



Reading Comprehension in EFL: An Overview

Kusumarasdyati Kusumarasdyati^(✉)

Universitas Negeri Surabaya, Surabaya, Indonesia
kusumarasdyati@unesa.ac.id

Abstract. This paper provides a general overview of reading comprehension in English as a foreign language (EFL). Reading comprehension is defined as the process of constructing meaning from the printed text, involving cognitive and social factors. There are three types of reading processes: bottom-up, top-down and interactive. In order to comprehend a text well, the proponents of the reading-universal hypothesis believe that good reading ability in the first language (L1) makes the readers read well in FL. On the contrary, those who support the short-circuit hypothesis argue that the readers need to reach a certain threshold level of proficiency in FL before such a transfer occurs. Some implications are suggested for language teachers who teach reading comprehension.

Keywords: Reading Comprehension · EFL · Reading Processes · Reading-Universal Hypothesis · Short-Circuit Hypothesis

1 Introduction

Good reading comprehension has been considered indispensable in the academic settings as it is one of the factors that determines successful language learning [1, 2]. To facilitate the learners' attempts to become good readers, language teachers need to understand the basic concepts of reading comprehension. This paper reviews a number of issues in reading comprehension. It begins with the most fundamental question about this construct: what is reading comprehension? The definition is discussed first in order to clarify what the term reading comprehension means. Next, this paper will examine the cognitive processing that operates during reading, which may be bottom-up, top-down or interactive in nature. After the review of general concepts about reading, the focus will be sharpened further into reading in English as a foreign language (FL). The final section will contrast reading in FL and reading in the first language (L1) to make it clear that these two differ for several reasons.

2 Definitional Issues of Reading

Reading involves more than merely decoding printed words in a particular passage. In addition to this perceptual activity, reading also requires the learners to perform psychological as well as social activities in order to comprehend the passage [3, 4]. There have been several attempts to define this complex process, but the basic concept of reading

is perhaps outlined well by the definition offered by Ruddell [5]: “a process in which the reader constructs meaning while, or after, interacting with text through the combination of prior knowledge and previous experience, information in text, the stance s/he takes in relationship to the text, and immediate, remembered, or anticipated social interactions and communication” (p. 415). Thus, reading comprehension should be approached from the cognitive view, according to which the reader actively constructs meaning—instead of simply extracting it—by activating schemata or knowledge structures in his/her mind to relate the knowledge that is already possessed to the new ideas stated in a passage. This cognitive process results in unique personal meaning as different readers have different types and levels of knowledge about a certain topic discussed in the passage. The meaning is also socially constructed by taking into account the reader’s knowledge, beliefs and attitudes which are shaped by his/her social and cultural background [6]. It is vital, therefore, that text interpretation involve the activation of information shared by the members of the social group purported by the text.

The cognitive and social processes in reading could be elaborated in further detail by identifying a set of processes that define fluent reading [1]. Basically, reading comprehension is a process with the following characteristics: rapid, efficient, interactive, strategic, flexible, evaluating, purposeful, comprehending, learning and linguistic (see [7] for comprehensive discussion about these characteristics). To refine the aforementioned definitions, it is essential to review the basic concepts of reading comprehension proposed by influential scholars who have intensively examined it from the psycholinguistic point of view, Frank Smith and Kenneth Goodman.

2.1 Smith’s View of Reading

In his seminal work, Smith [8, 9] admits that formulating a definition of reading is a futile attempt as this word may mean different things in various contexts, making it almost impossible to rely on only a single definition. However, he proposes a model of reading that may explain how the written input is processed in a human’s mind and results in comprehension of ideas held in that piece of writing. According to Smith’s model, comprehension is viewed as the extraction of meaning from a text, and can be defined as “the reduction of uncertainty” (p. 185) at three levels: letter identification, word identification, and meaning identification. This model maintains that a reader needs to identify a letter and distinguish it from the other 25 letters. In other words, the reader should be certain that what s/he perceives as *h* is actually the letter *h* by recognizing its visual features. If s/he is able to reduce the possibilities out of the 26 letters of the alphabet and is convinced that the perceived letter is *h*, then comprehension is taking place. This also applies to word identification, in which the reader is supposed to identify a word by reducing a myriad of possible existing words in a language. For instance, s/he can confidently identify the word *horse* as *horse* instead of *house* or *hours*. Finally, the reduction of meaning also occurs at the semantic level, where s/he should pick up the most appropriate meaning of a word out of several plausible meanings. Smith adds that the comprehension process in reading is much more complicated than the above description. The letter identification in English, for example, does not always proceed from left to right although reading appears to be done in this direction. To illustrate, the reader can find out how to read the letters *h* and *o* at the beginning of a word and

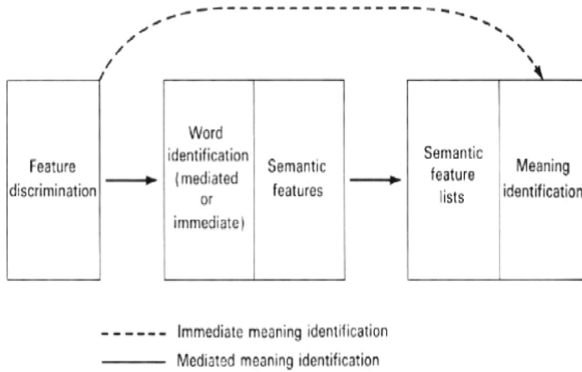


Fig. 1. Immediate and mediated meaning identification

transform them to the correct English sounds only by taking the letters that follow them into account. The letters *ho* that precede *use* would be pronounced differently from those that come before the letters *rse*. It can be concluded that letter identification actually goes bidirectionally, from left to right and also the other way around.

In spite of the aforementioned three levels that have been identified in the model, it proposes that reading comprehension is more complex than the execution of the serial process of identifying letters, words and meanings. Smith distinguishes two ways in which the identification takes place, namely immediate and mediated. In the immediate meaning identification, the reader recognizes the features of the letters in print, and can instantly understand the meaning of what s/he is perceiving. On the other hand, the mediated meaning identification needs a longer process. After the reader successfully identifies the features of the letters, s/he attempts to identify the individual words in order to know the semantic features of each word. From a list of these semantic features s/he narrows down the meaning by eliminating the alternatives so that s/he could eventually decide which meaning is the most appropriate (Fig. 1).

Smith posits that every reader relies on both types of meaning identification, but one is used in a different condition from another. If s/he already has non-visual information in the form of prior knowledge, it is easier for him/her to understand the meaning stated in the printed text and in this case immediate meaning identification occurs. The typical reading activity normally involves this sort of meaning identification. However, when the previous experience related to the issues discussed in the text is absent on the part of the reader, comprehension is impeded and this condition prompts the reader to switch to the mediated meaning identification, in which every individual word is retrieved and figured out to enable easier identification of meaning. Thus, reading comprehension in Smith's model requires both visual information from the text and non-visual information in the form of reader's personal experience and has meaning identification as its end.

2.2 Goodman's View of Reading

Another cognitive view of reading comprehension is that of Goodman [10], who defines reading as follows:

Reading is a perceptive language process. It is a psycholinguistic process in that it starts with a linguistic surface representation encoded by a writer and ends with meaning which the reader constructs. There is thus an essential interaction between language and thought in reading. The writer encodes thought as language and the reader decodes language to thought (p. 12).

The key concept in his model is the construction of meaning. Instead of merely getting the meaning written in the text, the reader ‘interacts’ with the writer by reconstructing the meaning which is communicated and intended by the writer.

Goodman [11] coined the term ‘psycholinguistic guessing game,’ which refers to a mental process where, as the name suggests, the reader deciphers information in the text and attempts to make guesses based on the available cues by making effective use of the existing knowledge of the world and the linguistic knowledge. The aforementioned information is not confined to the printed letters only, but also includes the syntactic and semantic cues implicated in the text. To comprehend it, the reader selects the most appropriate types of cues in order to predict and anticipate ideas, then either confirms or disconfirms the accuracy of the prediction. If the prediction turns out to make sense, s/he will proceed to the other ideas in the same manner, but disconfirmation of the prediction will produce miscues, or “errors” of comprehension. The reader has the ability to monitor the miscues s/he produces, and the awareness of such miscues leads to the re-examination of the ideas by means of the possible cues and prior knowledge to generation other predictions. At the end of the cyclical process, comprehension of the whole text can be attained. Apparently, Goodman’s view of reading acknowledges the important role of both the visual input from the text and the cognitive abilities of the reader. His model, therefore, defines reading as the process of constructing meaning by integrating the textual information and the reader’s knowledge.

The complicated process as explained above makes the label of passive language skill for reading seem to be a misnomer as the reader actually does not passively decode written information in the text. Reading is more appropriately called a receptive skill than a passive one as the reader actively constructs meaning while deciphering the printed input [12, 13]. This mental process, as educators and researchers agree, operates in a complex manner, involving a number of different variables that interact with each other. The rest of this paper discusses some issues relevant to this concept.

3 Cognitive Processes in Reading

It is generally agreed that comprehension processes may be approached cognitively in three ways, namely bottom-up, top-down and interactive [1, 14]. The *bottom-up* or *data-driven* model views decoding and linguistic comprehension as central processes in reading [15, 16]. Thus, the reader performs this process by decoding the printed letters first, followed by such larger syntactic chunks as words, phrases and sentences. When this perception is completed, the reader can construct meaning based on them. It operates serially in that the direction goes strictly in such an order, from the lowest level (letters) to the highest one (sentences), and the higher level cannot possibly affect the perception of the previous levels. While the bottom-up model holds some truth, it seems

an oversimplification to claim that reading is a linear activity of identifying the exact linguistic units. Goodman [17] argues that guessing and prediction occur during reading instead of the precise process of retrieving individual linguistic units, as demonstrated in his example of a reader who made a miscue by substituting the word *ride* with a more familiar word *run*. This provides evidence that the lexical knowledge the reader already had affected the perception of the actual printed word, and this indicates another type of cognitive process, i.e. the top-down mode.

The *top-down* or *expectation-based* model emphasizes the salient role of schemata in comprehension. This model relies heavily on schema theory which posits that knowledge is stored in units called schemata in the reader's mind [18]. Each schema contains objects and actions that relate to a particular type of knowledge, and a huge collection of schemata are organized efficiently in the mind for retrieval whenever necessary. Anderson [19] suggests that reading mainly involves an interaction between the old knowledge stored in memory (schemata) and the new information in the text. The reader comprehends successfully if s/he manages to 'hook up' the information learned from the text with the prior knowledge that s/he has already possessed. Studies involving verbal reports reveal that such an interaction between the text content and the reader's knowledge occurs extensively during text processing [20]. However, it can be misleading to argue that reading is strictly top-down and requires the reader to simply relate the schemata and the knowledge attained from the printed text. Studies about eye movement during reading indicate that skilled readers fixate at least once on the majority of words in a text. Rather than skipping a large number of words as proposed by the top-down proponents, the readers perceive the letters and words quite carefully [21–23]. Thus, the bottom-up processing is not completely refutable as letter-by-letter and word-by-word perceptions still occur while the reader is trying to comprehend a piece of writing.

It is apparent that neither the bottom-up nor top-down model alone can sufficiently explain how the reading process works to attain comprehension: both are necessary and operate interactively in order to ensure thorough comprehension on the part of the reader [1, 14]. Several types of *interactive* model have been proposed, such as the *interactive-activation* model [24] and the *interactive-compensatory* model [25], but in spite of the different emphasis each puts they all have a key feature: linguistic-based and the knowledge-based processing works simultaneously. The interactive model still recognizes the hierarchical processing from the lowest linguistic level to the highest, but the procedure goes in cyclical movement instead of a serial one [10], which enables the reader to go back and forth along these levels (Fig. 2).

Although this interactive reading process is applicable universally in any reading, some significant distinct features exist between reading in the native language (L1) and the second language (L2) or the foreign language (FL). It is essential that these differences be taken into account in the teaching of reading so the next section will elaborate this issue.

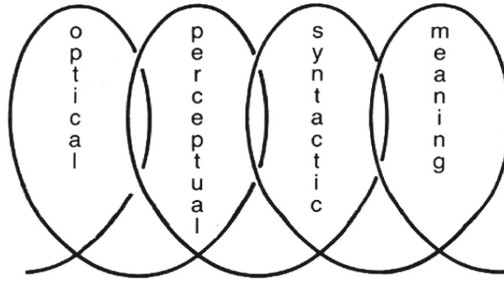


Fig. 2. Cyclical mode of linguistic processing

4 Reading in the First Language and Foreign Language

Bernhardt [26] emphasizes the distinct nature of L1 reading and L2 reading for two reasons. First, readers store different types of memory related to languages, and this affects the cognitive processing when they read a certain text. To illustrate, a Spanish reader possesses visual and syntactic memory that corresponds with the English text input due to the same alphabetic system and the similar grammatical rules between the two languages, but phonological memory that does not because these languages do not share the sounds. In the case of Indonesian readers, the extent to which their memory matches the English text input may even be lower as English and Bahasa Indonesia or Javanese are only remotely related: they share the alphabetical system but not the phonological, lexical and syntactic ones. Thus, the readers' stored memory of sounds, words and grammar might not match the input in the form of an English text, demanding an extra effort to expend in its processing.

The second difference relates to the aforementioned social aspect of reading. It has been argued that the meaning constructed while reading is influenced to a certain degree by the readers' social experience and culture. Bernhardt [26] provides an example of this phenomenon by comparing the meaning of 'breakfast' as read by an English and a Japanese person. The English reader is very likely to have the relevant information of a typical breakfast prepared in a Western culture, but the Japanese reader possibly does not possess the same semantic concepts and thinks, instead, of a typical breakfast in his/her own culture. Thus, although both readers can recognize the meaning of the word, they may have different memory representation associated to it.

As a matter of fact, the different cognitive processing involved in reading texts in L1 and FL has long invited controversy. To date the opinions related to the influence of L1 on FL as far as reading is concerned have been polarized in two different hypotheses [1, 27]. The first hypothesis, known as the *reading-universal hypothesis* or the *linguistic interdependence hypothesis*, states that L1 reading ability automatically transfers to FL reading, hence good readers in L1 are assumed to read similarly well in FL as both are considered to require the same processes. Common Underlying Proficiency [28, 29] shared by the L1 and other languages that the readers possess facilitates the transfer of reading skills from one language to another (Fig. 3).

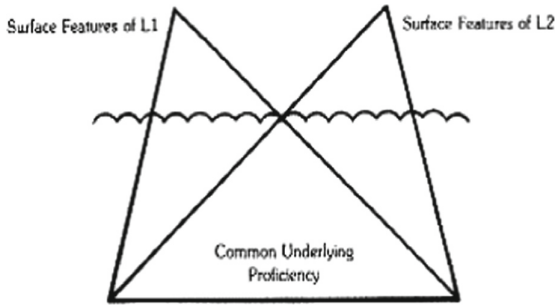


Fig. 3. Common Underlying Proficiency

On the other hand, the *short-circuit hypothesis* [30] or the linguistic threshold hypothesis asserts that attaining a certain threshold level of FL proficiency is an essential prerequisite of such a transfer to occur. Alderson [27] provides some empirical evidence that supports each hypothesis and concludes that both L1 reading ability and FL proficiency contribute to successful comprehension in FL, but he emphasizes—at least tentatively—that the latter seems to become a more dominant factor in the cases of lower levels of FL, and encourages further research.

Since then, studies have been conducted to respond to this call, resulting in mixed findings. Some studies support the linguistic interdependence hypothesis [31–40], whereas others confirm both hypotheses, highlighting the importance of L2 proficiency over L1 reading ability [41–49]. The latter stance seems to make more sense, as it takes into account all relevant factors in foreign language reading, namely the strategies applied in the native language reading and the linguistic competence in the foreign language, and explains the way they interact while the readers are attempting to apprehend the ideas in a passage. Successful comprehension requires more than merely the mastery of a reasonable amount of FL linguistic knowledge; it also involves the application of the appropriate L1 reading strategies to FL reading.

5 Conclusion

In this paper, it has been argued that reading comprehension is the socio-cognitive process of constructing meaning from a text. The process could be bottom-up (from the smallest linguistic unit to the largest), top-down (using background knowledge) or interactive (both bottom-up and top-down). According to the reading-universal hypothesis, good reading ability in L1 transfers automatically to reading in FL. However, the short-circuit hypothesis, which requires the readers to reach the threshold level of FL proficiency for such a transfer to occur, seems to be more sensible.

The implications of this stance for reading instructions are threefold. First, reading teachers should ensure the learners' FL proficiency passes the threshold level to facilitate the learners' reading comprehension. The teachers should give sufficient opportunity to the learners to enrich their vocabulary and knowledge about grammar while the learners are trying to make sense of the reading texts. Next, the teachers should encourage the learners to construct meaning, rather than getting meaning, from the text. In doing so, the

learners need to rely on their cognitive ability as well as the social context where reading comprehension is occurring. Finally, it is better for the teachers to provide guidance about the use of bottom-up and top-down processes in interactive reading. For instance, the top-down process is more suitable for texts which are relatively easy to comprehend, but once the comprehension is impeded by unknown words or complicated sentence structures, the learners should switch to the bottom-up process. By taking these three points into consideration and applying them in reading instructions, hopefully reading comprehension becomes more effective for the EFL learners.

Acknowledgments. The author would like to acknowledge Universitas Negeri Surabaya which has funded this present research.

Authors' Contributions. The author finished all process of the article finalization.

References

1. W. Grabe and F. L. Stoller, *Teaching and researching reading*. New York: Routledge, 2013.
2. J. Harmer, *How to teach English*. Harlow: Longman, 2007.
3. D. Bloome and J. Green, "Directions in the sociolinguistic study of reading," in *Handbook of Reading Research*, P. D. Pearson, R. Barr, M. L. Kamil, and P. Mosenthal, Eds. New York: Longman, 1984, pp. 395-421.
4. S. G. Paris, M. Y. Lipson, and K. Wixson, "Becoming a strategic reader," *Contemporary Educational Psychology*, vol. 8, pp. 293-316, 1983.
5. M.R. Ruddell, "Vocabulary knowledge and comprehension: A comprehension-process view of complex literacy relationships," in *Theoretical Models and Processes of Reading*, R. B. Ruddell, M. R. Ruddell & H. Singer Eds. Newark: International Reading Association, 1994.
6. P. Smagorinsky, "If meaning is constructed, what's it made from? Toward a cultural theory of reading," *Review of Educational Research*, vol. 71, pp. 133-169, 2001.
7. W. Grabe, *Reading in a second language: Moving from theory to practice*. Cambridge: Cambridge University Press, 2009.
8. F. Smith, *Understanding reading*. Mahwah: Lawrence Erlbaum Associates, 1971.
9. F. Smith, *Understanding reading: A psycholinguistic analysis of reading and learning to read*. Mahwah: Laurence Erlbaum Associates, 2004.
10. K. Goodman, "The reading process," in *Interactive Approaches to Second Language Reading*, P. L. Carrell, J. Devine, and D. E. Eskey, Eds. Cambridge: Cambridge University Press, 1988.
11. K. S. Goodman, "Behind the eye: What happens in reading," in *Theoretical Models and Processes in Reading*, H. Singer and M. R. Ruddell, Eds. Newark: International Reading Association, 1976, pp. 470-496.
12. M. Barnett, "Reading through context: How real and perceived strategy use affects L2 comprehension," *The Modern Language Journal*, vol. 72, pp. 150-162, 1988.
13. D. Köksal and Ö. G. Ulum, "Classroom implications of teaching strategies to improve reading," *The Reading Matrix: An International Online Journal*, vol. 19, pp. 243-248, 2019.
14. J. C. Alderson, *Assessing reading*. Cambridge: Cambridge University Press, 2000.
15. P. B. Gough, "One second of reading," in *Language by Ear and Eye*, J. F. Kavanagh and I. G. Mattingly, Eds. Cambridge: MIT Press, 1972.
16. W. A. Hoover and P. B. Gough, "The simple view of reading," *Reading and Writing*, vol. 2, 1990.
17. K. Goodman, *On reading*. Ontario: Scholastic, 1996.

18. D. Rumelhart, "Schemata: The building blocks of cognition," in *Theoretical Issues in Reading Comprehension: Perspectives from Cognitive Psychology, Linguistics, Artificial Intelligence, and Education*, R. J. Spiro, B. C. Bruce, and W. F. Brewer, Eds. Hillsdale: Erlbaum Associates, 1980.
19. R. C. Anderson, "Role of the reader's schema in comprehension, learning, and memory," in *Theoretical models and processes of reading*, D. E. Alvermann, N. J. Unrau, and R. B. Ruddell, Eds. Newark: International Reading Association, 2013, pp. 476-488.
20. M. Pressley and P. Afflerbach, *Verbal protocols of reading: the nature of constructively responsive reading*. Hillsdale: Lawrence Erlbaum Associates, 1995.
21. K. Bicknell, R. Levy, and K. Rayner, "Ongoing cognitive processing influences precise eye-movement targets in reading," *Psychological Science*, 2020.
22. E. J. Paulson and K. S. Goodman, "Re-reading eye-movement research support for transactional models of reading," in *Scientific realism in studies of reading*, A. D. Flurkey, E. J. Paulson, and K. S. Goodman, Eds. New York: Routledge, 2008, pp. 25-47.
23. D. Schmidtke, J. A. V. Dyke, and V. Kuperman, "CompLex: an eye-movement database of compound word reading in English," *Behavior Research Methods*, vol. 53, pp. 59-77, 2021.
24. J. L. McClelland and D. E. Rumelhart, "An Interactive Activation Model of Context Effects in Letter Perception," *Psychological Review*, vol. 88, pp. 375-407, 1981.
25. K. E. Stanovich, "Toward an Interactive-Compensatory Model of Individual Differences in the Development of Reading Fluency," *Reading Research Quarterly*, vol. 16, pp. 32-71, 1980.
26. E. B. Bernhardt, "Challenges to reading research from a multilingual world," *Reading Research Quarterly*, vol. 38, pp. 112-117, 2003.
27. J. C. Alderson, "Reading: A reading problem or a language problem?," in *Reading in a Foreign Language*, J. C. Alderson and A. H. Urquhart, Eds. London: Longman, 1984, pp. 1-24.
28. J. Cummins, "Bilingualism and special education: Program and pedagogical issues," *Learning Disability Quarterly*, vol. 6, pp. 373-386, 1984.
29. J. Cummins, "Language and literacy acquisition in bilingual contexts," *Journal of Multilingual and Multicultural Development*, vol. 10, pp. 17-31, 1989.
30. M. A. Clarke, "The Short-circuit hypothesis of ESL reading--or when language competence interferes with reading performance," in *Interactive Approaches to Second Language Reading*, P. L. Carrell, J. Devine, and D. E. Eskey, Eds. Cambridge: Cambridge University Press, 1988.
31. P. H. Chen, "The interplay between English proficiency and reading strategy use in English reading: Validating the linguistic threshold hypothesis and the interactive-compensatory model," *Taiwan Journal of TESOL*, vol. 17, pp. 1-37, 2020.
32. M. Dufva and M. J. M. Voeten, "Native language literacy and phonological memory as prerequisites for learning English as a foreign language," *Applied Psycholinguistics*, vol. 20, pp. 329-349, 1999.
33. E. P. Galloway, P. Uccelli, G. Aguilar, and C. D. Barr, "Exploring the cross-linguistic contribution of Spanish and English academic language skills to English text comprehension for middle-grade dual language learners," *AERA Open*, vol. 6, 2020.
34. M. Gholamain and E. Geva, "Orthographic and cognitive factors in the concurrent development of basic reading skills in English and Persian," *Language Learning*, vol. 49, pp. 183-217, 1999.
35. V. B. Hardin, "Transfer and variation in cognitive reading strategies of Latino fourth-grade students in a late-exit bilingual program," *Bilingual Research Journal*, vol. 25, pp. 539-561, 2001.
36. B. Jiang and P. Kuehn, "Transfer in the academic language development of post-secondary ESL students," *Bilingual Research Journal*, vol. 25, pp. 653-672, 2001.
37. M. Kim, S. A. Crossley, and B.-K. Kim, "Second language reading and writing in relation to first language, vocabulary knowledge, and learning backgrounds," *International Journal of Bilingual Education and Bilingualism* 2020.

38. D. Lasagabaster, "The threshold hypothesis applied to three languages in contact at school," *International Journal of Bilingual Education and Bilingualism*, vol. 1, pp. 119-133, 1998.
39. G. Meschyan and A. Hernandez, "Is native-language decoding skill related to second language learning?," *Journal of Educational Psychology*, vol. 94, pp. 14-22, 2002.
40. A. van Gelderen, R. Schoonen, K. de Glopper, J. Hulstijn, A. Simis, P. Snellings, and M. Stevenson, "Linguistic knowledge, processing speed, and metacognitive knowledge in first- and second-language reading comprehension: A componential analysis," *Journal of Educational Psychology*, vol. 96, pp. 19-30, 2004.
41. M. Daller and Z. Ongun, "The threshold hypothesis revisited: Bilingual lexical knowledge and non-verbal IQ development," *International Journal of Bilingualism*, vol. 22, pp. 675-694, 2018.
42. B. Laufer, "Reading in a foreign language: How does L2 lexical knowledge interact with the reader's general academic ability?," *Journal of Research in Reading*, vol. 15, pp. 95-103, 1992.
43. K. Koda, "Transferred L1 strategies and L2 syntactic structure in L2 sentence comprehension," *The Modern Language Journal*, vol. 77, pp. 490-500, 1993.
44. T. I. Pae, "A simultaneous analysis of relations between L1 and L2 skills in reading and writing," *Reading Research Quarterly*, vol. 54, pp. 109-124, 2019.
45. F. Pichette, N. Segalowitz, and K. Connors, "Impact of maintaining L1 reading skills on L2 reading skill development in adults: Evidence from speakers of Serb-Croatian learning French," *The Modern Language Journal*, vol. 87, pp. 391-403, 2003.
46. G. F. Taillefer, "L2 reading ability: Further insight into the short-circuit hypothesis," *The Modern Language Journal*, vol. 80, pp. 461-477, 1996.
47. H. Taillefer and T. Pugh, "Strategies for professionals reading in L1 and L2," *Journal of Research in Reading*, vol. 21, pp. 96-108, 1998.
48. R. Schoonen, J. Hulstijn, and B. Bossers, "Metacognitive and language-specific knowledge in native and foreign language reading comprehension: An empirical study among Dutch students in grades 6, 8, and 10," *Language Learning*, vol. 48, pp. 71-106, 1998.
49. Z. Wang, J. Sabatini, T. O'Reilly, and J. Weeks, "Decoding and reading comprehension: A test of the decoding threshold hypothesis," *Journal of Educational Psychology*, vol. 111, pp. 387-401, 2019.

Open Access This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

