test included five short passages assessed inferential (lexical and global) and referential skills by including both referential and inferential questions. The passage comprehension test (WJ III ACH), which is an American norm-referenced standardized test, was utilized to assess the participants' reading comprehension ability. The test included 19 items from which 15 items included pictures with each sentence requiring the testee to utter an appropriate word to complete them. The rest of the items were sentences and short paragraphs with no picture clues. Additionally, the reading comprehension cloze test included six short passages with some blank spaces in order to assess students' reading comprehension ability.

4. Results

4.1 Reliability of the Instruments

Since reliability is sample dependent, all instruments were piloted on 30 participants having similar characteristics to the main participants of the study, and Cronbach's Alpha was calculated to assure appropriateness of the instruments for the current research context. Table 2 illustrates the results of Cronbach's Alpha for the instruments utilized in this study. Since the Cronbach's Alpha indices are all above .70, it can be interpreted that all measures of the study met a satisfactory level of reliability (Brown, 2007).

Table 2

Cronbach's Alpha Indices for the Instruments of the Study

Instrument	Cronbach's Alpha	Number of Items
Oxford reading proficiency	0.71	20
Vocabulary	0.73	19
Reading comprehension cloze	0.82	24
Reading comprehension multiple choice	0.73	22
English passage comprehension (WJ III ACH)	0.79	19

4.2 Analysis

To examine the relationship between lexical and global inferencing and reading comprehension, the reading comprehension scores of the 120 participants were correlated once with the lexical inferencing and once with the global inferencing scores. As mentioned earlier, reading comprehension in the present study was measured through a reading comprehension cloze test and an English passage comprehension test with a total of 43 test items. Global and lexical inferencing skills were assessed by giving the learners a 22 item multiple-choice test. In this test, 12 items measured inferential (lexical inferencing skills), and 10 items assessed referential (global inferencing skills). Table 3 demonstrates the descriptive statistics of the reading comprehension and lexical as well as global inferencing scores of the 120 participants of the study.

Table 3

The Descriptive Statistics of the Reading Comprehension, Lexical and Global Inference Skills of the Participants

	Number	Total score	Min	Max	Mean	SD
Reading Total	120	43	8	35	21.35	6.95
Lexical Inferencing	120	12	1	9	5.32	2.29
Global Inferencing	120	10	2	9	5.69	1.99

Note. SD = Standard Deviation

In order to identify whether parametric or non-parametric tests should be used to analyze the data, the one-sample Kolmogorov-Smirnov Test of normality was run. Table 4 demonstrates the results of the One-Sample Kolmogorov-Smirnov Test of normality for

the reading total scores as well as the lexical and global inferencing scores of the participants (see Table 4).

Table 4

The Results of One-Sample Kolmogorov-Smirnov Test of Normality for Reading Comprehension, Lexical and Global Inference Skills of the Participants

	N	Most Extreme Difference			Test Statistics	Kolmogorov-Smirnov Z	Asymp. Sig. (2-tailed)
		Absolute	Positive	Negative			
Reading Total	120	.10	.10	-.10	6.95	1.16	.13
Lexical inference	120	.11	.11	-.11	2.29	1.30	.06
Global inference	120	.14	.14	-.14	1.99	1.57	.01

As Table 4 presented, one of the variables showed a significant value lower than 0.05, indicating that the normality assumption was not met. Thus, the Spearman correlation coefficient was calculated to investigate the relationship between the reading scores and the lexical and global inferencing scores. Correlations among all the measures were found significant (see Table 5).

Table 5

The Results of the Spearman Correlation Coefficient between Reading Comprehension and the Lexical/Global Inference Skills of the Participants

	Global inference	Reading total
Lexical inference	.956**	.418**
Global inference		.444**

The results showed that lexical and global inference skills were significantly correlated with others, and both types of inference skills (lexical and global) were interrelated with reading comprehension ability (p<.01).

The present study also aimed to investigate the impact of inference skills on reading comprehension ability. To this end, the control and experimental groups were examined to ensure that there was no significant difference between them in terms of reading comprehension ability before the treatment. Table 6 displays the descriptive

statistics and the results of the independent sample t-test of the results of the pretest performed by the control and experimental groups.

Table 6

Descriptive Statistics and the Results of the Independent Sample t-test of the Reading Pretest and posttest of the Control and Experimental Group

	Control group			Experimental group					
	N	Mean	SD	N	Mean	SD	Mean difference	t	Sig. (2-tailed)
Reading (pretest)	60	20.86	7.15	60	21.83	6.78	-3.48, 1.55	-.75	.44
Reading (posttest)	60	21.53	7	60	27.41	5.46	-8.15, -3.61	-5.12	.00

Table 6 demonstrates the descriptive statistics of the pre- and posttest results of the participants along with the results of the independent sample t-test to examine any significant difference between the groups before and after the intervention programme. The results of the pretest showed that the control and experimental groups (M=20.86 and M=21.83, respectively) were relatively similar. The results of the independent samples t-test between the reading pretest scores of the control and experimental groups showed the significant value higher than the confidence level of 0.05 (p=.44). Thus, it can be concluded that the participants' reading comprehension scores in the two groups were not significantly different prior to the administration of the treatment.

After the intervention programme, which focused on teaching inference skills and strategies explicitly besides the conventional teachings that all participants were exposed to, the posttest results of the reading comprehension measures were compared. As illustrated in Table 6, the mean score for the control and experimental groups on reading posttest were slightly increased; however, the results of the t-test revealed that the two groups became significantly different (p=.00). Thus, it can be concluded that the participants' reading comprehension posttest scores in the two groups were significantly different after the administration of the treatment with the experimental group performing better. Additionally, the results revealed that teaching inference skills had a significant and positive impact on the reading comprehension performance of EFL learners.

5. Discussion

This study examined the relationship between inference (lexical and global) and English (L2) reading comprehension and also the effects of inference skills on reading comprehension ability of EFL learners. The overall results of the correlation and the independent sample t-test revealed a significant relationship between lexical and global inference skills and the reading comprehension in English as L2. Additionally, findings revealed that inference skills positively influence reading comprehension ability among EFL learners.

Reading comprehension requires both lower level and higher-level language skills. Lower level skills including vocabulary and grammar help the reader to construct the literal meaning of the text (Kintsch & Kintsch, 2005; Landi, 2010). However, previous studies have shown that the higher-level skills such as inference are also important in reading comprehension (Cane, Oakhill & Lemmon, 2004; Graesser & Bertus, 1998).

The findings of the current study also indicated that inference skills are important in reading comprehension and can contribute to the ability of EFL learners to understand the text more effortlessly (Nuttall, 2000); Ribeiro et al., 2016; Van Zealand, 2014). Given that professional readers make inference while reading by reaping benefit from their background knowledge (Yuill & Oakhill, 1991), it can be further argued that inference skills from the ability of monitoring the immediate and distant information within a text may facilitate filling information gaps and help the reader go beyond words which in turn may accelerate text comprehension. Hence inference skills help readers create a comprehensive mental model (Bowyer-Crane & Snowling, 2005). Inference skills help readers understand the underlying meaning instead of the literal meaning, which should enhance comprehension of the written text.

This study also revealed that above decoding and linguistic comprehension that are suggested by the SVR, inference as a higher-level skill of linguistic comprehension is important in reading comprehension, and it can contribute to and improve reading comprehension ability among English language learners. Lexical inference refers to connecting linguistic and contextual cues in the text and using them to indirectly find out the meaning of unknown words by using the surrounding context (Nassaji, 2007). Hence to learn how to infer unfamiliar and implicit facts from the text, readers need to be fluent in basic reading skills such as decoding, vocabulary, and morphosyntax to be able to find clues in the text (i.e., words that convey the crucial meanings) (Calvo, 2005; Ahour & Ranjbar, 2016).

Additionally, comprehension of the overall meaning of the text is needed to enable the reader to utilize lexical inference. This study revealed that EFL learners who are more competent in inferring the meaning of unknown words from the context and immediate co-text are better readers and comprehend the deeper meaning of the text compared to those with lower lexical inference skills. In addition to the ability of making informed guesses about the immediate unknown words and facts within a text, being able to retrieve the underlying meaning of the whole text and bearing all key information in mind plays an important role in comprehending a passage. Having a holistic view of the text and connecting all distant information together can be defined under global inference skills (Graesser et al., 1994; Perfetti & Stafura, 2014).

This study also supports the association between global inference and reading comprehension. A skill that goes beyond lower levels of comprehension such as vocabulary and syntactic knowledge and enables readers to get away from the literal meaning of the text and monitor crucial factors within the text, and move toward deeper comprehension (Perfetti & Stafura, 2014; Singer et al., 1994).

Although decoding (word recognition) and vocabulary knowledge are undeniable aspects of reading comprehension as proposed by the simple view of reading, full grasp of underlying idea and making a connection between the components of the text to make informed guesses is also required to enhance reading comprehension, the process that is referred to as higher-level skills of comprehension. Since comprehending referential questions seems easier than those of inferential questions, instructions, and methods focusing on inference techniques need to be utilized in teaching reading skills to enable readers to make inference habitual. According to the findings of the current study, explicit instructions on making informed guesses along with teaching and practicing strategies to recognize and remember determining factors of the text can improve inference making and consequently reading comprehension skills.

Consequently, there was a strong and positive relationship between inference skills and reading comprehension in English among EFL learners. The results of this study also showed that teaching inference skills significantly affect reading comprehension ability. Explicit instructions and teaching methods to read efficiently may also help learners increase their comprehension ability.

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