UNIVERSITY OF SZEGED
DOCTORAL SCHOOL OF EDUCATION
TEACHING AND LEARNING PROGRAMME

ONLINE ASSESSMENT AND DEVELOPMENT OF MORPHOLOGICAL AWARENESS AND READING COMPREHENSION IN GRADES 2-4

PhD Dissertation

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Szeged, 2021

Contents

INTRODUCTION

This dissertation presents the results of developing an online instrument for assessing morphological awareness and the relationship between morphological awareness and reading comprehension in grades 2-4. Morphological awareness is defined as "children's conscious awareness of the morphemic structure of words and their ability to reflect on and manipulate that structure" (Carlisle, 1995, p. 194). Reading comprehension has been in the centre of attention for a long time since it is a key information processing skill. Good reading skills facilitate an access to knowledge, success at school, better career prospects and engagement in social and cultural activities (Csapó & Csépe, 2012; Grabe & Stoller, 2011). Reading research attempts to find the answer to the question what processes underpin reading skills. Components and prerequisites of reading have been widely researched.

According to the current theories, reading comprehension has two main pillars: decoding and language comprehension (Gough & Tunmer, 1986; Bloomert & Csépe, 2012; Steklács, 2018b). Decoding involves processing orthographic, linguistic and semantic information; acquisition of different skills like phonological awareness, morphological awareness and vocabulary (Apel et al., 2013; Carlisle, 1995; Carlisle, 2000; Steklács et al., 2015; Verhoeven & Perfetti, 2017). Phonological awareness plays a very important part in decoding. Nevertheless, decoding is not equal to comprehension; it is more than converting orthographic forms into phonological forms. Comprehension can only be realized when the converted phonological information is connected to semantic information (Kuo & Anderson, 2006). We need the morphological awareness and grammatical rules to get access to the meaning of the word.

The smallest units of the words that convey semantic information are morphemes. The metalinguistic skill to identify, reflect on, manipulate the morphemes and apply the word formation rules is referred to as morphological awareness (Apel et al., 2013; Kuo & Anderson, 2006; Levesque et al., 2017). Morphological knowledge is the basis of morphological awareness. Morphological knowledge can support the identification of morphologically complex words through non-lexical word processing (Rastle, 2019). For example, in Hungarian, the word *gyorsan (quickly)* consists of two morphemes. In order to identify the meaning of the word *gyorsan (quickly),* you need to understand the meaning of the morphemes: the stem *gyors (quick),* which denotes a quality of moving at a high speed and the suffix *-an (ly),* which means in a stated way (Varga, Pásztor & Steklács, 2020).

Morphological awareness underpins word recognitions, and this way it has an impact on reading skills. Recognising words in a text lays the foundations for understanding sentences and texts. Our brain makes a very quick decision about the words we read. They can be either identified as a whole (lexical way) or if the word seem to be unfamiliar, it can be can be segmented into the constituent morphemes (non-lexical word recognition). In this way morphological awareness plays a very important part in the acquisition of reading skills as well. This skill grows during school years, and its importance increases in predicting reading comprehension performances (Carlisle, 2000).

The significant contribution of morphological awareness to reading comprehension has been shown in studies conducted in languages with deep orthographies. However, there are only a few studies about this relationship and the development of morphological awareness in an agglutinative language with a transparent orthography and a rich morphology. There are no empirical studies which analyse the contribution of morphological knowledge and morphological awareness to reading comprehension in grades 2-4 among Hungarian children.

This research is novel in many ways. First, I made an attempt to create an online instrument for assessing the relationship between morphological awareness and reading comprehension. By having created an instrument, I intended to fill a research gap and report

the results of a three-stage online test development process on eDia system (Molnár et al., 2018). Second, this investigation aimed to follow the development of the two constructs in grades 2-4. Third, the relationship between morphological awareness and reading comprehension was examined. The dissertation also endeavoured to find out how the two constructs related to each other in grades 2-4 in the Hungarian language, an agglutinative language with a rich morphological system. In addition, the relationship among morphological awareness, reading comprehension and reading motivation were investigated.

This dissertation enriches pedagogical research in many ways. First, tapping into the processes of comprehension might support better understanding of reading acquisition. Learning highly depends on the comprehension of information from text sources (Csapó, 2015). International surveys show that Hungarian children's performance in reading comprehension must be improved which justifies the research efforts put into the assessment and development of reading comprehension skills, especially in lower elementary grades (Csapó et al., 2014; Hódi, 2018). The development of reading skills in these grades lays the foundation for further development of reading comprehension skills. It is essential that children understand the printed texts accurately in order to make a progress in all school subjects. Second, this research is connected to the pedagogical aspects of linguistics, and aims to help reading instruction by finding efficient methods to measure morphological awareness was found to be linked to reading comprehension. Third, this research shed the light on the role of morphological knowledge. Morphological instruction might promote the development of metalinguistic awareness, which can facilitate developing literacy skills.

Extended research has resulted in finding a lot of prerequisites; components of reading acquisition are known (Adamikné Jászó, 2006; Csapó & Csépe, 2012; Cs. Czachesz, 1998; Gósy, 2005; Lőrik, 2006; Steklács, 2013; Steklács et al., 2015). However, morphology has received little attention. Most reading acquisition theories have not focused much on morphology (Rastle, 2019). This study attempts to formulate the view that the knowledge about morphemes and the ability to reflect on and manipulate them play an essential part in acquiring a direct relationship between printed words and their meanings. Morphology was usually neglected in the research due to the fact that theories on reading comprehension only concentrated on monomorphemic words (Rastle, 2019). Monomorphemic words consist of only one morpheme. However, the ability to perform a morphological analysis is indispensable for skilled readers, especially in the understanding morphologically complex words (Apel et al., 2013; Carlisle, 2000). Raste (2019) suggests that the skilled readers must acquire morphological knowledge at a certain phase of their reading acquisition. Children show a certain amount of morphological knowledge even before they start school, and they know how language works because they are proficient speakers (Gábor & Lukács, 2012). Reading skills have a strong link to language acquisition and thinking skills (Blomert & Csépe, 2012; Vygotsky, 1962; Ziegler & Goswami, 2005). However, it is not clear what role morphological knowledge plays in reading acquisition. Recent reading research has increased attention to morphology and how it contributes to literacy skills (Carlisle, 2000; Deacon et al., 2014; Kuo & Anderson, 2006; Rastle, 2019; Verhoeven & Perfetti, 2017). Kuo and Anderson (2006) list some reasons why there must be a strong relationship between morphological awareness and reading comprehension. First, morphemes have phonological, semantic, and syntactic properties. Therefore, morphology is closely connected to other aspects of the language. Second, research shows that morphological information is employed when morphologically complex words are processed. Thus, children with more advanced morphological knowledge can possibly acquire morphologically more complex vocabulary. It is evident that vocabulary is important in reading, therefore; morphology should be very important too. Besides, morphological knowledge may provide additional information about the writing system (Kuo & Anderson, 2006).

This dissertation includes a theoretical part and an empirical part and a summary. The theoretical part (chapter 1-5) attempts to review models which explain how linguistic information is processed during reading; and discuss the role morphological awareness plays in reading acquisition, and in reading comprehension. Models of word recognition are discussed. Several definitions of morphological awareness and some possible measurements, instruments for assessing morphological awareness are described. Hypotheses on the development of morphological awareness throughout primary school years are delineated. The contribution of reading motivation to reading comprehension is also analysed.

The empirical part reports the results of the empirical research. The different phases of the development of the online instrument for assessing morphological awareness and reading comprehension are discussed. In chapter 6, the research questions, and hypotheses are defined. Chapter 7 introduces the results of the pilot study (N=359) in grades 2-4. Chapter 8, analyses the findings concerning the large sample survey (N=4,134) which included a reading motivation questionnaire as well. Chapter 9 summarises the main findings of this dissertation and describes future research plans.

1. THE DEFINITION OF MORPHOLOGICAL AWARENESS

The purpose of this chapter is to provide background information on morphological awareness and attempts to tap into the role of morphology in literacy. Morphology is a major organising principle of alphabetical languages. Research findings support the view that learning to recognise morphological relationships is a vital part of mapping between the printed words and their meanings. The general model of word recognition (Verhoeven & Perfetti, 2011) highlights the significance of morphological processing in understanding morphologically complex words. This model gives a theoretical foundation for empirical studies on morphological awareness. The description of the model is followed by several definitions of morphological awareness which delineate the construct aimed to be examined in this dissertation. Then, the differences among morphological knowledge, awareness and linguistic competence are clarified. The second part of this chapter places morphological awareness into broader framework of metalinguistic skills which underpin reading acquisition. Metalinguistic skills are strongly associated with children's cognitive development; therefore, children may benefit from fostering morphological awareness.

1.1. What is Morphological Awareness?

Recently there has been an increasing research interest in morphological awareness because a number of research findings show its correlation to reading comprehension. Morphology refers to different processes of word-formation, for example, inflections, derivations and compounds. Morphemes are defined as the smallest units of a language that convey meaning. All the words are comprised of at least one morpheme (Aronoff & Fudeman, 2011). For example, the Hungarian word *erdők (forests)* can be broken down into two morphemes: *erdő+k, (forest+s)* each morpheme has a distinct meaning or indicates a grammatical function but the word *felhő (cloud)* cannot be broken down further because it contains only one morpheme. Morphemes can be free and bound. Free morphemes are also called base words or simple words (i.e., *"méz" (honey). Bound* morphemes or affixes (prefixes & suffixes) modify the meaning of the word (i.e., "*ság" (hood)* in "*anyaság"* (*motherhood).* Inflectional and derivational morphemes are two types of bound morphemes. Inflectional morphemes change the number or the tense of the word e.g., "*ment" (went),* "*megy" (goes)*. Derivational morphemes might change the part of speech of the word e.g*., "esős "(rainy),* but not in every case *"kisebb" (smaller).*

In orthographically transparent derivation the base word can be seen or heard in the derived word e.g., "*tanít-tanítás"(teach-teaching).* There are morphologically less transparent derived words where base words cannot be seen or heard e.g., "*hó/havas"* (*snow/snowy*) in Hungarian. However, the word *snow/snowy* in English is morphologically transparent, however, in Hungarian "*havas" (snowy)* is opaque.

The theory of morphological awareness originates from the model of the recognition of morphologically complex words created by Verhoeven and Perfetti (2011). This model propagates the dual-route of word recognition which means that the brain recognises words in the lexical and non-lexical way. In the case of morphologically complex words they emphasize the importance of non-lexical route. According to Verhoeven and Perfetti (2011), splitting the words into morphemes can happen at the initial phase of word identification directly from the orthographic form or indirectly when the orthographic units are processed. For familiar words a skilled reader can automatically identify the meaning of words using the patterns of phoneme-grapheme correspondence rules, if there is a pattern for them (lexical-route). If the word form is morphologically complex, the brain tries to decompose it

separating it into the component morphemes (Figure F 1.1. Verhoeven & Perfetti, 2011, p. 458). Verhoeven and Perfetti (2011) use the term morphological decomposition rather than the term morphological awareness.

Morphological awareness is defined in various ways. Carlisle defines it as "children's conscious awareness of the morphemic structure of words and their ability to reflect on and manipulate that structure" (Carlisle, 2000, p. 170). Kuo and Anderson (2006) claims that it is "the ability to reflect upon and manipulate morphemes and employ word formation rules in one's language..." (p. 161). According to Deacon et al. (2014), morphological awareness is „the awareness of and ability to manipulate the smallest meaningful units or morphemes" (p. 432). In accordance with Nagy et al. (2014), it is the ability to analyse words into smaller meaningful parts such as prefixes, roots, and suffixes. There is no consensus about the definition of morphological awareness (Apel, 2014). Most definitions use the term ability when they refer to morphological awareness (Carlisle, 2000; Deacon et al, 2014; Nagy et al., 2014) However, the word "skill" is often used as well when related to morphological awareness (Apel, 2014). The abilities and skills mean qualities that we are able to do something. The words "skill" and "ability" are used interchangeably to describe morphological awareness in studies because there is a fine line between skills and abilities. Skills are learnt behaviours. It means that morphological awareness is ability and a skill at the same time because it has innate features which develop naturally, however it can be also be called a skill which is a combination of knowledge and ability which develops as a result of practising.

The concept of awareness leads to debates about consciousness (Nagy et al., 2014). Pléh (2000) defines the term awareness as implicit rather than explicit knowledge. It means that when children acquire different morphological elements, they usually cannot give clear concepts about why they use one or another inflectional affixes and different inflected forms (Pléh, 2000). However, other researchers make a distinction between awareness, conscious knowledge, and tacit knowledge. Tacit knowledge is related to the unconscious linguistic knowledge that means the speaker of a language is familiar with the rules determining the grammatical correctness of the sentences of the given language.

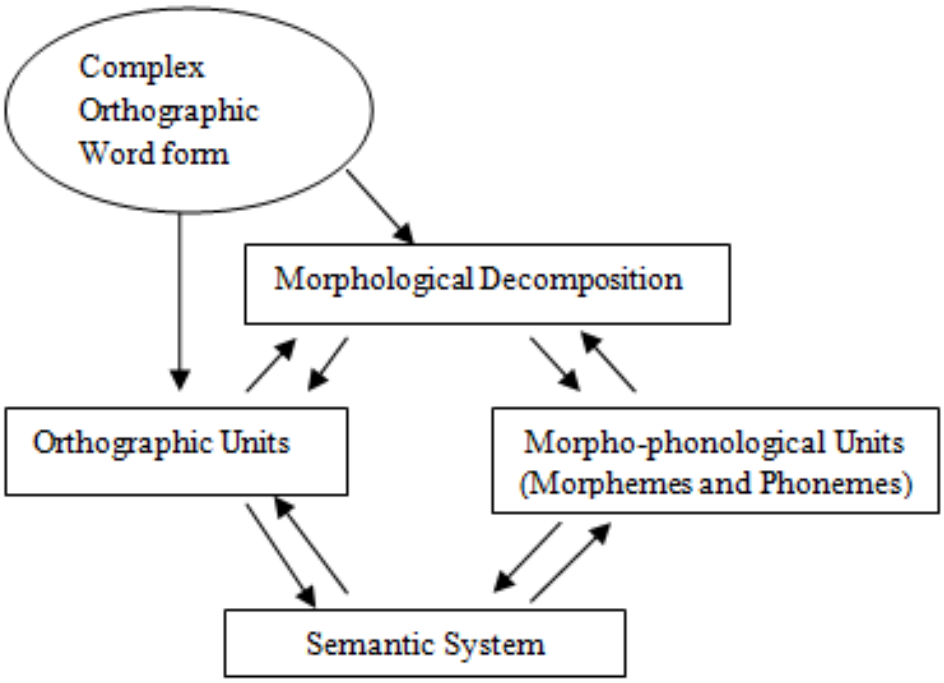

Figure 1.1. Recognition of morphologically complex words (Verhoeven & Perfetti, 2011)

Linguistic competence is a system of rules, or grammar that represents the speaker's knowledge of his language (Nagy et al., 2014). This knowledge is considered to be unconscious since speakers are unaware of the rules when they use the language. The speakers are unable to recall the rules which they utilised during speech production and comprehension when reflecting back on what they said or heard. When a native speaker can judge whether a particular phrase or sentence is the right or wrong it can be called linguistic intuitions (Nagy et al, 2014).

Kuo and Anderson (2006) provide an overview of empirical studies on the relationship between morphological awareness and reading from a cross-linguistic perspective. This study examines different factors influencing reading acquisition. Children speaking several languages were tested and it was found that they acquire the knowledge of inflectional morphology before understanding derivational morphology and the morphology of compounds. There is a gradual development in morphological knowledge during elementary school years. According to Kuo and Anderson (2006), morphological awareness influences the decoding of morphologically complex words, and it has an impact on the development of reading comprehension; however, the relationship is probably bidirectional. As children grow older, morphological awareness has an increasingly stronger effect on reading comprehension. Morphological awareness is closely associated with other components of metalinguistic awareness and linguistic competence — namely, phonological awareness, syntactic awareness, and vocabulary knowledge. (Nagy et al., 2014).

In sum, morphological awareness can be more widely interpreted as children's skill for understanding how the language works, the application of linguistic rules, the ability to comprehend words and sentences. Morphological awareness also applies to the ability to recognise, understand and use common morphological forms, and segment words into smaller units. Finally, it also includes the ability to understand the meaning of different affixes, and how they change the meaning of the word (Carlisle, 2000; Nagy et al., 2014). The definition of morphological awareness I accept is that it is the ability to reflect upon and manipulate morphemes and employ word formation rules in one's language (Kuo & Anderson, 2006).

1.2 Morphological Knowledge as Part of Metalinguistic Awareness

Morphological awareness is considered to be a metalinguistic skill. From a linguistic perspective, comprehension consists of sublexical and lexical elements which include phonological awareness, morphological awareness, syntactic, and semantic awareness (Kuo & Anderson, 2006). Recent research in psycholinguistics shows that in order to comprehend the text, the reader must have metalinguistic knowledge. Metalinguistic knowledge means that the reader knows the structure of the language, how the texts are developed. Metalinguistic awareness is the ability to analyse, to talk and think about language as an object, independent of the concrete meaning of each word. It is a cognitive process allowing people to observe and control their use of language. It includes the skill to see words as decontextualised objects; manipulate and analyse them apart from the context (Gombert, 1992). According to Roehr (2007), it is a type of metacognition, which is an awareness and control of one's own knowledge and cognitive processes that is being able to think about thinking (Flavell, 1976). Metalinguistic awareness is the skill to regard language as a code and distinguish it from its symbolic meaning. This cognitive skill also helps to understand language and its structure. Metalinguistic awareness skills can be a strong predictor of language development and ability to learn new languages. Metalinguistic awareness has its foundation in semantic, syntactic, and pragmatic (linguistic) knowledge (Kuo & Anderson, 2006).

There are different theories about the levels of cognitive development. Tunmer and Herriman (1984) attempt to build a conceptual framework for examining the emergence of metalinguistic awareness in children, they think that it is important to distinguish it from other concepts that emerged from research in generative linguistics; the terms tacit knowledge, linguistic competence, linguistic intuitions are conceptualised (Tunmer & Herriman, 1984).

There are three views on the nature of metalinguistic awareness (Pléh, 2000). According to the first view metalinguistic awareness appears at the beginning of the language acquisition process, the second one argues that it emerges when formal schooling begins, and the third one supposes that it develops after the child is introduced to formal schooling. In psychology, awareness is always connected with perception or knowledge of something. Accurate reportability of something perceived or known is widely used as a behavioural index of conscious awareness. However, it is possible to be aware of something without being explicitly conscious of it (Altman et al., 2018; Tunmer & Herriman, 1984; Kuo & Anderson, 2006; Nagy et al., 2014; Pléh, 2000).

Metalinguistic awareness is an important ingredient in learning to read, spell and understand words (Donaldson, 1978). Moreover, it explains a portion of the otherwise unexplained variance in comprehension scores, when other important variables have been controlled. English language learners benefit from metalinguistic awareness, too, including morphological awareness (Kuo & Anderson, 2006). Metalinguistic awareness is a cognitive "generator". It includes increased awareness of phonemes and syllables and rhymes, morphemes, words, and phrases, of syntax, connotations, homonyms, synonyms, and antonyms. Metalinguistic awareness encompasses every aspect of language.

In recent decades, two more types of metalinguistic insight have appeared in reading research journals: morphological awareness and orthographic awareness. If students increase their knowledge of morphological awareness, they become aware that words which share the same root are similar in form and meaning. Morphological awareness also includes knowledge of common suffixes and prefixes. Recently, Berninger, Abbott, Nagy, and Carlisle (2010) conducted a longitudinal study of two cohorts (N=241 students) from the first grade through the sixth grade. The study investigated growth curves for three types of metalinguistic awareness: Morphological awareness, orthographic awareness, and phonological awareness. The results showed that phonological awareness and receptive orthographic awareness increased from the first to the third grade and then peaked. Orthographic awareness continued to increase a bit after the third grade. However, morphological awareness grew quickly from the first to the third grade and then continued to develop, but less rapidly, through the sixth grade. In addition, morphological awareness influenced word knowledge as a significant correlation was found between the vocabulary knowledge and understanding derivational suffixes which influence the grammatical category of the word. (Berninger, Abbott, Nagy, & Carlisle, 2010).

Morphological awareness as part of metalinguistic awareness supports the argument that morphological awareness belongs to the cognitive processes; and as a child grows in morphological awareness, this can contribute to the child's cognitive development in general. From this point of view, it is obvious that morphological awareness supports both the development of literacy and cognitive skills, and it could also have an impact on reading comprehension skills.

2. THE CONTRIBUTION OF MORPOLOGICAL AWARENESS TO READING SKILLS

This chapter reviews some models of reading acquisition. There have been debates about the best way to teach children to read. Education theorists have been trying to demonstrate different methods of reading acquisition. Four theories of reading acquisition are discussed (Adams, 1990; Ehri, 1991; Garbe, Holle & Von Salisch, 2006; Verhoeven & Perfetti). Reading acquisition is hypothesised to be similar in all alphabetic systems; however, there are some differences depending on the writing system and the structure of the language (Verhoeven & Perfetti, 2017). Recent reading research findings proved that reading acquisition is initially data driven, which means that it develops serially. Children start recognising letters, syllables, words, clauses and sentences. All these skills have to become automatic before higher level reading processes start working. This chapter also discusses the contribution of morphological awareness to reading comprehension. Several studies prove that morphological skills support comprehension both in the early and advanced level of reading acquisition. Children benefit from acquiring morphological skills especially when processing multimophemic words.

2.1. Models for Reading Acquisition

This chapter investigates how different models of reading acquisition relate to morphological knowledge and morphological awareness. Learning to read is a complex process with many potential influences on it. Studies found that before learning to read children have to learn how to speak, they have to acquire their own mother tongue. There is a strong link between language acquisition and reading skills (Blomert & Csépe, 2012; Gósy, 2008). Csépe and Blomert (2012) focus on cognitive contributions to reading. They point out that children have to be trained over a long period of time before they start reading fluently. They emphasize the importance of phonological processing, phonological awareness and the Rapid Automatized Naming (RAN) in the process of reading. Theories of reading development propose that children increasingly rely on automatic visual word recognition thereby reducing the importance of phonological decoding skills for skilled reading (Blomert & Csépe, 2012).

Reading comprehension is primarily divided into two parts: decoding and comprehension. Morphological knowledge can be utilised both in decoding and in comprehension as well. In decoding it contributes to word recognition and it supports figuring out the meaning of new words (Levesque, 2017). Skilled reading encompasses a lot of different skills and subskills. In the initial phase of reading acquisition, decoding and word recognition play an important role. Phonological awareness facilitates successful decoding; it includes identifying various units of sounds, recognizing the rhyme of the words and also being able to split the words into syllables (Blomert & Csépe, 2012; Török & Hódi, 2015; Török et al., 2016). Phonemic awareness consists of the subskills, like finding rhyming words, finding alliterations in different words, isolating the different phonemes, and blending individual sounds into words. Another important criterion for word recognition is the ability to decode the words. In order to be able to decode words, children must understand the alphabetic principle and know the letter-sound correspondences. Practising decoding is important because it can cause dramatic improvement in word reading since many children do not have literacy experiences therefore they need instruction (Blomert & Csépe, 2012; Kiss, Hódi, Tóth & Németh, 2016). Recognising words by sight is a general requirement for skilful reading. Students who struggle with word reading find reading boring and useless and will avoid reading whenever possible. As a result, good readers read more and they become better

readers; poor readers read less; therefore, they do not develop into better readers. This disparity is called the "Matthew Effect" of reading (Stanovich, 1986).

Adams (1990) created a model of reading acquisition consisting of four processors: content processor, meaning processor, orthographic processor, and phonological processor. The orthographic processor receives information directly from the printed document. The letters and words of the text make up the basic perceptual data of reading. The context processor is responsible for constructing a coherent interpretation of the text. It is in charge of priming and selecting word meanings that are appropriate to the text (Adams, 1990).

The operation of the meaning processor seems to be similar to those of the orthographic processor. The spellings of familiar words are represented in the orthographic processor as interassociated sets of letters; their meanings are represented in the meaning processor. In addition, it enables us to obtain the meaning of new words gradually by seeing them in context. The phonological processor provides an important support to the reader. First, it offers a redundant processing route for the orthographic processor. Second, it provides critical support for the comprehension process as it effectively increases the reader's running memory for text. Adam's model pays no attention to morphological processing (Adams, 1990).

According to Ehri's model of learning to read, four developmental phases of the process: pre-alphabetic, partial alphabetic, full alphabetic, and consolidated alphabetic were proposed (Figure 2.1). They represented flexible overlapping phases, rather than clearly defined stages. In the pre-alphabetic/logographic phase the words were not objects of linguistic analysis, children could not identify the letters, and there was no evidence of phonetic processing. Children identified the word using context and not the alphabet. This phase was called the 'logographic' phase, and Ehri (1991) changed the label to 'pre-alphabetic'. Morton (1979) proposed that at this stage, visual treatment of words relied on pictorial rather than verbal meaning (Ehri, 1991).

In the partial alphabetic phase, the reader applied a combination of reading some letters in the words, and using these to attempt to pronounce the word; the first and final letters were generally the most important within this phase. In the full alphabetic phase, the reader could form alphabetic connections; he/she could also match graphemes to phonemes of 'sight words'. Sight words were defined here in terms of words that had been read several times. Ehri pointed out the advantages of this process for reducing memory load because the brain could utilise the learned knowledge (Ehri, 1991).

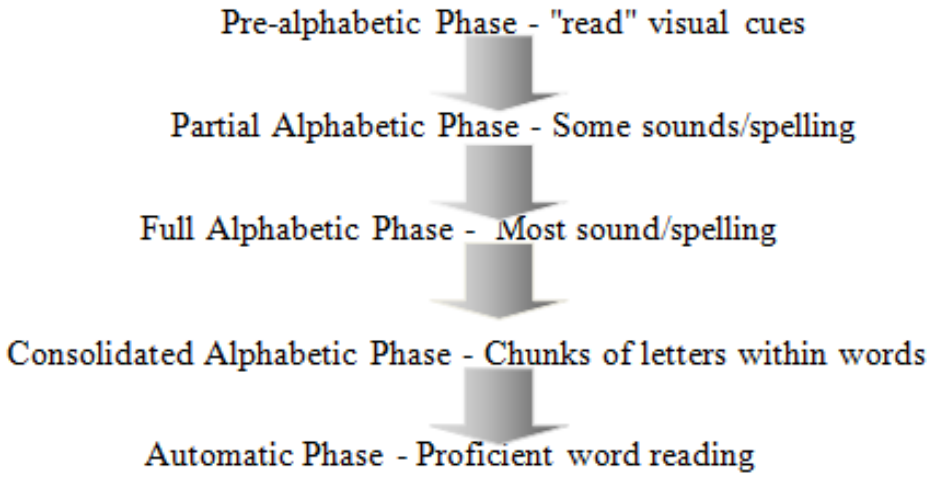

Figure 2.1. Ehri's model of reading acquisition (2005)

In the consolidated alphabetic phase of decoding, the sequence of letters in a word becomes salient. A student in this phase groups common patterns of letters and sounds as units. This skill allows decoding multi-syllable, novel, and nonsense words by analogy. Children in this phase decode many words by sight (Ehri, 1991).

The description of acquisition implies that the order of the stage is fixed and identical for every subject. No stage can be skipped, and proceeding to the next stage results from mastery reached on the previous stage. The performance in the middle of each stage is homogenous, and that qualitative change characterises the progression because the method of processing is radically different from one stage to the next (Ehri, 1991).

Garble's model of reading acquisition (Garbe et al., 2006) mentioned four phases of learning to read: supported reading (kindergarten - grade 3), independent reading (grades 1-4), fluent/strategic reading (grades 3 – 7), and adaptive/reflective reading (grades 6 -13). The different phases overlap; therefore, she also created different plateaus to describe the phases. Figure 2.2. shows an acquisition model of reading competence (Garbe et al., 2010, p.44).

On plateau 1, students are supported in their reading. This is the phase of emergent literacy: oral story-telling detached from the situational context. In this stage, children start exploring the alphabetic principle. Children are not able to read yet as they only learn to read in school contexts. However, many come in contact with written texts when they are being read to by adults. On this plateau, children can only experience reading with the help of others (Garbe et al., 2006).

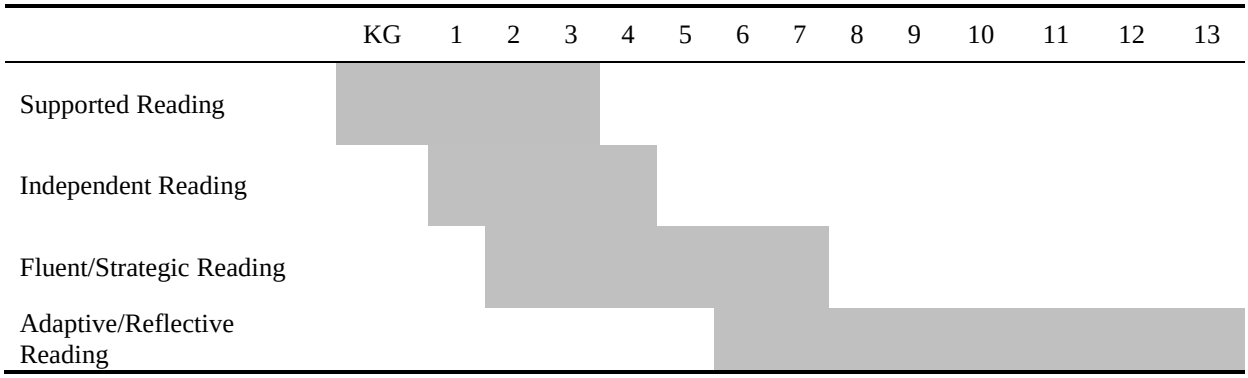

Figure 2.2. An acquisition model of reading competence (Garbe et al., 2010)

On plateau 2, children can read autonomously whatever they like. This period starts in grade 1 and goes through grade 6. This is the period of transition from decoding to reading fluency which provides the chance for children to enjoy extensive and autonomous reading for pleasure during childhood. It helps to develop personal reading preferences and genre preferences as well as the ability to generate mental images with texts through projection and empathy (Garbe et al, 2006).

Plateau 3 starts in grade 7 goes through the grade 12. The students make the transition from fluent decoding to adaptive and strategic reading. They can use reading to get to know the world and to build their own identity. Reading can stimulate reflection and communication about texts. They develop functional literacy by acquiring and consolidating cognitive and metacognitive reading strategies in private, school and professional contexts. Reading comprehension skills are important for all school subjects (Garbe, et al., 2006).

Most models of reading acquisition ignore the role of morphology in reading acquisition. However; Verhoeven and Perfetti (2017) emphasise the role of linguistic processing in learning to read across different writing systems. They established operating principles which foster children's reading development (Verhoeven & Perfetti, 2017). These principles help children perceive, analyse and utilize written texts. The authors call the

attention to the fact that language acquisition lays the foundation for acquisition of literacy. When children are exposed to speech, they start to segment the acoustic signals into parts that represent phonemes. Based on these experiences, children can develop speech-based lexical representations. The next stage is to build children's phonological awareness which includes the ability to manipulate the sounds of the language independently of their meaning. Recent research by Moll et al. (2014) investigated the contribution of RAN and phonological awareness to reading development. The sample included European elementary school children learning to read in orthographical systems which varied in the degree of grapheme-phoneme correspondence. It was found that that RAN was the best predictor of reading speed, but phonological processing contributed to unique variance in reading accuracy and spelling. Development of literacy skills are supported by the attendance to the written and spoken language and giving the opportunities to children to link the spoken and the written forms. The basic conditions for reading acquisition are establishing the link between spoken and written language, which pave the way for the beginning of the orthographic lexicon. Additional operating principles are necessary to develop word identification ability (Blomert & Csépe, 2012; Verhoeven & Perfetti, 2017).

Further development of word identification include learning graphic forms which might encourage children to learn additional graphic signs which they did not come across at the beginning phase of the acquiring literacy skills. According to Verhoeven and Perfetti (2017), children are encouraged to increase the inventory of familiar words through reading. In shallow orthographies like Hungarian, it is relatively easy because the reader can easily decode words and the word becomes familiar. In shallow orthography languages, there is a consistent relationship between the written language and the spoken language. However, in deep orthographies the novel reader cannot always infer the pronunciation of the word from the written form which results in profound delays in reading development (Katz & Frost, 1992). Operating principles for the development of reading comprehension also include attending morphological affixes. Morphological decomposition is essential to understand the systematic relationships among the surface forms of the words and their meaning. Morphological processing is an inter-level activation pattern that reflects the correlation among orthography, phonology and semantics" (Verhoeven & Perfetti, 2017). Based on parallel processing models, morphological decomposition takes part in orthographical and semantic processing. Morphological knowledge support identification of constituent morphemes in polymorphemic words. The word identification takes place when a unique item in the mental lexicon is activated based on the parsing of phonological, morphological and semantic information (Verhoeven & Perfetti, 2011).

The changes in theories and models of reading acquisition have demonstrated that reading research must address the processes of word identification in order to tap into the processes of reading acquisition. In general, learning to read has some general features which can be applied for all the alphabetic languages; however, some differences were found in the case of languages with different writing systems.

2.2. The Role of Morphology in Learning to Read

Verhoeven and Perfetti (2017) define a number of features which are similar in all the writing systems. Languages can be arranged into groups on the basis of how language constituents are represented, for example, morphemes, syllables, phonemes. Reading has its foundation both in the language and the writing system. Reading can be defined as decoding the language forms from graphical symbols and spelling is decoding the linguistic forms into graphical symbols. Learning to decode the print into spoken language also affects thinking, cognitive

processes as well. Although languages are very different on the surface we can expect certain similarities across different alphabetical languages which can be called universal grammar of reading (Verhoeven & Perfetti, 2017). Comprehension processes are universal to the degree that they belong to human cognitive capacity. The differences among languages are related to specific linguistic structures (number of inflections, derivation) and writing rules (e. g., punctuation); however, word identification and the retrieval of meaning are the most important processes for comprehension (Dąbrowska, 2015).

Verhoeven and Perfetti (2017) mention five universal aspects of manifested across different writing systems: (1) Reading Depends how on How a Writing System Decodes the Language, (2) Word Reading and Spelling Engage Phonology and Morphology, (3) Familiarity Shifts Word Reading from Computation to Retrieval, (4) Reading Comprehension is Driven by Word Knowledge (Lexical Quality), (5) Reading Comprehension=Word knowledge, Language comprehension" (Verhoeven and Perfetti, 2017).

The first universal is *reading depends on how a writing system decodes the language*. According to Verhoeven and Perfetti (2017) reading and spelling rely on a lexical representation containing both orthographic and phonological constituents (Perfetti, 1997). Orthography is the specific utilization of the writing system for that language. The writing system reflects the level of correspondence between the spoken language and the written texts. Therefore the writing system can reflect the prevalent conventions typical of the given alphabetic language on morphemic level, syllabic level or phonemic level. In languages like Finnish, Korean one graphic symbol corresponds to one phoneme, however, in English; French one graphical symbol can correspond to both morphemes and phonemes (Verhoeven & Perfetti, 2017).

Verhoeven and Perfetti (2017) point out that *word reading and spelling engage phonology and morphology*. It means that both letter reading and spelling activate the lowest level of phonology system which is encoded in the given writing system: phonemes, morphemes, words. This principle follows from the general language constraint that all writing systems encode spoken language. In alphabetical writing systems the phonological activation is guided by letter-to phoneme correspondence. By this way words are identified and the activation of word pronunciations are activated. The consistency of grapheme-phoneme correspondence can affect word identification and the acquisition of reading (Katz & Frost, 1992; Ziegler, et al., 2010). By word identification both the word meaning and the grammar are retrieved from the mental lexicon. In some writing systems spelling activates only phonology and in some systems spelling activates spelling activates both phonology and morphology. The main reading models were developed on the basis of one writing system; therefore, the generalizability of these models is questionable (Babayigit, 2009; Share, 2008).

The third and fourth universals address word identification. Verhoeven and Perfetti (2017) argue that *familiarity shifts word reading from computation to retrieval*, this principle suggests that the irregular spelling is more common among high frequency words. *Reading comprehension is driven by word knowledge (Lexical Quality*). Reading comprehension is primarily determined by word knowledge. As stated by Perfetti and Hart (2001) in the lexical quality hypothesis comprehension depends on orthographic, phonological and semantic forms, the number of words stored in the reader's mental lexicon. There is a lot of evidence for the contribution of vocabulary to the reading comprehension. It should be noted that the connection between vocabulary and reading comprehension is bidirectional. The more children read the more they can infer the word meanings from the context, and the more they understand, the more vocabulary they can develop (Verhoeven & Perfetti, 2017).

In Universal 5 it is suggested that, *reading comprehension is word knowledge and language comprehension in this point the authors support the "simple view of reading* (Gough & Tunmer, 1986; Hoover & Gough, 1990) which argues that word decoding and listening

comprehension determine reading comprehension. In general, it suggests that reading comprehension is primarily influenced by listening comprehension. Reading comprehension processes are closely connected to the spoken language skills. The main idea of this issue is that the reader can comprehend the written text in any writing systems if the reader can identify the meanings of all the words in the text both in a written and in an oral form to the same extent (Verhoeven & Perfetti, 2017). Table 2.1. shows the comparisons of phonology and morphology, writing system and orthography, predictors of learning to read and word reading development in Turkish and Finnish languages. It demonstrates that the five universals work in shallow orthography languages (Finnish, Turkish) as well. (Verhoeven & Perfetti, 2017).

Table 2.1. Comparisons of Finnish and Turkish languages (Verhoeven & Perfetti, 2017)

Language	Language Phonology and morphology	Writing system and orthography	Predictors of learning to read	Reading development
FINNISH	Uralic 13 consonants, 8 vowels, 16 diphthongs multisyllabic Rich inflectional morphology with cases but not genders Derivational compounding is common. Combination of inflectional affixes and compounding creates long words, monomorphemic words are rare	Swedish version of Latin alphabet with 29 letters Predict spelling from pronunciations. Strict grapheme-phoneme correspondence in both directions. Morphologically influenced phonological changes are not reflected in spellings	Phonological awareness, first at syllable level and by the age of 6 at phoneme level, is predictive of early reading. Morphological awareness of inflectional forms develops by age 3 and is predictive of reading. Letter knowledge, in kindergarten is also a strong predictor.	Literacy instructions starts at the age of 7; word identification is at asymptote after one year. Reading speed continues to develop and problems with reading are related more to the speed more than accuracy, reading comprehension correlates with listening comprehension; letter knowledge is a strong predictor in grade 4.
TURKISH	Turkic 8 vowels, 20 consonants, salient syllables, open CV most common; CVC, VCC also occur, rich inflectional, morphological system through suffixes; phonological forms vary for each suffix.	Latin alphabet of 26 letters (replaced by Arabic alphabet in 1928) Transparent orthography; one-to-one mappings.	Phonological awareness at syllable and final consonant level develops rapidly because the salience of syllables. Morphological awareness is correlated with phonological awareness.	Complex morphology, multisyllabic words, phonological variation in suffixes challenge learning to read word identification develops quickly; decoding skill is at asymptote after one year. Comprehension is predicted by listening comprehension and vocabulary.

Recent development in reading acquisition has revealed that there is a relationship between morphological knowledge and reading comprehension which works across writing

systems. This view is supported by the universal grammar theory, which claims the basic processes of comprehension are similar for all human languages (Chomsky et al., 2019; Dąbrowska, 2015). Although the basic processes of reading acquisition in languages with different writing systems are the same; the different phases of reading development can be different. In addition, more empirical research would be needed to explore how morphology takes part in this process (Verhoeven & Perfetti, 2017).

2.3. The Relationship between Morphological Awareness and Reading

Along with the shift in tendencies of reading research among the factors influencing reading comprehension morphological awareness has received an increasing interest. A number of research studies pointed out the significance of morphological awareness in reading comprehension (Casalis et al., 2011; Deacon et al., 2014; Kinanti et al., 2012). Their results showed there was a positive correlation between students' morphological awareness and their reading comprehension. It was found that understanding of words contributes to reading comprehension. Wolter and Green (2013) also found that school-age children infer meanings of new words based on word structure. The hypothesis that morphological awareness can influence reading comprehension both directly and indirectly has been supported by current findings (Levesque et al, 2017).

An important hypothesis referring to the orthography of the languages and reading acquisition is the "grain size theory" (Ziegler & Goswami, 2005) which states that the more transparent the orthography of the language is the easier can children learn to decode the graphical symbols (letters). This means that Hungarian and Finnish children can learn to read in a considerably shorter time than English children because English is a language with a deep orthography in which the grapheme -phoneme correspondence is incidental.

However, there are findings in recent research which seem to contradict these results, for instance, Rothou et al. (2013) investigated the contribution of phonological awareness, morphological awareness and vocabulary to decoding in grades 1 and 2 using structural equation modelling (SEM) analysis and found that morphology does not play a role in early word reading (Rothou et al., 2013).

Carlisle (2000) examined 34 third graders and 25 fifth graders. The research was conducted to investigate whether students can identify the structure of morphologically complex words and comprehend their meanings. The aim of the research was to investigate whether third and fifth graders developed the awareness of the structure and meanings of derived words and wanted to find out whether morphological awareness contributes to word reading and reading comprehension. The results showed that awareness of structure was significantly related to the skill to define morphologically complex words and the reading of derived words. The three morphology tasks explained the significant variance in reading comprehension at both grade levels, but the contribution was stronger for the fifth than the third grade. "The results for the third grade indicate that the three morphology tests accounted for 43% of the variance [$F(3.30) = 7.42$; $p < 0.001$] in reading comprehension" (Carlisle, 2000, p.181). "For the fifth grade, the results showed that the three morphology tests accounted for 53% of the variance in vocabulary [$F(3.21) = 8.03$; $p < 0.01$]" (Carlisle, 2000, p.181). Carlisle (2000) demonstrated the growth in the morphological awareness throughout the third and the fifth grade. Both in derivation and decomposition tasks children showed higher performances in the fifth grade than in the third grade. Stronger correlations were shown in grade 5 than in grade 3, which indicate that the contribution of morphological awareness gets stronger throughout primary grades.

Nunes et al., (2006) investigated how children recognise words and how much this knowledge influences reading development. Their research focuses on the effects of learning to spell on children's morphological awareness. Their findings raised the possibility that when children learn to read and write gain explicit knowledge about morphemes. They examined 175 children in grades 2-4. They tested spelling, verbs and non-verbs, morphological awareness, sentence analogy and word analogy. In their studies they conclude that the experience of learning to read and write affects people's knowledge of morphemes, and it is argued that the causal relationship among morphemic knowledge, reading and writing is possibly a bidirectional one.

Larsen and Nippold (2007) investigated how well school-age children could use morphological analysis to explain the meanings of words. 50 typically developing sixth-grade children were asked to explain the meanings of 15 low-frequency morphologically complex words, and a dynamic assessment procedure was used to assess the construct. Children were interviewed one by one and they were asked to give a definition to each word. A wide range of skill levels were assessed for their word knowledge and reading comprehension. Some children used morphological analysis to explain the meanings of unfamiliar words; others needed greater amounts of adult scaffolding to complete the task (Larsen & Nippold, 2007).

Kirby et al. (2012) examined the effects of morphological awareness on different reading tasks. 103 children were tested from grades 1 to 3. Morphological awareness was assessed with a word analogy task that included different morphological measures. Results showed that morphological awareness had a large effect on word reading accuracy and speed, nonword reading accuracy, text reading speed, and reading comprehension. Morphological awareness also explained variance in scores children reached on reading comprehension after controlling word reading. The study establishes that morphological awareness has important roles in word reading and reading comprehension, and it is suggested that assessments and instruction should pay more attention to it (Kirby et al., 2012). The results indicate that the correlation between morphological awareness and reading comprehension gets stronger in grades 1-3. The moderate significant correlations give evidence for the relationship among the constructs.

Tong et al. (2011) conducted a longitudinal research where the performance of poor comprehenders was examined on several reading related skills in grades 3-5 of elementary school. Three groups of readers were formed in grade 5: unexpected poor comprehenders, expected average comprehenders, and unexpected good comprehenders. The members of the different groups were assessed on different tasks: word reading accuracy and speed, nonverbal cognitive ability, and age. The scores of these groups in grade 5 and, retrospectively, in grade 3 were analysed. Tong et al. (2011) suggest that poor morphological awareness contributes to reading comprehension difficulties, and that children with different reading comprehension profiles may learn morphology at different rates.

Nagy et al. (2014) intend to call the attention of researchers and educators to the significance of pedagogical implications of teaching morphology. The study provides detailed theoretical background information about morphological knowledge and considers the potential contributions of morphological knowledge to literacy. Nagy et al. (2014) differentiate between morphological awareness (explicit/strategic) and morphological processing (tacit). They point out that morphological awareness on the level of word form includes decoding or spelling new words by analysing their constituent morphemes, on the level of word meaning; it encompasses inferring the meanings of morphologically complex words based on the meaning of familiar parts or creating a new word, and the level of syntax; it is comprised of inferring the part of speech of a new word on the basis of the suffixes or creating a new word to meet the syntactic demands of a sentence. However they define morphological processing as tacit knowledge which involves recognising known word forms,

accessing known meanings of words and the part of speech the word belongs to more quickly (Nagy et al., 2014). They admit that the boundary between morphological processing and morphological awareness is not determined properly in research literature, and it is rather difficult to ascertain to what extent the individual differences in morphological awareness reflect differences in awareness or morphological processing. However, the term morphological knowledge refers to both morphological awareness and morphological processing; therefore, they suggest using this term. According to (Nagy et al., 2014) students with less advanced literacy skills are likely to lag behind their peers in morphological knowledge but that all students could probably benefit from morphological instruction. Morphological interventions can be useful, particularly for students who have difficulties in learning how to read and write, but further research is required to establish effective morphological interventions (Nagy et al., 2014).

Tong et al. (2014) examined the impact of morphological and syntactic awareness on reading comprehension in grade 4. They tested 30 children in morphological awareness with both morphological and syntactic cues. The measures also contained tasks involving word-reading accuracy, speed, vocabulary, nonverbal cognitive ability, and age. Children were divided into two groups: poor comprehenders (N=15) and average comprehenders (N=15). The results of the two groups were similar on a morphological awareness task which included both morphological and syntactic prompts; nevertheless, poor comprehenders had lower scores on a derivational word analogy measure and also on a syntactic awareness task where there were no morphological manipulations. These findings suggest that the task also determines the relationships among reading comprehension, morphological awareness, and syntactic awareness.

Deacon et al. (2014) monitored more than 100 children from grade 1 to grade 4, in their longitudinal study; however, the research paper focused only on testing children in grades 3-4. The measures contained word reading, real and nonword reading accuracy. They hypothesized that morphological awareness is a factor in reading comprehension. In their longitudinal study, they measured English-speaking children's morphological awareness, word reading skills, and reading comprehension. Phonological awareness, vocabulary and nonverbal ability were also tested. The results showed that morphological awareness partially explained the variances in reading comprehension, which means that morphological awareness affects reading comprehension both directly and indirectly through word reading. In both grades, morphological awareness had a significant, small to moderate on reading comprehension (Deacon et al., 2014).

Li and Wu (2015) examined the contribution of metalinguistic awareness including morphological awareness, phonological awareness and orthographical awareness to reading comprehension, and the role of reading fluency as a mediator of the effects of metalinguistic awareness on reading comprehension from grades 2 to 4.They tested a hundred and fifteen elementary students in China, they administered a test battery that included measures of morphological awareness, phonological awareness, orthographical awareness, reading fluency, reading comprehension and IQ. Morphological awareness uniquely explained 9%, 10% and 13% variance of reading comprehension respectively from grade 2 to grade 4; however, phonological awareness and orthographical awareness did not contribute to reading comprehension. Reading fluency partially mediated the effect of morphological awareness on reading comprehension in grades 2-4. Reading fluency was a significant link between morphological awareness and reading comprehension in grades 2-4 (Li & Wu, 2015).

Casalis et al. (2015) examined how specific the connection is between morphological awareness and spelling. Participants included French children. 42 (30 females) children in grade 3, and 38 (15 females) children in grade 4. Their study suggests that grade 3 and 4 French-speaking children relied on morphological structure to spell sounds for which there

are several alternative spellings. Further, morphological awareness appears to be generally connected to spelling.

Zhang (2017) examined how morphological awareness contributes to reading comprehension in 108 EFL students. The students completed the same test twice within a year; the first testing took place at the end of the third year, the second time was at the end of the fourth year. The test examined derivation, vocabulary size, word reading and reading comprehension. The morphological test included the "comes from "task which asked the students to judge whether the second word of a word pair came from the first one (e.g., think-thinker). Zhang used the structural equation modelling method at both surveys. According to the findings morphological awareness showed a significant correlation with the reading comprehension performances. This effect was larger than the impact of the vocabulary had on reading comprehension. At the second testing the influence of morphological awareness became even larger. The study calls the attention to the importance of teaching grammar explicitly to improve the students' reading comprehension skills. Figure 2.3. shows the structural relationships between morphological awareness, word reading fluency, vocabulary knowledge, and reading comprehension (Zhang, 2017)

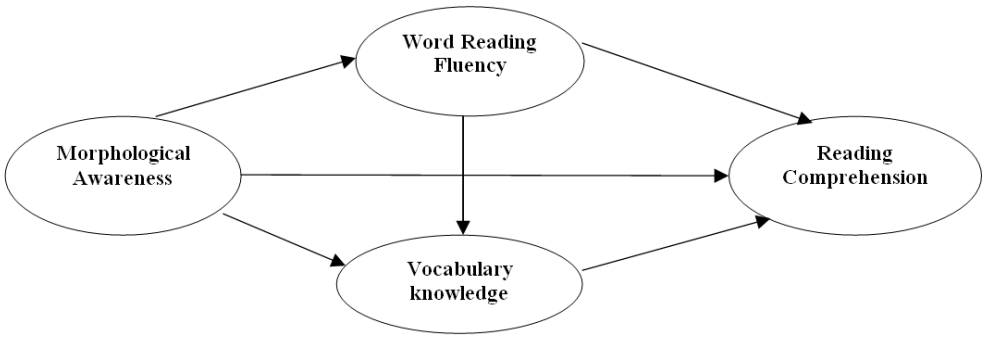

Figure 2.3. Relationship among morphological awareness, word reading fluency, vocabulary and reading comprehension (Zhang, 2017, p.10.)

Levesque et al. (2017) assessed four possible intervening variables through which morphological awareness may have a direct impact on reading comprehension. Children's word reading, vocabulary and morphological awareness (morphological decoding and morphological analysis, respectively) were evaluated. Phonological awareness and nonverbal ability were also included in the model. 221 English-speaking children in grade 3 participated in the investigation. Two indirect relations and one direct relation between morphological awareness and reading comprehension were revealed through multivariate path analyses. They found two indirect relationships between morphological awareness and reading comprehension. Morphological awareness had an impact on both morphological decoding and morphological analysis. Morphological decoding influenced word reading and finally reading comprehension. In addition, morphological awareness affected morphological analysis which contributed to reading comprehension. Morphological awareness also had a direct impact on reading comprehension (Levesque et. al., 2017). Figure 2.4 describes the model of contribution of the morphological awareness to reading comprehension (Levesque et al., 2017)

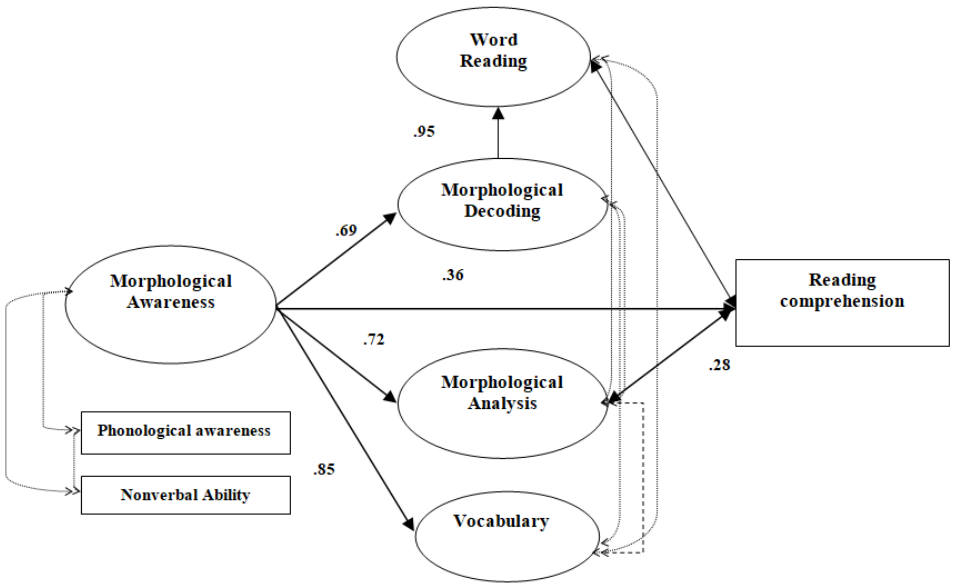

Figure 2.4. The contribution of morphological awareness to reading comprehension (Levesque et al., 2017).

Levesque, Kieffer and Deacon (2018) compared the role of morphological awareness and morphological analysis. They defined morphological awareness as "the ability to manipulate morphemes in a language and morphological analysis refers to the use of morphemes in inferring the meaning of unfamiliar morphologically complex (multimorphemic) words" (Levesque et al., 2018, p.63). Morphological skills were assessed in 197 English- speaking students who were monitored in grade 3-4. The instrument contained morphological awareness and morphological analysis tasks; they also measured reading comprehension, word reading, vocabulary, phonological awareness, nonverbal ability and age. Research findings suggest that morphological analysis, but not morphological awareness explained the variance in reading comprehension. However, morphological awareness had an impact on morphological analysis. The authors suggest that students' skill to use morphemes to identify the meanings of unfamiliar complex words supports the development of reading comprehension over time (Levesque et al., 2018).

Studies have found a positive correlation between morphological awareness and reading comprehension. An increasing number of researchers have investigated the contribution of morphological awareness to reading comprehension; and it is suggested that morphological awareness has both direct and indirect impact on reading comprehension. Morphological knowledge influences word identification, which affects reading comprehension. Children's morphological awareness shows growth throughout primary school years; and it becomes an increasingly strong factor of reading comprehension performances (Levesque et al., 2018).

3. LINGUISTIC INFORMATION PRESENTED IN DIFFERENT MODELS

In this chapter, some important models of reading and some models of word identification are described. There have been a number of attempts to explain the way the brain processes visual signals and comprehends their meaning. The top-down model underestimates the importance of processing linguistic elements (letters, syllables, morphemes and letters) during reading. The bottoms-up model does not pay attention to the role of a reader and the background knowledge in comprehension; it emphasises the importance of linguistic processing in comprehension. The bottoms-up and top-down processes jointly determine the nature of mental models formed in comprehension. This approach is represented by the interactive model (Stanovich, 1986).

Word identification models describe how the brain recognises words. Identification of words is described in different theories, e.g., lexical access model, logogen model, cohort model, lexical quality model and grain size model. Connectionist models endeavour to tap into understanding isolated words. The model Reading System Network considers word identification as the most important factor which determines comprehension. The model includes all the important factors which influence reading from the visual processing to the high level reading processes. Eye tracking research has also tried to find patterns for word recognition, and their findings seem to support the importance of bottom-up processes.

3.1. Bottom-up and Top-down Models

In this subchapter, the development of models and theories of reading and word identification are described. The role of morphology in the process of reading has been underestimated and referred to as part of the linguistic and semantic system. In accordance with the traditional view, which is also called the "bottom-up" model, comprehension begins with decoding the information from the printed text. Durkin (1978) suggests that a reader processes the visual information exhibited by the text that the reader is only a passive recipient, comprehending the essence of the text (Durkin, 1978). These models are data driven and emphasise the role of decoding (letter names, shapes, letter relationships) they also claim the importance of comprehension which include processing lexical, syntactic and semantic information during reading. It is believed that the first task is to learn the code or the alphabetical principle. The meaning of the text is expected to come naturally when the code is broken based on the readers' prior knowledge of words. First, the smallest linguistic unit is processed and then the bigger units are decrypted. The reader must learn to transfer from auditory signals to language signals (Csépe, 2006; Gósy, 2008). After some practice the reader must react automatically to the visual patterns. When children learn to read they have to learn a significant amount of routine responses to a given set of patterns of graphic shapes. The following researchers seem to agree with this approach: Gough (1972), LaBerge and Samuels (1974), Rayner and Pollatsek (1989), Urquart and Weir (1998). Gough is the most important researcher in this approach stating that reading is a strictly serial process. During the reading process lexical, syntactic and semantic rules are applied to the phonetic output (Hoover & Gough, 1990).

The concept "*Simple view of reading"* also belongs to the bottom-up models (Gough & Tunmer, 1986). It consisted of two components, decoding and linguistic comprehension which are considered to be necessary for skilled reading. Three predictions drawn from the simple view were assessed in a longitudinal sample of English-Spanish bilingual children in the first through the fourth grade. The results supported the view that skill in reading can be simply characterized as the product of skill in decoding and linguistic comprehension.

"*Simple view of reading"* of reading hypotheses that problems in connecting spelling to sound might result in reading difficulties (Hoover & Gough,1990).

However, advocates of the top-down model argue with the traditional view suggesting that the reader plays the most important role in comprehension, who constantly makes inferences during reading, and reading is a psycholinguistic guessing game (Goodman, 1973). The reader develops a level of automaticity recognising the words and sentences and able to predict the meaning of the text after the recognition takes place. Reading is conceptually driven. The model employs linear processing which means the reader moves from one sequence of cycle to another, makes hypotheses about the conceptual meaning of the text rather than depending on visual detail. These circles overlap with each other as the reader constantly attempts to predict the meaning of the text (Davoudi & Moghadam, 2015). The purposes of the top-down model are to encourage the children to focus more on understanding the main ideas of the passage than understanding each word (Carrell & Eisterhold, 1983; Csépe, 2006; Hódi, 2018). Top-down approach criticised the traditional reading instruction which was word oriented. As a result of the cognitive revolution the reading research established comprehension and high level reading processes as the core of reading. The whole language movement changed the basals. Therefore, phonics and other linguistic skills were pushed into the background, and literature moved to the centre (Pearson, 2004). When the reading instruction accepted the whole language approach, reading research tacitly accepted that skills are better taught in the act of reading and writing genuine texts for authentic purposes than taught directly and explicitly by the teachers. It was a mistake to suppose that reading instruction should only include reading authentic literary texts (Pearson, 2004). The top-down approach got a lot of criticism because it did not distinguish appropriately between beginning readers and fluent readers (Castles, Rastle & Nation, 2018; Tánczikné-Varga, 2017). With whole word reading instruction, children learned how to read more slowly than with the phonics concept, which followed the bottom up model (Dehaene, 2009). Bottom-up models put too much focus on grammatical and syntactical issues and did not try to integrate other factors into the comprehension process. Therefore, the concept of reading is oversimplified. However; current research shows grammatical and lexical elements are important components of the comprehension without which comprehension is impossible (Csépe, 2014).

3.2. Interactive Models

Neither bottom-up nor top–down model can explain completely how meaning is constructed. Coady (1979) extended Goodman's psycholinguistic model suggesting that it is important to emphasise that the reader's background knowledge interacts with conceptual abilities and process strategies. By conceptual ability Coady means general intellectual capacity. In addition, he points out the importance of processing strategies which are various subcomponents of reading ability, including general language processing skills (e.g. grapheme-morpho-phoneme correspondences, syllable-morpheme information, syntactic information, lexical meaning and contextual meaning). The model created by Coady mentions morphological knowledge among the subskills facilitating comprehension. (Coady, 1979; Davoudi & Moghadam, 2015).

The interactive-compensatory reading model (Stanovich, 1980) hypothesis supposes that the reader is processing information simultaneously, not in sequential stages. The reader perceives features, orthographic knowledge, semantics, syntax, and lexical (vocabulary) knowledge during the process. While the top-down model suggests that the semantics process drives and directs all lower level processes below. Comprehension starts with a hypothesis

made by the reader who then attempts to verify the hypothesis by processing the stimuli. The bottom-up model argues that higher up processes cannot begin until the lower level processes are completed which means that all processes must go in a sequential order, higher processes cannot activate until all lower level processes are completed. The interactive theory suggests that all processes are independent of each other. There is no sequential order to be completed for another process to begin. Any process at any level can compensate for a deficiency at another level. This theory is thought to be unlikely because a hypothesis cannot be formed in such a short time. However, later research seems to verify this concept.

Linguistic processing appears in another influential interactive model which was created by Verhoeven and Perfetti (2008) who suggest that understanding a written test includes both bottom-up and top-down processes as well. Therefore interactive models of reading (Kintch, 1998; Just & Carpenter, 1987; McClelland & Rumelhart, 1981) provide the best framework for studying of an individual variation in the development of the reading comprehension (Verhoeven & Perfetti, 2008). According to his theory comprehending texts involves the flexible use of different sources of information, including the integration of linguistic information with graphic information (Verhoeven & Perfetti, 2008; Tánczikné-Varga, 2017b).

One of the most influential and widely mentioned models of reading created by RAND emphasizes both the bottom-up and top-down elements (RAND, 2002). According to their definition comprehension is "the process of simultaneously constructing and extracting meaning through interaction and engagement with print" (RAND, Snow, 2002, p.13). Although morphology is not mentioned as an important component it might influence the higher level of processing semantic and linguistic information. The model argues that comprehension includes the following elements: the reader, the text and the activity or purpose of reading (Hódi, 2018; RAND, Snow, 2002). The theory emphasises the importance of phonemic awareness is reading acquisition, the knowledge that words are made up of a combination of individual sounds because it plays a very important part in decoding. It also includes the ability to hold on to those sounds, blend them successfully into words and take them apart again. The model calls the attention to the importance of phonics as well, the relationship between a specific letter and its sound, only as it relates to the written word. Phonics has a special significance in opaque orthographies like English where children have to learn the spelling of different words since the relationship between phonemes and graphemes is less direct RAND, Snow, 2002; Tánczikné-Varga, 2017b).

In the approach represented by RAND processing of the text involves decoding the text, higher level linguistic and semantic processing, and self-monitoring for comprehension (RAND, Snow, 2002). They admit that poor reading can be caused by deficit in phonological skills, the word recognition is not appropriate, limited vocabulary and linguistic knowledge syntactic competence, phonological and syntactic and pragmatic awareness (RAND, Snow, 2002; Tánczikné-Varga, 2017a, b).

3.3. Models of Word Identification

Theories and models of word identification are closely associated with several aspects of reading acquisition. On the level of word form, morphological knowledge is important for spelling and decoding as well as for understanding the lexical information. Word recognition is the ability to read words accurately, automatically and comprehend their meaning. It is a complex and multifaceted process. Proponents of the top-down model used to suggest that learning to read is a natural process; it is similar to learning to speak therefore if children are exposed to the print, and they will sooner or later recognize words. In the last few decades research has revealed that it does not work like this. However, the human brain is wired for

speech, but reading skills must be learned. Alphabetic script is an invention of humanity (Dehaene, 2009). As a result our brain had to develop new routes to become able to translate the graphemes into phonemes. Research revealed that the brain has an ability to rewire itself how to use different areas for reading which originally were meant for other processes (Dehaene, 2009).

The importance of word reading in reading comprehension is put forward by Gough's and Tunmer in *The Simple View of Reading* (1986). The authors divide reading comprehension into two different processes: word recognition and language comprehension skills. If children cannot read the words automatically, their reading won't be fluent, or if they do not understand the word, the comprehension process will not be sufficient. Word recognition means seeing the word, recognizing its pronunciation and meaning at once automatically and effortlessly. Automatic word recognition means that a skilled reader just glances at the word and remembers its pronunciation and its meaning. When you look at a page, you automatically decode the written symbols. Even when we recognize the words immediately, the brain reads every letter of the words. Therefore we can find misprints in the text (Gough & Tunmer, 1986).

In lexical access models researchers explain how the meaning of a lexical item is recognised by the brain. There are serial search models proposing that when we see or hear a word, we look through all the lexical entries to determine whether the item is a word or not, and then the necessary information about the word is retrieved. The term serial means that lexical access takes place sequentially, scanning one lexical entry at a time. In the autonomous search model Forster (1976) suggests that access of the lexicon is regarded to be autonomous; it does not depend on other systems involving in language processing. The representations are compared in three access files: orthographic, phonological, syntactic, semantic files for language production. Access files are in a series of file bins (first syllables, letters) the position in the bin is organised by the frequency of the word. Access files have "pointers" to meaning in semantic memory. According to Forster (1976) the frequency of the words determines the organisation of the bins. The activation of the words does not directly depend on the syntactic or semantic factors. It is the general cognitive system which is affected by syntactic and semantic aspects. The data is entered into a more general system; therefore word recognition is influenced by semantic/syntactic information in an indirect way.

In the logogen model Morton (1979) each word or morpheme appears in the lexicon as a logogen, which specifies the word's various features (semantic, orthographic, and syntactic). The logogens can be activated either by sensory input or by contextual information. The word is recognised if the sensory input reaches a threshold. In the case of more frequent words the threshold is lower. Seeing or hearing the word makes an access to the lexical entry. Semantic or syntactic structure of the sentence may influence the activation of the logogen. The logogen is activated if it we can somehow anticipate the word from the earlier words in the sentence. The two routes of word recognition are supposed to work parallel in this model.

The Cohort model was designed to describe auditory word recognition. Marslen-Wilson (1984) noticed that speakers could recognise the words very rapidly. According to their model word recognition is divided into three phases. In the first phase based on acoustic-phonetic information the possible lexical candidates are activated. This set is recognised as the word-initial cohort. Then one candidate is selected and analysed. Finally, at the point of recognition the word can be clearly differentiated from other words and they can be recognised and integrated into the context. The model does not explicitly discuss the role of morphology in word identification.

When children start learning to read they start to identify words and word parts. They understand that letters symbolize sounds in words and it develops into an abilty to understand complex words and morphemes. The importance of vocabulary and word knowledge

facilitate comprehension. “The lexical quality hypothesis” (Perfetti & Hart, 2001, p.294) suggests that reading skills are supported by knowledge of words, including orthography, phonology, morphology and meaning. The identification of words is essential for understanding sentences. Reading of the text starts with the identification of individual words, i.e. the processes which convert the visual input into linguistic presentation. The reader must combine the meaning of each sentence and evaluate the information in the text in order to comprehend the text. The reader needs to use his/her prior knowledge so that he could do this evaluation. It is this level of comprehension that reflects the situation. The reader chooses the meaning appropriate to the situation. Studies on eye movements have revealed that skilled readers fixate on most of the words they read. It seems to indicate that word identification is at the heart of reading comprehension (Rayner, 1998).

Ziegler and Goswami (2005) point out that reading is the process of understanding speech written down. The goal is to gain access to meaning. Children must learn the code used by their culture for representing speech as a series of visual symbols. Children have to match distinctive visual symbols to units of sound (phonology). The expression phonics refers to the connection between sounds and letter symbols. It is also the combination of these sound-symbol connections to create words. In most languages, the relationship between symbol and sound is systematic, whereas the relationship between symbol and meaning is arbitrary.

Connectionist models have been extensively employed to tap into the process of reading. These models focus on understanding isolated words; thus, they complement other type of research on text comprehension” (Csépe, 2014). The term “connectionism” refers to a theory that behaviour especially learning can be explained by neural networks. Connectionist models have been used in reading acquisition: how children learn to read, skilled reading, and reading impairment (dyslexia). These models are computer programs that simulate detailed aspects of behaviour (Seindenberg, 2005).

The parallel distributed processing (PDP) variety was developed by Rumelhart and McClelland in 1986. The model consists of large networks of simple neuron-like processing elements that learn to perform tasks such as reading words or recognising objects (Coltheart, 2005, 2006). Seindenberg’s model was used to explore a more general theory of how lexical knowledge is acquired and used in performing several communicative tasks (speaking, listening, reading, writing), based on PDP principles (Seindenberg, 2007).

The Connectionist Dual Process (CDP) model is the leading computational model of reading aloud for English, Italian, and French. It is based on a connectionist dual route architecture first described by Zorzi, Houghton and Butterworth (1998), in which the emergent “division of labour” between lexical and non-lexical processing is grounded in the different computational properties of the neural networks that implement these processes. The direct spelling-to-sound pathway responsible for phonological assembly is the key to the model’s success in explaining a wide range of empirical data from studies on skilled oral reading, learning to read and reading disorders (Seidenberg, 2005).

Computational models of word reading differ in details and focus; however, they are based on the same theoretical principles collectively known as the ”triangle model”. (Seindenberg, 2005). Large ovals represent groups (“layers”), of units that encode different types of information: orthography (spelling), phonology (derived from pronunciation and sound) and semantics (meaning). Smaller ovals represent “hidden units,” which increase the computational capacity of the network and provide the basis for abstraction. Most models focused on the orthography and phonology mapping (Harm & Seindenberg, 2004; Seidenberg, 2005).

Perfetti and Stafura (2014) developed a comprehensive view of reading comprehension called Reading Systems Framework, which focuses on word identification as the most

important factor which determines comprehension. Reading is a complex process, which is impossible to explain with one single model; therefore, theories and models usually concentrate on one segment of reading comprehension. Consequently, there are theories of word reading, learning to read, reading weaknesses, and the comprehension of sentences or texts. General models do not give a theoretical foundation for specific assumptions with testable hypotheses. However, according to Perfetti and Stafura (2014) The Reading System Framework includes all the components of reading from visual processing through higher level of comprehension. Three classes of knowledge sources, basic cognitive and language processes as well as the relationship among them play an important part in reading comprehension (linguistic knowledge, orthographic and general knowledge).

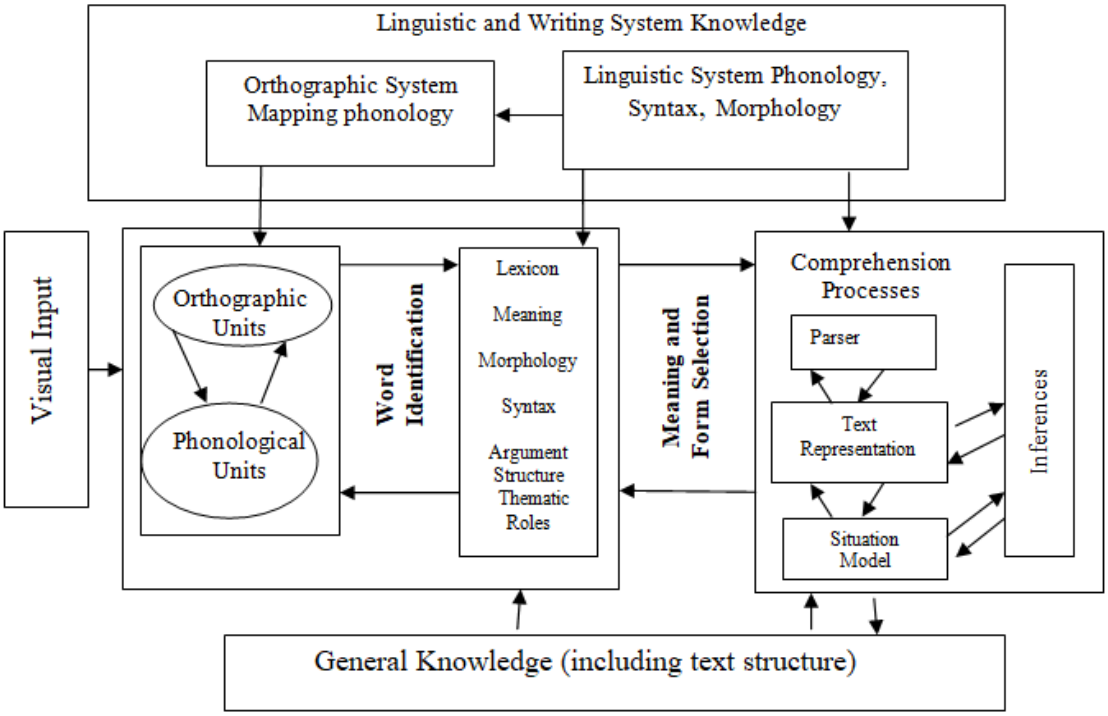

Figure 3.1. Reading system framework (Perfetti & Stafura, 2014, p.24)

The framework is a foundation for word identification models, propositions for the development of reading skills and reading difficulties. Mental lexicon is prioritized because it connects the word identification and comprehension system (Perfetti & Stafura, 2014).

The figure shows that morphology plays an important role both as part of the linguistic system and it facilitates processing semantic information. Figure 3.1. represents all important factors of comprehension. In addition to linguistic and writing system knowledge general knowledge also belongs to the three sources of knowledge. The figure lists the different processes of comprehension: decoding, word identification, retrieval of meaning, building of components, inferencing and using different sources of knowledge in different other ways. The Reading System Framework also indicates the processes which take place in the Mental Lexicon and the interaction among the different levels (Perfetti and Stafura, 2014). Perfetti and Stafura (2014) also point out that word recognition is a determining factor in comprehension; therefore, The Reading System Framework can support developing new hypotheses for explaining reading weaknesses.

The development of reading theories has led the researchers to the finding that word identification is a key factor in comprehension. Although brain research has revealed some important facts about cognitive processes which take place during the semantic processing of

printed text, there are still debates about how exactly the reading process takes place and what are the most important factors that contribute to reading (Perfetti & Stafura, 2014).

3.4. Eye Movements and Word Identification

The model created by Pollatsek and Rayner (1989) is based on the processing hierarchy presented in bottom-up models; they put more emphasis on how people read words. Eye tracking research has been expanding rapidly in the last decades since it can give additional information about eye movements in reading involved the visual processing of the written text. Rayner (1998) proposed that eye movements are closely linked to the current focus of attention; therefore language processing can be studied by monitoring eye movements while a subject is presented with linguistic input (Lowder, Choi & Gordon, 2013).

Eye tracking examinations show how graphical symbols of the text are decoded via series of eye movements from left-to-right across the line of the text. Visual information is encoded during fixations (200-250 ms.) and saccades (20-30 ms). Eyes move 7-8 letter spaces (range: 1-20 spaces) on average for readers of all alphabetic writing systems. Skilled readers of any alphabetic writing systems process information extending from 3-4 letter spaces to the left of the fixation to about 14-15 letter spaces to the right of fixation (Rayner, 1998; Steklács, 2014). A majority of the words in a text are fixated during reading; however, many words are skipped. When a word is longer, it is more likely to be fixated, therefore eight-letter- long or longer words are almost always fixated and often fixated more than once (Rayner, 1998).

Word length and predictability independently affect word skipping and fixation durations. In addition, the eyes sometimes skip long words even when the identity of the word can only be assumed based on partial parafoveal orthographic information (Rayner, 2011; Steklács, 2014). When readers make two fixations on a word, in the vast majority of cases, an initial fixation on a word is followed by a rightward movement within the word. By far the most frequent pattern is to fixate near the beginning of a word followed by a fixation near the end of the word (Rayner & Pollatsek, 1987; Rayner, 1998; Steklács, 2014). Nevertheless, the perceptual span (the area of effective vision) is very short in novice readers, and it takes time to develop. Readers obtain preview information from the word to the right of fixation. The growing perceptual span and the preview benefit result in more fluent reading, where low frequency words fixated for a longer time than high frequency words (Steklács, 2014).

The characteristics of children's eye movements are different from those of adults. Preschool children show more frequent short saccades and drifts during maintained fixation. They exhibit longer saccadic latency, and less precise saccadic accuracy in preschool children than in adults when scanning a slide. However, there are similarities in the shapes of the frequency distributions of fixation durations for children, adults (Rayner, 1998). Eye tracking research supports the proposition that children read more slowly than adults; they usually make shorter saccades, fixations, regressions are more frequent, and they fixate for a longer time, however, they show lower word skipping rates (Schroeder et al., 2015).

Schroeder et al. (2015) point out that reading is a cognitive challenge for younger children; therefore, they tend to spend more time on the task. Word length has a huge impact on word recognition. Longer and unpredictable words can be challenging for children. When children read shorter and frequent words, they tend to read them more quickly, however, when they encounter a multimorphemic word, they show a tendency to fixate, and refixate multiple times because processing these words requires analysis and planning (Rayner, 1998; Schroeder et al., 2015; Tánczikné-Varga & Steklács, 2019)

4. ASSESSMENT AND DEVELOPMENT OF MORPHOLOGICAL AWARENESS

This chapter reviews the assessment and development of morphological awareness. This part of the dissertation has four main purposes. First, morphological awareness has mostly been assessed in deep orthographies; therefore, the development of morphological awareness is introduced based on studies conducted in deep orthography languages. Second, research studies found that morphological awareness is important in shallow orthographies too like Finnish or Turkish. Some research studies show how the skill works in shallow orthographies. Third, common measures of morphological awareness are reviewed. The advantages of online instruments over paper-based are also analysed. Finally, the chapter discusses the possibilities of fostering morphological awareness, the benefits of morphological intervention programmes and online intervention programmes.

4.1. The Question of Orthography

Reading development is influenced by the orthography of the language. Orthographic depth hypothesis can be applied to both teaching reading for L1 and L2 readers. It emphasizes the importance of connections between orthographies of languages and reading process. Katz and Frost (1992) suggest that in shallow orthographies words can be identified more easily. Deep orthographies encourage a reader to process printed words by referring to their morphology. For languages with relatively deep orthographies the new readers have difficulty learning to decode the words. As a result children learn to read more slowly (Perfetti & Dunlap, 2008). Orthographic depth indicates the degree to which a written language deviates from grapheme-phoneme correspondence. It depends on how easy or difficult it is to predict the pronunciation of a word based on its spelling. In shallow orthographies, the spelling-sound correspondence is direct; from the rules of pronunciation one is able to pronounce the word correctly. Shallow (transparent) orthographies , also called phonemic orthographies have one-to one relationship between its graphemes and phonemes, and the spelling of words is very consistent, for example, Serbo-Croatian and Italian. In deep (opaque) orthographies, the relationship is less direct, and the reader must learn the arbitrary or unusual pronunciations of irregular words, for example, English and Hebrew (Dąbrowska, 2015; Tánczikné-Varga, 2017a).

4.2. Development of Morphological Awareness in Deep Orthographies

The development of morphological awareness has got more research attention in deep orthographies than in shallow orthographies; therefore its development tendencies are described based on findings in deep orthographies. The development of morphological awareness involves three major aspects: relational, syntactic and distributional knowledge which appear in the acquisition of inflectional, derivational and compound morphology (Apel, 2014). The three kinds of morphological awareness show the greatest growth during the first three or four grades. However, derivation even shows significant growth even after grade 4 (Berninger et al., 2010). Grade specific guidelines for the development of morphological knowledge and awareness are described in Common State Standards for English Language and Arts (2011).

Explicit knowledge of morphological awareness starts developing in grade 1 when children learn how to decode (read) words into sounds and encode (write) words into visual symbols. They start recognizing the orthographic patterns which represent; for example, past

tense, plurality and possession. They are expected to acquire the relational knowledge among common words with various grammatical inflections which mark tense, number and grammatical function. Additionally, the awareness of lexical morphology starts to emerge. In the first grade children start decomposing and blending compounds. They are required to understand differences in meaning between homophones and homonyms in grade level texts. Homophones are words which have the same pronunciation but they are spelt differently and mean different things (right, write). Homonyms are words which have the same pronunciation and same spelling but they have different meanings (e.g. *bark*) (Gabig & Zaretsky, 2013).

In grade 2 children are expected to acquire the basics of the derivational morphology. They learn the most common prefixes and suffixes and start decomposing complex words and derived words with one or two syllables. Children are required to decompose compound words and words with prefixes and suffixes in grade level texts (Gabig & Zaretsky, 2013). Gordon (1989) created a model for acquisition of derivational morphology. On level 1 children acquire irregular inflections (*goose-geese*), non-neutral suffixes, which cause phonological alterations in the stem (-ion, -ity). Level 2 processes include neutral derivational affixation, which does not change the base word, neutral derivatives are more transparent. Level 3 consists of regular inflections. First, children develop level 3 processes, which are the most productive and it is easier for children to learn. Irregular inflections are the most difficult, children master these inflections the latest. The acquisition of compound morphology starts in grade 2 (Gordon, 1989). Ku & Anderson (2003) tested the awareness of compounds in 2nd, 3rd and 4th graders. The grade had a significant effect on the performance. Zhang (2004) pointed out that the Mandarin speaking children in grade 2 had a little mastery of different compounding structures.

In grade 3 children can identify the meaning of the majority of common prefixes and suffixes, analyse the suffixes and prefixes within a novel word in order to comprehend the meaning of the word. Children are expected to apply their knowledge about the relationship between the base word and the affixes. For example, they develop the awareness of words sharing the same root. They can decompose common suffixes (*teach-teacher*) even unknown/unique words. They realise the syntactic function of common suffixes in transparent derived words of Anglo-Saxon origin. They can tell meanings of prefixes and find the correct pseudoword to complete the sentence (Gabig & Zaretsky, 2013). Anglin (1993) pointed out that the third graders knew more derivational suffixes that changed the part of the speech of the base word than first graders. Ku and Anderson (2003) found that children's morphological awareness skills ameliorated from grade 2 to grade 4 and to grade 6. The tasks assessed relational knowledge and awareness of the structure of morphologically complex words by the "comes from task" and awareness of affixes for real and pseudowords.

Berninger et al. (2010) examined the growth in phonological, orthographic and morphological awareness in grades 1-6 in a longitudinal study. Three kinds of morphological awareness (inflectional, derivational and compound morphology) showed the greatest growth in the first three or four grades. However, derivation morphological skills grow further throughout primary school years as the vocabulary knowledge extends. They used segmentation, morphological signals, derivation and decomposition tasks (Carlisle, 2000). The growth in morphological segmentation was steeper in grades 2 to 4 than in grades 4 to 6. In the morphological signals task the growth was steeper in grades 1 to 3 than in grades 3 to 5. The growth in the decomposition task was steeper in grades 3 to 4 than in grades 4 to 6.The derivation tasks did not show steeper growth in the first four grades, it continued to grow beyond the fourth grade (Berninger et al., 2010).

In grades 4-6 relational knowledge and syntactic knowledge of Greek and Latin morphemes start evolving. Children master the meaning of suffixes of Greek and Latin origin, they can also decompose derived words, compounds of Greek and Latin origin (Gabig &

Zaretsky, 2013). Syntactic knowledge of derivatives does not appear before former literacy instruction begins. Tyler & Nagy (1989) argued that children may become able to recognize syntactic properties encoded in derivational suffixes in grade 4. Syntactic knowledge continues to grow even beyond the eighth grade. Distributional knowledge also starts to develop in grade 4. Distributional morphology includes the understanding of how suffixes are constrained by the syntactic category of the stem they are attached to (*e.g. government*). For example, -ment suffix can be attached to a verb to form a noun from it (Kuo & Anderson, 2006).

The period between grades 4 and 6 is the time for consolidation of morphological awareness for lexical, grammatical and derivational morphology. Students are required to be proficient in word analysis and decomposition of unfamiliar multimorphemic words. Tyler and Nagy (1989) found that relational knowledge to recognize the stem was already developed in four graders; however, it continued to improve up to 8th grade. In middle school and high school students continue to develop their knowledge and use of grade-specific Greek and Latin derivational affixes. They enhance distributional knowledge of role of morphemes in creating unique word meaning (Gabig & Zaretsky, 2013).

4.3. Acquisition of Morphology in Shallow Orthographies

Children acquire morphological structures quite early since it is easier to learn the morphological markers than more distributed ways of marking grammatical relations. The possible explanation for the productive use of morphology even before learning syntax is that morphology marks the grammatical relationships locally, which makes it easier to recognise the typical patterns and use them to create new forms using analogies. This feature makes possible for children to get access to basic morphological structures relatively early during language acquisition. The limited formal variety of morphemes is another factor which makes relatively easy is to acquire morphological marking: a morpheme has relatively few allomorphs while the representations of syntactic structures show a great variety. It is important to point out that children gradually learn automatic use of the different morphemes; more frequent morphemes will appear earlier. According to Piaget's theory cognitive development must precede learning, which means that children can acquire an affix only when they have a clear idea about its mental schema. Using nonwords for testing children's grammatical knowledge is a one of the most efficient method. Berko (1958) in his Wug test used nonwords to test how creatively children could use grammatical rules independently from the meanings of words. He tested the usage of present and past tense, singular and plural of nouns.

As far as the Hungarian language is concerned, the acquisition of affixes precedes the acquisition of syntax. Research findings show that morphological productivity appears quite early: Hungarian children can use certain verbal and nominal suffixes even before the age of three. There is a gradual development of morphological acquisition which is influenced by different factors e.g. the variety of syntactic category and input. By the age of 3.5 Children can use nouns and verbs with considerable ease even with nonwords. In case of new verbs children coped with more difficulty, but mostly they gave correct answers (Gábor & Lukács, 2012).

It takes a long time to be become a skilled reader. In the case of transparent orthographies it takes much less time to acquire decoding. It is relatively easy for Hungarian children to learn the rules of orthography. Owing to almost "one-to-one" grapheme-morpheme correspondence reading fluency is developed much faster than in deep orthographies. Researchers have only little empirical data about how the model of word

recognition is formulated in agglutinative languages with shallow orthography. In these languages children have to read rather long words which can be difficult especially at the beginning of the reading acquisition. It seems that that the fast and precise word reading is developed between the age of 7-9, and its pace is influenced by the orthographical consistency (Ziegler & Goswami, 2005). English children develop morphological knowledge on the morphological structures of the language which help them to read morphologically complex words. It is a question whether the case is similar or not in shallow orthography languages. In these languages words contain a stem and one or more affixes. If the morphological variety plays an important role in reading acquisition, the time needed for acquisition of word recognition will be different for the languages with same transparency and orthographical consistency but with different morphological typology (Ziegler & Goswami, 2005).

Hungarian and Turkish children learn to read the compound words even the non-words quite early and can read many types of word endings with different conjugated and declined forms. Finnish children can read fluently after one month of reading instruction (Holopainen, 2002). However, it might be surprising that these children can read morphologically complex words more fluently than words consisting of only one morpheme especially when they have a high frequency stem (Bertram et al, 2000). It refers to the theory that Finnish children can learn the morpheme structure of their language, the common roots and the affixes quite early and they can identify them quite quickly. It seems that the problems with identification of morphemes can predict reading difficulties more effectively than simple reading exercises. The process is similar in languages with shallow or deep orthographies. Carlisle and Fleming (2003) point out that those children who perform well in morphological exercises will perform better in reading comprehension tasks. They found that the decomposition and composition of different unfamiliar words support word processing and can contribute to vocabulary extension and reading comprehension. Thus, in the development of reading comprehension a new aspect is emerging, knowledge about grammatical structures, knowledge about grammatical structures, namely, the role of morphological awareness. Nagy et al. (2006) point out that the higher level of morphological awareness goes hand in hand with bigger vocabulary, better reading comprehension, better and more precise reading. However, this can be demonstrated only in the later phase of reading development (Nagy et al., 2006).

According to Borleffs (2017) Finnish was found to be the most (or second most) morphologically complex language. Their research has demonstrated that majority of Finnish students acquires accurate reading skills during the first year. This shows that Finnish children acquire efficient strategies to overcome potential difficulties resulting from the morphological complexity of the Finnish language. It has been argued that Finnish children can differentiate words with small (single phonemic) variations and could identify a large number of exceptional inflections at school-entry age (Torppa et al., 2010). It is possible that morphological complexity can influence the automatization of reading in Finnish.

Aro (2017) in his study describes the features of Finish language and morphology and he also taps into the process of reading acquisition. The role of phonology is emphasised in learning to read in Finnish. Finnish and Hungarian languages belong to the same language family and share a lot of linguistic features. Finnish orthography like Hungarian is transparent and easy to learn, it has a complex morphological system with rich inflectional and derivational structures and productive compounding. The spelling is phonemic; however, there are a lot of multimorphemic and linguistically complex words. There is fairly little amount of empirical data on the effects of morphological skills in reading development. The cognitive foundations of fluency development are not understood at present. However, it seems probable that morphological processing plays an important role in reading development after the initial skill of phonological awareness is acquired (Aro, 2017).

Silvén et al. (2004) presents the results of a longitudinal research. They explored the developmental relations between language and reading acquisition before formal literacy instruction. Sixty-one Finnish-speaking children (L1) were examined once a year from infancy to the beginning of school years. Their instruments were comprised of oral tasks. They used different measures for testing children's development. The test for children aged 1-3 years included familiar concepts from children's everyday routines. From 3 years of age the acquisition of nouns, adjectives, verbs and the use of inflectional forms were evaluated. In the investigation they also used the Morphology Test (Silvén et al., 2004) based on Berko's (1958) nonword method. At the age of 5-6 children's phonological awareness, at 5-7 years of age word reading skills were evaluated. On the basis of the word reading test three groups were identified: precocious readers (N=18), emergent readers (N=26) and non-readers (N=17). The results suggest that "the children who would become emergent and precocious readers produced more verbs at 2 years of age, and more verbs and adjectives one year later. The precocious readers used a larger noun vocabulary at 2 years of age than the emergent readers" (Silvén et al., 2004. p.157). As far as the differences on inflectional forms are concerned at the age of 3 the children who would become readers had better performed in all the inflectional tasks, and one year later emergent readers fell behind precocious readers on noun and verb inflections. At 4 and 5 years of age readers outperformed non-readers in verb inflection tasks and word reading as well. However, one year later the differences among the groups decreased. For Finnish children morphological development is part of language acquisition, means that they can differentiate between different inflections and recognise suffixes, allomorphs. Morphological development along with phonological awareness has its roots in oral-language acquisition, which has a major effect on acquisition of reading. Thus more attention should be paid to preschool language development in order to prevent difficulties in literacy skills (Silvén et al., 2004).

In Turkish literacy the development reflects the characteristics of the language quite clearly. Turkish is an orthographically shallow language with a rich morphology. The language is characterised by a well-defined syllable structure which makes it easy for children to identify syllable boundaries (Durgunoğlu, 2017). Morphology plays an important role in language acquisition. Vowel harmony, consonant assimilation, and complex suffixation make children pay attention to the ending of words. This focus allows phonological awareness to develop quickly. Additionally, the Turkish alphabet has very systematic morpheme-phoneme correspondence. As a result of the transparent orthography children develop phonological awareness quite quickly which makes it possible for them to acquire quite high levels of proficiency in decoding in the first grade. Therefore, vocabulary and listening comprehension skills have a great influence on reading comprehension at an earlier stage in Turkish literacy development. The author suggests that after children have acquired the basics of decoding, greater emphasis must be put on vocabulary and linguistic development (Durgunoğlu, 2017).

Ziegler et al., (2010) examined the role of phonological awareness, memory, vocabulary, rapid naming, and nonverbal intelligence in reading performance across five languages which differed in transparency (Finnish, Hungarian, Dutch, Portuguese, and French). 1,265 children in the second grade took part in the survey. The results showed that phonological awareness was the main factor contributing to reading performance in each language. However, its impact was restrained by the transparency of the orthography, that is, it was stronger in less transparent orthographies.

In the last decade, it has become clear that orthographic consistency is the most important factor determining the rate of reading acquisition in different languages (Ziegler & Goswami, 2005). A cross-language investigation in which reading performance was measured at the end of Grade 1 in 14 European countries (Seymour et al., 2003) demonstrates that whereas reading accuracy in most transparent languages (e.g., Italian, German, Greek,

Spanish, and Finnish) reached ceiling at the end of the first grade. Nevertheless, the accuracy in less transparent languages (e.g., Portuguese, French, and Danish) was lower, about 80%, reading performance in English, which was the least transparent of the orthographies investigated, was only 34% (Ziegler et al.,2010).

The most alarming concern is that reading research based on the results which were found in connection with the English language might have overestimated the importance of phonological awareness (Share, 2008). Phonological awareness, the ability to identify and manipulate sound units, predicts the reading level, and it is also hypothesised that training in phonological-awareness skills significantly improves children's ability to read and spell words (Jordanidisz, 2009, 2010; Török & Hódi, 2015; Török et al., 2016) even in shallow orthography languages. English-based research have exaggerated the effects of phonological awareness because especially in the case of English high levels of phonological awareness support reading development, and at the same time, successful reading development enhances phonological-awareness skills that is the relationships between phonological awareness and reading is bidirectional. If so, transparent orthographies with a one to-one correspondence between graphemes and phonemes should naturally promote high levels of phonological awareness. As a consequence, phonological awareness might be a weaker predictor of reading development in transparent than in deep orthographies Ziegler et al. (2010). In the case of the Hungarian language the study found that besides phonological awareness rapid automatized naming (RAN) is also important contribution to reading is grade two, however in the English language phonological awareness is the most important predictor of reading performances in grade 2 orthographies (Ziegler et al., 2010).

Haddad et al. (2018) found their study that orthographic transparency enhances morphological segmentation in children reading Hebrew words. It is pointed out that children in the 2nd grade perform a morphological segmentation of Hebrew words which are composed of a root and a morphemic pattern. 2nd graders solve the task with difficulty but the process becomes automatic for the 5th. They found that morphological parsing of morphological structure facilitates word identification even when the script is transparent. Haddad et al. (2018) showed that children can benefit greatly from morphological segmentation in the transparent orthography. These results are in line with previous studies demonstrating the significance of morphological segmentation even in transparent orthographies such as Italian and French (Casalis et al., 2015).

In summary, it can be pointed out that in shallow orthographies children can usually spell printed words without analysing the morphological structure of the word. However, morphological knowledge becomes important when children must comprehend more complex structures and have to comprehend polimorphemic words (Babayigit, 2009). Several researchers agree that developmental theories and models which apply to the English language can only be partly applied for explaining processes in orthographically transparent languages. There are no research findings in shallow orthographies related to how polimorphemic words are processed in agglutinative systems. (Babayigit, 2009; Csépe, 2006)

4.4. Measures of Morphological Awareness

Morphological awareness is comprised of the following subcomponents: orthographic awareness, graphosemantic awareness and graphomorphological awareness. Nevertheless, morphological awareness is usually related to the ability to manipulate morphemes and use the word formation rules. Morphological awareness has a strong relationship with reading comprehension because morphemes have semantic, phonological and syntactic properties. Additionally, morphological awareness is connected to other aspects of language knowledge,

and may give a more general insight into metalinguistic skills than phonological awareness (Kuo & Anderson, 2006). Another reason to connect morphological awareness to reading comprehension is that in the mental lexicon the recognition of the morphologically complex words is affected by the root frequency. According to the psycholinguistic findings in connection with dual route models morphologically complex words are analysed regarding to their constituent parts (Rastle, 2019). This phenomenon is termed as morpho-orthographic segmentation. It is hypothesised the morphological analysis takes places on orthographic level before the activation of the whole-word presentations. Eye tracking examinations also suggest that morpho-orthographic analysis influences sentence reading as well when sentence contexts indicate parsing is not appropriate for example, in pseudo derivatives e.*g. kendő (scarf)* where *–endő* (*e.g.: készítendő*) is a derivational suffix meaning however, *kendő* in Hungarian it is a base word. After morpho-orthographic analysis the activation of semantic content is activated very quickly (Rastle, 2019). Functional magnetic resonance imaging examinations also support that hypothesis (Csépe, 2006).

The development of morphological knowledge starts with language acquisition. On the basis of brain research, it can be hypothesised that acquisition of inflectional morphology takes place relatively early; thus by age 4 children use inflectional morphology with a certain amount of flexibility (Gábor & Lukács, 2012; Rastle, 2019). Children acquire morphological structures easily since morphology marks the grammatical relationships locally, which makes it easier to recognise the typical patterns and use them to create new forms using analogies. This feature makes it possible for children to get access to basic morphological structures relatively early during language acquisition. Hungarian children acquire morphological rules before four years of age; the use of affixes precedes the acquisition of syntax. Research findings show that morphological productivity appears as well. Children can use nouns and verbs with considerable ease, even with nonwords. Regarding the usage of new verbs, children coped with more difficulty, but mostly gave correct answers (Gábor & Lukács, 2012, Varga, Pásztor, Steklács, 2020).

Berko (1958) was the first researcher to systematically test children's morphological knowledge with his Wug test. He investigated the acquisition of morphological knowledge in three different dimensions: inflectional, derivational and compound morphology. Based on his study, a number of researchers investigated the acquisition of this skill using this pattern (Apel et al., Carlisle, 2000; Deacon et al., 2014; Kuo & Anderson, 2006; 2013; Levesque et al., 2017). Both inflections and derivation involve attaching affixes to the words. Inflections change the word form while maintaining the same word; however, a derivational rule may change the syntactic category or the lexical meaning of the stem to which it is attached. Compound words are combinations of two or more words; they often have a meaning that is different, or more specific than the two individual words. Acquisition of inflectional morphology encompasses the syntactic relations between the monosyntactic content of the words; that is, differences in tense, number/person and agreement, and their morphological forms. Inflectional suffixes are bound morphemes that convey grammatical information. English has relatively few inflectional morphemes. However, Hungarian has plenty of inflections. The number on a noun belongs to inflectional morphology. For example, for English nouns the inflectional morpheme for the plural is an –s, or –es. - "girls, houses". In Hungarian, the morpheme for the plurals is a *–k, -ak, -ek, -ok - székek* - "chairs" as well as *–i,-ai, -ei,-jai, -jei - gyermekei* - "children". Children acquire the use of inflectional morphology before learning to use the syntax (Gábor & Lukács, 2012; MacWhinney, 1976; Varga, et al., 2020).

Berko (1958) conducted systematic research on children's inflectional morphology skills. He tested children between ages of 4 and 7. The assessment tasks tested sentences with a pseudoword in it; children had to form the plural, verb tense or possessive form of the

pseudoword. The "Wug" test usage nonwords proved to be the most effective measure to analyse a child's awareness of morphological structures as the child could not rely on word meaning of the words, therefore; metalinguistic awareness skills were used (Kuo & Anderson, 2006). The Wug test demonstrates that preschool children already have some knowledge of the inflectional markers and a basic ability to manipulate new words. Berko's findings also suggest that such knowledge improves significantly from preschool to the first grade. In addition, children acquire most inflectional rules by early elementary grades (Berko, 1958; Kuo & Anderson, 2006). Other research findings also support that children use inflections in natural speech (Gábor & Lukács, 2012). Gábor and Lukács (2012) examined morphological productivity of morpheme use in Hungarian children aged between ages 3 and 5. They tested how children could produce inflected forms through nonwords, for example, children were taught the pseudoword *gaku*, and then, asked questions. In their answers children had to use different inflections formed from nonwords. Children were also taught a pseudo-verb and a pseudo-suffix as well. The findings suggest that children can use nominal and verbal suffixes productively, although noun morphology seemed to be more difficult than verb morphology. In addition, children in the oldest group were able to understand the new suffix; however, they struggled to produce new words using the pseudo-suffix. This might apply that children's morphological awareness was not developed enough to enable them to use it efficiently (Gábor & Lukács, 2012; Varga et al., 2020).

Despite the fact that children are able to utilize inflectional suffixes by the early elementary grades, they still have trouble understanding and producing allomorphs. Allomorphs are actual representations of morphemes, such as the plural endings –s (as in cars). Both good and struggling readers possibly develop various depths of understanding an abstract level of morphological presentations; however, most make mistakes in forming some inflected forms (Berko, 1958).

While the acquisition of inflectional morphology is quite developed by the age of four, it takes longer for children to acquire derivational morphology. First graders have a basic knowledge about derived forms (Kuo & Anderson, 2006). During the third, and the fourth grade children start to develop explicit awareness of the structure and meaning of derived forms of words (Carlisle, 2000). It is believed that this develops further even throughout the high school years (Berko, 1958). This is the period when metalinguistic knowledge or awareness develops which makes it possible for the child to objectify the language. The acquisition of rapid morphemic analysis is also developed late in reading acquisition. (Rastle, 2019). According to brain research two pathways have been identified for skilled readers (dual-pathway) theory: dorsal (spelling-to-sound-to-meaning) and ventral (spelling-to-meaning). The morphological analysis of visual word recognition is strongly associated with the ventral reading pathway (Lewis et al., 2011).

Metacognitive awareness begins with a phase where the knowledge is below a threshold level of consciousness. During this phase, children demonstrate a functional control in rich pragmatic contents. This phase develops into the phase of "actual consciousness", and then it develops into the "conscious awareness" stage. At this stage children are able to intentionally concentrate on and manipulate linguistic units (Kuo & Anderson, 2006).

Inflectional and derivational suffixes differ in the number of suffix types and the frequency of the derived forms. In English, the number of derivational suffixes is limited. However, as the Hungarian language is an agglutinative language, with a rich morphological system, it has a myriad of derivational suffixes. Some common derivational suffixes form a verb from another verb (*öltöz* -"dress" plus the verb -*ködik*, becomes *öltözködik* "get dressed"*), a* noun from a verb *(gyűjt*-"collect" plus the suffix -*emény* , becomes *gyűtemény* "collection" *), a* noun from an adjective *(szép* - "beautiful" plus the suffix - *ség* , becomes

szépség - "beauty"*),a* verb from an adjective *(szép* - "beautiful" plus the suffix *-ít* , becomes *szépít* - "beautify",, *a* participle from a verb *(ír/írás* - "write/writing").

The ideas of productivity and constraints can determine acquisition of derivational morphology. Productivity is the extent to which stem and affixes can be combined to form words. Constraints refer to restrictions on productivity (Gordon, 1989). He tried to explain the differences in inflectional and derivational morphology. He created a three-level model in which the first level contains irregular inflections (*children)*and non-neutral derivational affixes which causes phonological change in the stem *(-ion, -ity)* and second level is composed of neutral derivational affixes *(-er, -ness).* The third level contains productive affixes (Gordon, 1989).

Three major aspects are included in inflectional morphology: relational, syntactic and distributional knowledge. They are also present in the acquisition of inflectional morphology, however, derivational morphology demands more sophisticated metalinguistic skills than inflectional morphology especially in case of non-neutral affixes which require a phonological alteration in the stem.

Relational knowledge shows children's ability to determine whether the one word comes from another word or not (Derwing, 1976). The relational knowledge can also be tested with a morpheme segmentation task (Carlisle, 2000). The examiner asks children to segment a word. The segmentation task gives an insight into children's awareness of the structure of the morphologically complex words and might not consider their understanding the difference between the stems and derived words. Carlisle (2000) tested children in the third and the fifth grade and found that the performance of children on the segmentation task was not connected to the ability to define morphologically complex words. "Comes from" task was criticised because it can be confounded with vocabulary size and general world knowledge.

The multiple choice task testing the relational knowledge proved to be more reliable. Children had to find the right interpretation of the sentence (Tyler & Nagy, 1989). The child needed to realise the stem in a derived low frequency word with a high frequency stem (Kuo & Anderson, 2006). Morphological knowledge concerning the syntactic properties of derivatives does not develop until formal literacy instruction starts (Berko, 1958). The ability includes the awareness of syntactic information in derivatives, the skill increases with grade level. It seems that by grade 4 children are able to recognise the syntactic information encoded into the derived words.

Distributional knowledge encompasses the awareness how suffixes are constrained by the syntactic category of the stem they are attached to. In English the suffix *–ly* can be attached to adjectives but you cannot attach it to a noun; for example, expensively is right, however, and expensely is not correct (Kuo &Anderson, 2006). It was also revealed that the second and fourth graders did not show sophisticated distributional skills when solving the tasks of distinguishing well-formed and ill-formed derivatives (Ku & Anderson, 2003)

The most common types of compounds are coordinative compounds, subordinate compounds, subject-predicate compounds, verb-object compounds, and compounds with a verb/adjective complement. There has been little research on the acquisition of compounds. Berko (1958) examined to what extent children acquired awareness of compound morphology. He asked children to explain the meanings of compound words. Preschoolers had developed very limited awareness related to the structure of compound words. Instead of decomposing compound words, preschool children tended to store them as a single lexical item regardless of its structure. Ku and Anderson (2003) assessed the compounds with three tests. In the first one, children were asked to select the interpretation of a compound word composed from high frequency base words. In the second one, children had to find the well-formed compound. In the third test children had to find the odd-man out, from words which

shared a part; they had to choose the one with different meaning (Ku and Anderson, 2003). To sum up, based on the research literature, it can be assumed that awareness of inflectional and compound morphology usually develops earlier than the acquisition of derivational morphology. The knowledge of inflectional and compound morphology seem to develop prior to the formal reading instruction, the awareness about derivational morphology usually does not appear before mid-elementary grades. Children learn the major inflectional rules by the early elementary grades, but the awareness of compound and derivational morphology continues to evolve through elementary school years later (Kuo and Anderson, 2006).

Carlisle (2000) identified two dimensions of morphological awareness: morphological structure awareness, morphological analysis. Kuo and Anderson (2006) added a third one, morphological decoding (Deacon, Tong & Francis 2017). Morphological structure awareness is children's awareness of the grammatical structures of the language without arriving at word meaning. Morphological analysis includes the use of morphological structures to determine the meaning of words (Carlisle, 2000, Deacon, Tong & Francis, 2017), and morphological decoding is the ability to use morphemes to arrive at an accurate pronunciation of a written word (Kuo & Anderson, 2006).

Measures of assessing morphological awareness have been discussed by several studies (Apel et al., 2013; Carlisle, 1995, 2000; Kuo & Anderson, 2006; Török & Hódi, 2015) Deacon et al. (2017) give a detailed analysis about the tasks involved in assessing morphological awareness. Variety of tasks has been used to assess this ability consisting of judgment tasks, production tasks and analogy tasks including several subvarieties.

The most common methods of measuring morphological structure awareness were identified by Carlisle (2000) which include either sentence completion or analogy tasks; for example, "farm. My uncle is a ___"; (Carlisle, 2000, p.187), or analogy tasks, where children have to use the same morphological manipulation on a different word or sentence, for instance, walk: walked: run: ___; (Nunes et al., 1997, p.649.) In these exercises the emphasis is on the child's ability to manipulate the morphological structure of the word to fit the context, they are testing how much the child is aware of the structure of the word. Morphological decoding is the ability to use morphemes to arrive at an accurate pronunciation of a written word (Kuo & Anderson, 2006). Word reading exercises can particularly work for orthographically opaque languages where children have difficulties with decoding the graphical symbols because the letter-sound correspondence follows difficult patterns. Morphological analysis can be associated with morphological problem solving. It tests the use of morphological structure to determine the meaning of words (Carlisle, 2000). Typical exercises include defining derived words and base words. Apel et al. (2013) differentiates judgment, production and identification, partly oral and written tasks. The relatives tasks are similar to the ones created by Carlisle (2000), that is, children have to produce inflected or conjugated forms of the given word. For morphological testing nonwords are also used with real affixes to assess children's awareness of the grammatical structures (Berko, 1958; Apel et al., 2013). Children are usually tested orally face to face and some tasks are done in writing using paper-based methods.

Judgment tasks have been included in a large number of examinations. In a judgment task students have to make decision about the semantic relation between two words. It is called the "Does this word come from the other word?" type of exercise. For example: "Does *mother* come from *moth*?" (Kuo & Anderson, 2006). A usual answer for this question is: yes or no. Another task involved in judgment of semantic accuracy is a sentence completion task. There are four options and children have complete the sentence *("direct, directing, directed, directions*) did you understand the _____?" (Apel et al., 2013; Nippold & Sun, 2007). In addition to judgement types of measures production type of tasks were used as well. Close type procedures can be implemented (e.g., *teach. Mr Smith is a*_____).

Table 4.1. Examples for tasks measuring morphological awareness adapted from Apel et al., 2013; Apel, 2014

type of awareness	task	example	Grades/ Age
awareness of the structure of the word	morphological structure test/ decomposition - cloze test	Finish the sentence: growth. She wanted her plant_____ (Carlisle, 2000)	3rd,5th
awareness of the relations within the word	relatives task	Finish the sentence. friend. The teacher was very _____	3rd,5th
awareness of structure of the word	morphological structure test: composition of derived form – cloze test	Finish the sentence. Farm. My father is a ___ (farmer) (Carlisle, 2000)	3rd,5th
awareness of the relationships between the morphemes in the word	comes from task	Does the word mother come from the word moth? (Apel et al., 2013)	preschool , 1st, 2nd
awareness of the different morphemes in the word	segmenting task	Tell me how many different words can you hear in the word recyclable? (Casalis et al., 2004)	aged 8-13 years
awareness of morphemes in words (nonwords)	affix identification: Identifying real affixes attached to base words nonwords	Circle adds on in words: doeper, rhinning, hetts, remape (Apel et al., 2013	preschool 1st, 2nd
awareness of the meaning of morphemes in compounds	rehit task	Say "re" and say "read". Then put these two words together. What does it mean? (Apel et al., 2013)	preschool 1st, 2nd
Awareness of the meaning of different suffixes and changes in the part of speech depending on different suffixes	multiple choice test	Complete the sentence with the correct word. When they decided to build a house, they had to find a _____ location for it. A. suitlike/B. suitability/C. suitable/ D. sulphurous. (Tyler & Nagy, 1989; Nippold & Sun, 2008)	4th, 6th, 8th
Awareness of the meaning of affixes and the changes in the meaning	Definition Defining nonwords	Define the following words: unclimb (Nunes et al., 2006)	2nd ,3rd, 4th
Awareness of the meaning of morphemes in a derived word	morphological analysis four multiple choice definitions 1 correct item and 3 distractors	Four multiple choice definitions: mournful: A: to feel sad/ B: to feel happy/C: to feel funny, D: to feel angry (Deacon et al., 2017; Levesque, 2017)	3rd ,5th
Ability to segment and analyse multimorphemic words	analysis of multimorphemic words dynamic assessment task segmentation	Tell me what the word beastly means? Tell me what smaller words you can find in the word beastly? (Larsen & Nippold, 2007)	6th
awareness of the rules of the language on the word level	word analogy	push:pushed::jump: ____ teach:teacher::work: ____(Nunes et al., 2006, Kirby et al., 2012)	2nd - 4th preschool 1st-3rd
awareness of the rules of the language on the word level	word analogy with nonwords	This is a wug. Now, there are two of them. There are two _____. This is a dog with quirks. What kind of dog is that? _____ (Berko, 1958)	preschool 1st
awareness of the rules of the language on the sentence level	sentence analogy	Tom helps Mary: Tom helped Mary. Tom sees Mary: ____ (Nunes et al., 2006)	2nd - 4th

Researchers used production type tasks to assess the acquisition of inflectional and derivational morphology. The target morphemes were varied usually multimorphemic words. In other cases children had to decompose multimorphemic word. (e.g. *"friendly. I want to be his* _____.") (Apel et al., 2013; Carlisle, 2000; Green, 2004, November; Ku & Anderson, 2003; Kuo &Anderson, 2006). World analogies were also used to assess students' morphological awareness skills. These exercises were usually presented orally. Kirby et al. (2012) used analogy tasks to measure morphological awareness. (e.g. "*push: pushed::jump,* _____). Deacon & Kirby (2004) used sentence analogies (e.g. *Peter plays at school; Peter played at school: Peter works at school:* _____. Only analogy type tasks with inflectional morphological items were used in the research (Deacon & Kirby, 2004).

Apel et al. (2013) observed that researchers usually use different methods in their research; therefore, it is difficult to compare the results. It is an interesting fact that no research studies have assessed students' identification of affixes within written words. They proposed four tasks for assessing morphological awareness, and for assessing different levels and aspects of morphological awareness. The Relatives Task, a cloze task, was based on production measures used by Carlisle (2000). Students were given a base word and then they were asked to finish the sentence using the base word. (e.g. run. Every morning the man ___).

The other task they used was the "rehit task". Apel et al., (2013) attempted to determine the children's ability to combine two morphemes into a novel word, give a definition to this word and judge its semantic acceptability in the spoken sentence. Students were asked to repeat the one bound and one free morpheme and then to combine them. Then they were asked to define the new word. When the students gave wrong definitions, they were given two definitions and asked to decide about the acceptability of two definitions. The task tested children's ability to understand the meaning of affixes.

Apel et al. (2013) list several typical tasks to assess morphological awareness. For affix identification the most common task used is the nonwords task, which is typically implemented to test children's ability to manipulate morphemes without being able to rely on their meaning. Berko (1958) was the first who used nonwords with real affixes. Children were asked to identify (circle) real suffixes attached to the base word which do not exist in the English language. As it was mentioned, the "relatives" task which is usually administered orally requires the students to produce multimorphemic word when the base is given in the sentence context. The above mentioned rehit task can be either production or judgment. Real affixes and base words are combined to form pseudo words: in inflectional and derivational morphology.

In this subchapter the most important measures of morphological awareness have been described. The skill has several dimensions and a variety of measures is used to assess it. It is measured both in a written form and orally, individually and in a group. Different tasks including judgement, production, identification and analysis on real and nonwords are utilized to investigate the level of awareness in children; and the development they show throughout primary school years. In shallow orthographies children can learn decoding of the words relatively fast, during the first school year. They become fluent readers in a short time. The research on the processing of multimorphemic words is addressed in order to get an insight into the reading process. Therefore, this research concentrated on the children's awareness of the grammatical structures rather than on word reading. There are no online instruments for measuring morphological awareness online; therefore, there is a niche which this research attempts to fill.

4.5. Paper-based versus Online Assessment

The new-information-communication technologies have greatly contributed to the improvement of pedagogical assessment. Technology offers new assessment methods changing education assessment from authoring, the automatic generation and storage of items through the delivery methods (Csapó, et al., 2010).

Paper based tests have been assessment tools for quite a long time, however, their administration and scoring is a time consuming task. The assessment of tests takes time from preparation and designing creative tasks for the students (Snyder et al., 2005). Online tests offer solutions for these challenges. Using online platforms allows for some reduction of time investment required during the whole testing process. Online assessment is relatively cost effective since it reduces the costs of printing (Dhawan, 2020). Online tools make it easier to create or modify tests. Authoring questions, supervision or approval of the tests can be done more easily. Test items are scored automatically. Various computer programmes provide streamline assessment with adaptive programmes. Computers score tests reliantly no matter how many times they have to correct the same mistake. They do not get angry or frustrated. Online assessment methods have a strong contribution to the valid and reliable assessment. Online assessment facilitates quick and clear reports on candidate results and progress. It makes it easier to give useful feedback to the candidates in the skills they are making progress, which areas of learning require attention (Dhawan, 2020; Shute & Rahimi, 2017; Snyder et al., 2005). Security is of primary importance in online testing. However, making online systems secure and providing privacy require serious efforts and application of new methods (Zughoul, 2013). Students can receive their results confidentially which encourages them to concentrate on improvement rather than comparing themselves with their peers. This kind of security and privacy creates a healthier atmosphere towards the testing process for both the teachers and students as well (Zughoul, 2013).

There are certain issues to be addressed related to the transition from paper-and-pencil (PP) to computer-based (CB) assessment. Csapó et al. (2009) examined how the students perform in PP and CB versions of an inductive reasoning test. The test achievements in PP and CB were highly correlated; there were significant differences between the average score on PP test and the online test. Students performed better in the PP test mode except one subtest which contained multiple choice questions. There were students who significantly performed better on one or on the other media (Csapó et al., 2009).

There are other issues in connection with online assessment. For example, there are certain aspects of skills which are quite difficult to assess with online tests. Reading comprehension requires complex and multidimensional assessment; online tests cover reliably the key features. However, there are some doubts about the validity of these measures because not all the aspects of reading comprehension can be measured by online tests, especially the higher level of reading comprehension. There are several attempts that endeavour to encompass all the dimensions of reading comprehension and develop valid and reliable instruments which support reading instruction (Snyder et al., 2005). Finally, online testing is more secure than a paper-based system.

4.6. Assessment of Reading Comprehension in Primary Grades

This subchapter is about the assessment of reading comprehension in primary grades. Up-to-date and easy to use assessment tools are important to enhance the efficiency of school education. The efficient assessment can shed the light on students' difficulties in comprehension and could support focusing on intervention when it is needed. Reading is a

complex construct; it has different levels and the assessment tools to measure the comprehension should be suitable for the levels which are to be assessed. The construct to be measured should be made clear before choosing the assessment tools. The reading process has three main factors: the reader, the text and the activity. The sociocultural context in which children learn is also important (RRSG, 2002; Hódi, 2018). Comprehension is determined by the reader's cognitive capabilities (attention, memory, and critical inferencing), motivation, and knowledge (vocabulary, topic, comprehension strategies, and experiences). The reader creates different representations of the text: the surface code (exact words), the text base (units representing the meaning of the text) and the mental model (the way the information in the text is processed). The type of text, the familiarity, the medium also influences comprehension; for example, for digital texts have non-linear structure, however, the hyperlinks in the text help understanding (RRSG, 2002). The text format also determines comprehension (Hódi, 2018). The activity involves tasks, and operations the reader does to process the text; for example, skimming, learning. The reading outcomes also influence comprehension; for example, the reader increases his/her knowledge or finds a solution to a problem. Finally, the sociocultural environment, the cultural values of the community, the way they think about the world, that is, the context in which children study has an impact on comprehension as well (Hódi, 2018; RRSG, 2002).

Reading comprehension has different levels. The lowest level of reading comprehension is the literal. The reader identifies the main ideas of the paragraph or the short story. It also includes recalling the details of the story, and sequence in which the main events happened. In grades 1-3 this level of comprehension is required from the students (Cadwell, 2008). The second level of comprehension is the interpretive or inferential level; the reader interprets the information to find the answers. They predict endings and anticipate consequences, state reasons for events, make generalisations. On the third level of comprehension (application level) the readers develop the ability to read between the lines (make judgements, make comparisons, make generalisations, make recommendations and suggestions, create alternative endings) (Cadwell, 2008).

Teachers evaluate reading comprehension for different purposes. The assessment aims to evaluate programs and curricula, identify children at risk for problems, diagnose children with reading problems; and measure student progress/outcomes during the course of intervention. By assessing academic outcomes the use of evidence based reading practices is supported, adequate yearly progress is documented as well. Standardised assessment procedures monitor schools whether they use evidence-based reading practices, make sure that students make yearly progress, and respond when there is a need for improvement (Snyder et al., 2005).

The tools of assessment can vary in a lot of dimensions: text types (narrative, informational, or poetic material) and time constraints. The task types can also be different: multiple choice questions, true-false questions, cloze tests, open ended questions and portfolios. There are three common formats: cloze, question-answering, and retellings. Cloze format tests present sentences or passages with blanks in them (e.g., *"Birds were flying in the ____")*; children were expected to read the text and fill the gap with an appropriate word (for the previous example, a word such as *sky*, *cage*, or *room*). The question-answering format can also be different: multiple-choice or open-ended items and they may be answered orally or in writing.

Some problems were found with almost all task types: When students solve true-false questions, they have 50 % per cent chance to get the answer right. Multiple choice questions can be answered with clever guessing. Close tests rather give information about students' in linguistic and semantic knowledge than about comprehension. The assessment scales of portfolios were found to be neither reliable nor valid (Snyder et al., Wise, 2005). There are

some discrepancies found related to reading research and system-level assessments. System-level assessments do not usually present a wide range of text formats. Certain text formats, for example, non-continuous text format are underrepresented in system-level assessments (Hódi, 2018).

When constructing a test the curriculum standards for the given age group must be considered. The National Core Curriculum (2020) and the new framework curricula set the guidelines for the reading standards in Hungary. Children in grades 1-4 acquire the foundations of reading comprehension. Children must acquire the first (literal comprehension) and second levels of reading comprehension (interpreting or inferential level). Besides being able to answer questions about the main idea, the details of the story, they must be able to summarise the story with their own words. Basic reading strategies, for example, inferencing, and ability to use graphical organisers are required.

Reading comprehension difficulties can be caused by deficiencies on different levels. The most obvious problems can emerge from the deficiencies related to word identification, lack of vocabulary, inefficiencies in orthographical, semantic, morphological and syntactic processing. The lack of cognitive capabilities (attention, memory) can also limit the access to the comprehension. Non-continuous and mixed format texts require using different cognitive aspects; therefore, understanding these texts is more difficult for children (Hódi, 2018). The background knowledge and cultural specificities will also lead to difficulties in understanding (Coppola, 2014).

4.7. Gender Differences in Reading and Language Skills

Boys' and girls' performances are often compared in system-level assessments and it is a frequently observed research finding that girls outperform boys on tasks of reading and language abilities, but there are large differences in effect sizes from sample to sample. Gender differences in performances in cognitive abilities are usually found in demographically representative samples (Reilly, Neumann & Andrews, 2019). Some researchers argue that differences in reading abilities between genders are usually small or do not exist at all (Carroll & Fox, 2017; McGeown et al., 2012). Gender similarity hypothesis claims that boys and girls have more similarities than differences. Males and females are similar on most psychological variables. Shibley-Hyde (2005) collected 46 meta-analyses and investigated gender differences in diverse abilities; for example, language skills. She claimed that 78% of the studies showed gender differences to be small or negligible (Shibley-Hyde, 2005).

Although boys and girls are more similar than different we can find more boys in groups with reading impairment, dyslexia and attention disorders than girls (Reilly et al., 2019). This phenomenon is often explained by the greater male variability effect that claims that males show greater variability in cognitive performance (Gray et al., 2019). Evidence for gender differences have been found in large international assessments (OECD, 2019). Reilly et al. (2019) examined 3.035 million students' national performance data for NAEP reading assessments. Students' achievements in reading and in grades 4, 8 and 12 were investigated. Girls significantly outperformed boys in every task in every grade. Another finding was that the differences in achievements between boys and girls increased with age. The differences were smaller in grade 4 and got bigger in grade 8. Research shows that females also score higher on standardised tests of spelling and linguistic skills which calls the attention to the importance of these basic skills (Reilly et al., 2019; Stanley et al., 1992). Moss and Washbrook (2016) found that gender influences literacy attainment and the language development regardless of social situation. They examined literacy achievements of children

aged 7-11years and found that early language and attention skills strongly predict poorer literacy at 11. More boys than girls have poorer early language skills at the age of 5. The study assumes that "two third of gender gap in achieving the required level in reading at 11 years of age is attributable to the fact that boys have lower levels of language and attention at the age of 5" (Moss & Washbrook, 2016, p.3). It was also found that girls' attention and prosocial behaviour scores were particularly better than boys' scores. Boys lag behind the girls in language acquisition and communication. All developmental disorders concerning language, communication skills primarily affect boys. Language and communication development is faster in boys than in girls (Adani & Cepanec, 2019).

These differences are important because a number of boys as well as girls who do not become good readers might not be able to learn independently. They become low achievers at school; they have less chance to pursue university or college studies. The educational implications of these results call the attention to the importance of early intervention programmes for reading from which boys and girls would equally benefit (Reilly et al., 2019).

4.8. The Role of Morphological Instruction in Reading Acquisition

The development of reading skills is important in all education systems since being able to comprehend information from written texts is a prerequisite for success for both the individual and the society. Therefore, efficient reading instruction and reading intervention programmes are important for both teachers and students. The primary aim of intervention programmes is to foster children's skills in different subjects. All efforts made to determine better ways of helping children acquire good reading skills support the effectiveness of the educational system. (Steklács, 2013, 2018a, 2018b). First, this subchapter gives a short review of studies on intervention programmes which develop reading comprehension skills by giving morphological and reading instruction to children (Carlisle, 2010; Casalis & Colé Nunes et al., 2003).

A great number of studies focused on reading acquisition; and revealed several preconditions and components of the skill (Adamikné Jászó, 2006; Cs. Czachesz, 2014; Csapó & Csépe, 2012; Csapó et al., 2015; Gósy, 2008; Steklács, 2013). Reading intervention programmes focused on different factors of reading comprehension; however, the linguistic aspects of reading acquisition and reading comprehension got relatively little attention. Although children receive morphological instruction in primary grades it seems that it would be beneficial to enhance children's motivation to learn about the language by innovative teaching methods.

Hungarian Core Curriculum (NCC) (2020) suggests fostering grammatical skills in a playful way rather than repeating grammatical rules. The Framework Curriculum for Grades 1-4 (2020) mentions the importance of developing metalinguistic awareness skills. In grade 2 children start being familiar with the term stem and affixes. They acquire inflectional morphology and recognition of basic suffixes; for example, -ban, -ben, -ba, -be, -ból, -ből, -ról, -ről, - val, -vel. In grade 3, children learn morpheme segmentation and they are introduced to homonyms. The curriculum includes the recognition of verbal inflections; for example, the inflections for present, past and future tenses. Children learn to decompose nouns and adjectives. Nominal inflections; for example, plurals are identified. They master derivation in grade level texts. In grade 4, compound morphology is mastered. Children must acquire syntactic functions of morphemes and they must recognise and decompose different parts of speech (nouns, verbs, adjectives). Numerals and postpositions are recognized as well.

The importance of morphological instruction was supported by psycholinguistic studies which emphasise that language acquisition is the basis of reading acquisition and the

development of the mental lexicon (Babarczy et al., 2014; Csépe, 2006, 2014; Gósy, 2008; Gósy & Krepsz, 2017). There are some excellent examples for intervention programmes developing morphological awareness in an effective way (McLeod & Apel, 2015; Wolter & Green 2013)

Morphological instruction is connected to improving metalinguistic awareness skills which help children consciously think about the nature of the language. This skill makes children be capable of concentrating on the structure of the language, and differentiate between the linguistic elements and do different manipulations with different parts of the words (Altman et. al., 2018; Cs. Czachesz, 2014; Kuo & Alderson, 2006; Nagy et al., 2014). Morphological intervention programmes could improve metalinguistic awareness skills which include all subskills which take part in processing linguistic information; for example, morphological, phonological, syntactic and lexical awareness; these skills are closely connected to each other.

It is important to improve metalinguistic skills in school environments because children reach a basic level of metalinguistic knowledge by the age of six, and they are able to understand the basic differences between the different linguistic elements and they are capable of utilizing their abilities during communication (Bialystok et al., 2014). Reading research supports the contribution of metalinguistic awareness and its components (morphological awareness) to reading acquisition; and the correlation between metalinguistic awareness, its subskills and reading comprehension is demonstrated as well (Adamikné Jászó, 2006; Bialystok et al., 2014). There are debates about which subkill is the most important in which part of reading acquisition; for example, phonological awareness in the initial part of reading acquisition (Csapó, et al., 2015; Jordanidisz, 2010; Török & Hódi, 2015; Török et al., 2016); morphological, syntactic, and lexical awareness play a crucial role in the consolidated alphabetic phase (Ehri, 2005).

The impacts of morphological intervention programmes have not been researched in Hungary before; however, it has come to the forefront in reading research worldwide recently. Morphological intervention programmes could foster the ability to identify morphemes, to do operations with the constituent morphemes of the words; the ability to understand how words are formed, how the language works. The role of morphological awareness in reading acquisition can be described in different ways. It develops (1) relational, (2) syntactic and (3) distributional knowledge which are presented in inflectional, derivational and compound morphology. This knowledge facilitates guessing the meaning of unfamiliar words since children learn to identify the stem and the affixes. Children learn to understand the syntactic functions of morphemes. Morphological instruction also fosters distributional knowledge which encompasses how suffixes are constrained by the syntactic category of the stem they are attached to. Morphological instruction primarily supports literal reading comprehension possibly in a bidirectional way (Carlisle, 2010).

According to Verhoeven and Perfetti (2017), morphological processing works across different writing systems; therefore, it influences reading comprehension through the retrieval of the phonological, semantic segments of the word. Therefore, teaching morphological knowledge; for example, segmentation of the morphemes improves the processing of the orthographic form and the processing of semantic information. Word recognition is the key to the comprehension; therefore, morphological intervention affects comprehension directly and in directly as well (Gósy & Krepsz, 2017; Török & Hódi, 2015). Children could get instructed in identifying different morphemes within the word which helps children understand the meaning of multimorphemic words.

The ability to segment words and manipulate the structure of the word supports the development of reading skills. According to Zhang and Koda (2012) morphological awareness influences the representation of words, the size of vocabulary, which influences

reading comprehension as well. Their findings indicate that the development of morphological awareness is closely attached to the accuracy of the reading comprehension. There is a bidirectional relationship between the development of morphological awareness and reading comprehension, that is, as a result of literacy acquisition morphological awareness develops more intensively, and morphological awareness supports reading comprehension. Therefore, intervention programmes aiming to develop these skills might be effective in supporting struggling readers to develop better reading skills (Carlisle, 2010; Deacon et al., 2012).

4.9. Morphological Intervention Programmes

Several researchers propose that morphological awareness can predict reading comprehension after the initial phases of the reading acquisition (Carlisle, 2010; Clarke et al., 2010; Kirk & Gillon, 2009; Wolter and Green, 2013; Xiaoying et al., 2009). Carlisle (2010) summarized the results of 16 different intervention programmes; the author pointed out that they found it important to use the tasks developing morphological awareness in their pedagogical practice because of their relevance and usefulness in education. These tasks promoted the acquisition of metalinguistic awareness and other linguistic competences. Carlisle (2010) used different points to classify experiments; the authors, the purpose the design and method (participants, treatment duration, content and the instruction). Several experiments employed three experimental groups (morphemic instruction only, context only, combined morphemic and context instruction) and a control group (Baumann et al., 2003; Carlisle, 2010). Other experiments combined morphological instructions with other literacy tasks as well, and treatments improving textbook vocabulary, morphemic and contextual analysis (Beumann et al., 2003). They compared the results of the groups that got only morphological treatments, with the ones which got mixed treatments, for example, reading, vocabulary and morphological tasks as well. In the intervention programmes different morphological intervention tasks were used, for example, word building, word sorts, and reading exercises like summarizing passages in writing (Berlinger et al., 2003; Carlisle, 2010).

Some programmes (Nunes et al., 2003) employed explicit grammatical treatments, and procedures by language units; however, most programmes do not mention explicit teaching of grammar. Nagy et al., (2002) implemented a programme which based on teaching morphological analysis, showing a lot of examples rather than forcing children to memorize grammatical rules. Casalis and Colé (2009) focused on derivational morphology; children studied inflections only in one lesson; the participants were instructed about the constituent morphemes of the words: base words and suffixes; segmentation and composition tasks (Carlisle, 2010; Casalis & Colé, 2009). Most programmes taught children in a class or group setting using oral instructions; some combined oral and written instructions (Carlisle, 2010; Nunes et al, 2003).

Kirk and Gillon (2009) evaluated the results of their intervention programme which aimed to improve both spelling and reading skills. The tasks implemented were related to morphological awareness and other forms of metalinguistic awareness, for example, phonology, spelling, semantic and syntactic awareness. Children who took part in the programme were 8-11 years of age, and they took part in 19.4 intervention sessions. During the sessions children practised the recognition of different parts of the words, and the spelling as well. The comparison of the results of the experimental group and the control group demonstrated that the intervention was successful and the experimental group showed better performance than the control group both in reading comprehension and spelling. Besides, the

experimental group applied the rules they learned about word formation much better than the control group which received a regular instruction (Kirk & Dillon, 2009).

Clarke et al. (2010) reports on the results of three reading intervention programmes. Children with reading difficulties took part in the intervention programme. 84 children participated in the intervention programme were selected from 23 schools. While the first group practised reading comprehension with different reading strategies, the second group received treatments in vocabulary building, and third programme was the mixture of the first and the second one. In the first half of the programme they solved reading tasks and in the other half of the programme they did vocabulary building exercises (Clarke et al., 2010). The experimenters conducted four surveys before and after the intervention. The pretest was the first one, and after the intervention they tested the children in the 10th, 20th weeks, and 11 months later too. The pretest showed that the control group performed better than the experimental group. During the intervention the differences were equalized, moreover, in some cases the experimental group outperformed the control group. The vocabulary building exercises proved to be the most efficient. Children who took part in the vocabulary treatment showed growth even 10 months after the intervention (Clarke et al., 2010).

Xiaoying et al. (2009) carried out an experiment with 169 Chinese children. The first half of the group got treatments in morphological awareness at the beginning of the second and third grades; the other half did not get treatments at all. The posttests proved that the intervention tasks improved the results of the students both in morphological awareness and reading comprehension.

Wolter and Green (2013) observed that their programme which aimed to develop morphological awareness improved the development of a child with reading and spelling difficulties in phonological awareness, spelling and reading comprehension. The research-based theoretically founded intervention programme supported the development of the student's capability development. A case study of an 8-year-old boy was analysed who had been diagnosed with a speech and language impairment, as well as a reading deficit. The intervention was successful which meant that the ability of recognising morphemes supports automatic word recognition and word reading, and on the other hand, segmenting words helped the recognition of word meanings which supported the comprehension of texts as well. Wolter and Green (2013) measured children's performances in the preintervention and the postintervention tasks. Different intervention tasks included vocabulary, reading, word attack, word identification, the Test of Silent Reading Fluency (TOSWRF), phonological awareness, segmenting nonwords. Morphological awareness consisted of relational tasks: words with transparent relationships, word with opaque relationships, production tasks: words with transparent relationships, words with opaque relationships.

McLeod and Apel (2015) conducted a morphological intervention programme. It was a case study. Gordon, six years of age, received a 7-week intervention; he took part in 25 sessions which were 35 minutes long. The boy had a language and speech impairment. He was instructed by phonological, morphological awareness tasks (word attack, word identification, segmenting, relational, rehit, and relational and production tasks) as well as he received treatments in reading comprehension. The research findings demonstrated the effectiveness of morphological intervention even for children with disabilities (McLeod & Apel, 2015).

4.10. Digital Reading Intervention Programmes

In this subchapter some digital intervention programmes and game-based intervention programmes are reviewed (Amendum et al., 2011; Horne, 2017; Jong, 2015). Teachers and

children could benefit from intervention programmes, on the other hand, a lot of extra time and efforts are needed to implement and integrate them into the school curriculum. In addition, intervention programmes were mostly paper-based in the past, which made them expensive. Therefore, it was rather complicated to utilize of them in the everyday teaching practice. However, online intervention programmes offer solutions; for example, the opportunity of the automatic feedback, an innovative items and easy data handling which would support the implementation of school intervention programmes, pretests and the posttests as well. Teachers could follow the progress of their students on the online surface and students would find learning more rewarding since they would see their own results as well. A number of research efforts have been made to combine the benefits of intervention programmes with the opportunities provided by online systems (Amendum et al., 2011; Erhel and Jamet 2013; Franceschini et al., 2013; Hall et al., 2000; Horne, 2017; Hwang & Wu, 2012; James, 2014; Jong, 2015; Jamshidifarsani et al., 2018; Mioduser et al., 2000; Van Eck, 2006).

Jamshidifarsani et al. (2018) in their analytical review presented a comprehensive overview of the studies published on technology-based reading interventions for primary school children. They did research on Google Scholar studies database and found 42 studies about the topic. Jamshidifarsani et al., (2018) analysed 32 intervention programmes between 2000 and 2017. The studies were divided into six categories: phonological awareness, phonics, vocabulary, comprehension, fluency and multi-component. Jamshidifarsani et al. pointed out that more research would be needed to develop innovative reading approaches. They suggested emotion interaction being included in the research. In addition, to enhance the effectiveness of the intervention intelligent self-adaptable systems should be developed to assess students' skills (Jamshidifarsani et al., 2018).

Horne (2017) analysed the impacts of the Comprehension Booster which was developed for children who struggle with reading. Horne (2017) noted that this topic did not get enough attention in the research literature despite the fact the computer enhanced learning complemented the traditional paper-based, face-to-face education to an increasing extent. Horne (2017) was the first researcher who conducted an empirical research in connection with the programme. 36 children (26 boys and 12 girls) took part in the survey. The programme lasted for 6 weeks, the half of the group (the experimental group) received treatments based on Comprehension Booster programme, while the other half of the group (control group) received traditional education at school. The programme provided interactive tasks to children aged 7-12 years old, which developed reading comprehension skills. The tasks included texts of different length, topic and the level of difficulty, printed and listening texts; the programme consisted of 70 fiction and 70 nonfiction texts, images, vocabulary building exercises with the explanation of 1800 not frequent words. Every passage was followed by a multiple choice unit which contained questions checking comprehension (Horne, 2017). The posttest the performance of the experimental groups showed a significant difference in the accuracy of reading and in the comprehension performances. Horne (2017) declared that the computer enhanced intervention proved to be useful; however, it could not replace the traditional face-to face education.

Mioduser et al. (2000) examined the impacts of a technology-based reading intervention programme for preschool children. 46 preschool children (5-6 years of age) took part in the intervention. The children who were selected were at risk to develop learning difficulties. The selection was based on the results of the pretest. The children were divided into three groups and they received different types of intervention. The first group (7 children) got printed teaching materials and digital treatments as well. The second group (15 children) got only printed materials, and the third group (15children) was the control group, they did not get any reading treatments, and took part in the traditional preschool activities. The first part of

the intervention was aimed at preparing children for reading acquisition, for example, recognition of graphemes and phonemes (letter and sounds), visual discrimination were practised. The second phase contained reading acquisition tasks. In the digital version children got templates similar to games. Children were tested after the intervention and the test revealed that in the case of children who were at risk of developing learning difficulties the programme efficiently developed phonological awareness, morpheme-grapheme recognition, naming of letters, compared to those children who did not get any treatments or learned from printed materials (Mioduser et al., 2000).

Franceschini et al. (2013) examined the impact of playing action videogames in dyslexic grade 2 children, and found that only 12 hours of video gaming developed children's reading performances. They tested reading abilities, phonological awareness, and attention span in the group which contained two dyslexic children. The experimental group played action videogames, the control group played videogames which were not action games. The children were tested before and after playing videogames. Although the beneficial effects of the intervention were analysed little information was provided about the children's background or the content of the action video games.

Erhel and Jamet (2013) wrote a study about effects of digital game-based learning, feedback and instructions on the motivation, and the effectiveness of learning; and opportunities of using digital games in education. Based on experiments Erhel and Jamet (2013) pointed out that digital games were accepted as an approved teaching method to an increasing extent. According to the experiments serious games promoted the learning process provided that the game gave appropriate instructions and feedback, which motivated the learners and it mobilized the learners' cognitive processes.

Jong (2015) also discussed whether online game-based programmes could be fitted into traditional education. The study described a pedagogical experiment with 198 students. In the experiment they compared the effectiveness of traditional face to face education with the effectiveness of the digital game-based learning. The experimental group studied with VISOLE computer programme. The experimental group consisted of children from low middle and high rates of schools, and the children were divided into six groups; three experimental and three control groups. The results of the experiment showed that in the case of struggling students the VISOLE programme showed positive effects, however, in the case of outstanding students this positive influence was not observed (Jong, 2015).

Van Eck (2006) discusses general theoretical issues on game-based learning. Although there are several advantages of the game-based learning; for example, its motivating power, the education cannot use game-based learning to an appropriate extent owing to the prejudice against using online games as teaching tools.

One of the most important arguments against game-based learning is that many people think that digital games entertain, however, they do not teach, because playing is the opposite of working. The most important virtue of the digital game-based learning is that the learning process, the practice and the testing take place in a seemingly realistic environment (Westera, 2015); it is called a situation-based learning process. Games are basic tools for socialisation and learning; and gaming is typical of the animals as well (Westera, 2015). Piaget's learning theory mentions that learning is assimilation which means that people try to fit the new information into their existing concepts about the real world. Games use cognitive disequilibrium which means that when the problem cannot be solved by using the existing schemas, one should find new schemas or change old schema to solve the problem. Well designed games create cognitive imbalance to support learning (Van Eck, 2006). The player is motivated to constantly search for answers. Besides the great number of advantages offered by the digital serious games, for instance, the development of cognitive skills, problem solving skills, enhancing reaction skills, keeping up the motivation for a long time and the

immediate feedback (Westera, 2015), games have a lot of disadvantages, e.g., they were not originally designed for learning purposes. They are not suitable for using in all topics and the scale of the knowledge acquired by playing games is limited. Not all the subjects can be taught in a playful way. In addition, the creation of the best games require serious teamwork; the collaboration of different experts, for example, researchers, programmers, graphic designers and artists which is time consuming and expensive (Van Eck, 2006).

Digital games are suitable for motivating students to learn certain subjects; however, they are not able to keep up the motivation for a long time. The usage of the digital games can be applicable by ensuring the balance of classroom activities. The widespread use of online digital games is hampered by several factors. These can be technical problems, for example, the shortage or lack of computers, conditions and capacity of computers, the shortage of usable software, the low capacity of the wide bandwidth internet connection. Van Eck (2006) suggests the good practices of using serious games in a classroom environment should be collected and published. Providing the institutional and financial background can also be a challenge (Van Eck, 2006).

Amendum et al. (2011) reported the impact assessment of an intervention programme which was designed for children with reading difficulties. The technology based Targeted Reading Intervention programme aimed at helping preschool children and first grades who struggled with reading acquisition. 364 children took part in the research who came from low SES families, and from a poor country background. The children were tested with standard tests before and after the intervention, and the participants of the experimental and the control groups were randomly selected. They were taught with TRI (Targeted Reading Intervention) method. The programme was implemented through laptop and web camera. The intervention was supported by TRI experts, who could monitor the intervention by a web camera, and they could give assistance through videoconferencing. The programme focused on the development of reading fluency. Children got treatments in different subskills; in phonological awareness, vocabulary building, reading aloud, word recognition, reading comprehension and spelling. Results showed that the children who participated outperformed the one who did not get a treatment (Amendum et al., 2011).

In summary, it is important to point out that intervention programmes proved to be successful in developing cognitive skills. Therefore, it is essential to find the possibilities for fostering morphological awareness and reading comprehension skills. It would also be necessary to combine morphological instruction with the advantages of online game-based intervention programmes.

5. READING MOTIVATION

This chapter reviews some key terms related to reading motivation. Reading proficiency is closely connected with reading motivation. Different aspects of reading motivation for example, intrinsic, extrinsic motivation and reading self-concept are discussed. Research findings on the relationship between word reading, reading performances, and reading motivation are analysed including the differences between boys' and girls' reading motivation. Some instruments assessing reading motivation and the problem of decreasing reading motivation are also discussed.

5.1. Definition of Reading Motivation

Research proves that students' motivation is a key factor in successful reading. Students who are interested in reading spend more time reading, however, the ones who are not motivated avoid reading. In a long term it is hypothesised that the students who are more engaged in reading become more proficient in solving reading tasks, and understand more complex written information (Klauda & Guthrie, 2015).

Becoming a good reader is a long process. Motivation supports the process of developing good reading skills. In the first phase of reading acquisition reading is simply understood as decoding (converting written texts into sounds). Reading literacy encompasses a wide range of linguistic and cognitive competencies. It consists of basic grammatical and lexical knowledge, mapping the meaning one's knowledge about the world. It also includes metacognitive reading strategies when the reader chooses his/her strategy when reading a text. Motivation helps students become a proficient reader, namely, to develop one's knowledge about a subject or field, and develop an ability to learn, use and communicate the written information (OECD, 2019). Good readers understand more from the written texts. The word understanding is closely associated with reading comprehension which means integrating the meaning of the text into the readers' present knowledge. The lower stages of reading include the ability to decode the letters and recognise the words and it can be extended by the application of mental models how the text reflects the real world. The more advanced levels of reading proficiency cannot be developed without motivation. Motivation helps students to undertake more challenging reading tasks which require the use of metacognitive strategies, for example, use the information in the text for different purposes, solve a task, or act in a situation (OECD, 2019).

Since PISA 2000, the reading literacy framework has performed the assessment on reading motivation, reading motivation questionnaire items and scales were developed to measure motivational attributes, for example, the attitude towards reading and reading practices. It has been declared that reading motivation and reading strategies can depend on different factors; the context and the type of the text. The questionnaire items were created to pay attention to the different situations students have to use their reading skills in (PISA2018).

5.2. Aspects of Reading Motivation

Reading motivation is a multifaceted construct. There are some definitions of reading motivation. Guthrie & Wigfield defined it as "the individual's personal goals, values, and beliefs with regard to the topics, processes, and outcomes of reading" (Guthrie & Wigfield, 2000, p. 405). Reading motivation is defined as students' reading practices, motivation and

attitudes reading and the awareness how effective their reading strategies are; and this awareness plays an important role in developing reading proficiency (OECD, 2019).

Studies found that students who read because they are interested in reading either printed or online texts, read more and become a better reader, however, the ones who read only because it is compulsory will read less and will be less proficient in reading (Molitorisz, 2013). There are certain factors which are worth considering because they are predictors of reading performances and because they are important objectives of the school system and can promote life–long learning. These factors are motivation, practices and metacognition. Studies prove that motivation and practices can be positively changed by teaching different reading strategies to children (OECD, 2019). Research terminology distinguishes intrinsic and extrinsic motivation.

Extrinsic motivation is usually referred to as the willingness to take part in activities to gain external rewards. For example, students read because they want to get good grades, parents' and teachers' appreciation. Intrinsic motivation is a sort of behaviour of doing something without getting a reward, namely, the person engages in an activity for his/her own enjoyment, the activity itself is the reward. For example, students read because they like reading.

Reading motivation has different dimensions; however, one of the most researched dimensions is connected to self-efficacy. Many researchers focus on students' sense of efficacy and beliefs about their ability. Bandura (1986) assumes that motivation is the result of an individual's self-efficacy related to a task. Bandura defines self-efficacy as the beliefs people have about themselves that encourage us to make choices, make efforts, and persevere through challenges. Self-efficacy means that the reader is interested in what he/she is reading and reads with enjoyment. This factor includes a number of affective and behavioural characteristics, it also encompasses that the reader has a control over what he reads, and involved in social dimension of reading and in everyday common reading practices (OECD, 2019).

Reading motivation has been researched widely in the last few decades since studies found reading literacy and reading comprehension results are closely connected with reading motivation. Reading engagement is closely associated with intrinsic reading motivation. Reading engagement is different from general reading motivation. Motivation includes beliefs goals values in a specific topic or area; engagement is comprised of efforts, time and energy which are invested into reaching the targeted results. A number of empirical studies prove the motivation and engagement have an impact on reading performances. In OECD 2000 a strong correlation was shown (OECD, 2019) between reading engagement (intrinsic motivation, comprising interest, avoidance of reading and practices) and reading abilities (OECD, 2002; 2010). Reading motivation was hypothesised to explain reading performances better than other variables (Guthrie et al., 2007) and it is also linked to success in learning and learning outside school. Motivation helps reduce the difference in reading skills of different ability students and it can be a driving for reaching better results and reduces the possibility of developing a negative attitude towards reading. The lack of interest has a strong negative impact on reading proficiency (Klauda & Guthrie, 2015).

Reading self-concept is related to reading motivation and to reading performance. It is the individual's self-perception of oneself as a reader (Chapman & Tunmer, 1995, 2003; Hódi, 2018; Katzir et al., 2018; Szenczi, 2008, 2013). Chapman and Tunmer (2003) found that phonological processing ability and letter-name knowledge at the beginning of formal education predict reading performance, academic self-concept and reading self-efficacy as well. They also found that children's beliefs are linked to their reading performances (Chapman & Tunmer, 2003). Katzir et al. (2009) claimed that children with more positive reading self-concept have a higher performance in reading comprehension after accounting

for their verbal ability and word reading (Katzir et al., 2009). Hódi (2018) found that grade 2 children's reading performances and self-concept showed significant relationships. Ecological data was less related to reading achievements (Hódi, 2018).

5.3. Instruments for Measuring Reading Motivation

Reading motivation was examined by Wigfield and Guthrie (1997). They designed a questionnaire which aimed to examine reading motivation. They examined how reading motivation influences the amount and breadth of reading in 105 fifth grade students. They assessed self-efficacy, intrinsic-extrinsic motivation, goals and social aspects. The 11 aspects they investigated were the following: reading efficacy, reading challenge, reading curiosity, reading involvement, importance of reading, reading work avoidance, competition in reading, recognition for reading, reading for grades and social reasons for reading and compliance. The internal consistency (alpha) estimates for the 11 scale scores ranged from 0.43 to 0.81 (Wigfield & Guthrie, 1997).

Reading efficacy dimension of the questionnaire included items about how children assess themselves regarding their proficiency in reading: "I know that I will do well in reading next year", "I am a good reader", "I learn more from reading than most students in the class". The items about challenge tested the children's willingness to undertake challenging reading tasks: "I like hard, challenging books.", "If a book is interesting, I don't care how hard it is to read". The statements about curiosity assessed students' interest in reading: „I have favourite subjects that I like to read about". The questions about Involvement contained items evaluating how much students feel a part of the story they are reading, for example, "I read stories about fantasy and make believe" (Wigfield & Guthrie, 1997).

The questions also referred to how important reading achievements are for the students: "It is very important to me to be a good reader". Recognition from parents and peers was assessed by questions like "My friends sometimes tell me I am a good reader" and "I like to get compliments for my reading." The questionnaire investigated whether children read for grades or not: "I read to improve my grades ", "My parents ask me about my reading grade ". Statements on Social dimension of motivation evaluated how much the child enjoys social activities in connection with reading by questions like "I visit the library often with my family". Compliance with school criteria was tested by statements like "I read because I have to" or "I do as little schoolwork as possible in reading." Competition questions tested the children's desire to be better in reading than their peers: "I try to get more answers right than my friends. ", "I like being the best at reading. Children who do not like reading usually avoid reading if they can. Reading work avoidance was examined by items, for example, "I don't like vocabulary questions", "Complicated stories are no fun to read. ", "I don't like reading something when the words arc too difficult" (Wigfield & Guthrie, 1997, p.431). Children answered each item on a 1 to 4 scale, with answer choices ranging from "very different from me to a lot like me "(Wigfield & Guthrie, 1997, p.422)

Most research assessing reading motivation implement statements based on a questionnaire developed by Wigfield and Guthrie (1997). The questionnaire has different versions; for example, the one used by Guthrie (2009), which contained items about efficacy for reading, reading orientation, perceptions of difficulty in reading.

Guthrie et al. (2007) conducted research on reading motivation and reading comprehension growth in the later elementary years in 31 fourth grade students. The research was a part of a bigger intervention programme. Children's motivation was measured in September and in December. The methods included different aspects of motivation, for example, interest, perceived control, collaboration, involvement, and efficacy, different text genres, specific and general contexts. They administered semi-structured interviews, multiple

text comprehension, pretest and posttest general composite motivation, situated total motivation, situated narrative motivation, situated informational motivation, teachers' ratings (Guthrie et al., 2007).

De Naeghel et al. (2012) examined the dimensions of reading motivation; a recreational and academic reading motivation in 1,260 Flemish students in grade 5 and their 67 teachers. The study shed the light on the relationship among reading motivation, reading self-concept, reading behaviour (i.e., engagement and frequency), and reading proficiency. A questionnaire based on the self-determination theory was developed and validated to assess 2 factors of reading motivation: autonomous and controlled motivation. It contained items assessing autonomous reading motivation in a recreational context and in school context. The questions referring to recreational and academic context assessed intrinsic motivation (e.g.," I enjoy reading", "e. g., I read for school because it's fun to read "); controlled reading motivation questions evaluated extrinsic regulation (e.g., " I read in my free time because I don't want to disappoint others") (De Naeghel et al., 2012). Reading self-concept was also assessed by Chapman and Tunmer (1995, 2003) by the reading self-concept scale consisting of 30 items. The scale investigates perceptions of competence in reading, perceptions of difficulty in reading, and attitudes towards reading.

Davis et al. (2018) summarized 16 current reading motivation scales. Databases PsychInfo, Psych were selected for search. There were two main criteria for selection. First, only the motivation scales developed after and including the year 1990 were examined. Secondly, they analysed only the scales that included some aspect of a self-report Likert-type scale. A number of strengths were found, for example, extensive information referring to reliability and validity, large sample sizes for the development. The authors suggested adapting elementary school scales to fit the needs of their older or younger students. They also recommended to develop of a set of reading motivation measures for children from early childhood to adolescence (Davis et al., 2018).

5.4. The Relationship between Reading Motivation and Reading Performance

Research on the relationship between reading motivation and reading achievements suggests that intrinsic reading motivation, engagement and self-efficacy contribute to reading achievements (Guthrie et al, 2007; Klauda & Guthrie, 2015; Solheim, 2011).

This hypothesis is supported by a number of research studies, for example, Wigfield & Guthrie (1997) found that intrinsic motivation, which consisted of the scales measuring the reading challenge, reading curiosity, and reading involvement, showed significant relationships with reading proficiency. Other researchers also found that children's intrinsic reading motivation and reading efficacy correlated with their reading skill whereas their extrinsic reading motivation did not (McGeown et al., 2012).

Guthrie et al. (2007) examined reading motivation and reading comprehension growth in the later elementary years in grade 4. Guthrie et al. (2007) assumes that there is a correlation among motivational and reading comprehension variables. "The interview- based reading motivation coding predicted reading comprehension growth, but reading comprehension did not predict motivation growth." (Guthrie et al., 2007, p. 282) Students' scores for reading motivation for narrative and information texts were not highly correlated. Situation and general motivations were correlated. General reading motivation growth was predicted by situated reading motivation for information books. The students who were interested in special books developed a more general motivation in reading as a result of the intervention. There are significant correlations, for example, among efficacy and interest,

involvement and efficacy. Figure 5.1 shows the gains in reading comprehension associated with reading motivation profiles (Guthrie et al, 2007, p.303).

Solheim (2011) tapped into the processes that could influence reading motivation and reading achievements. She examined the impact of reading self-efficacy and task value on reading comprehension scores in different item formats in 217 fifth graders aged 10–11 years. Reading self-efficacy, reading competence, listening comprehension, nonverbal capabilities were assessed. Reading self efficacy showed a significant positive relationship with reading achievements. Regarding the item formats it was found that reading self-efficacy was a significant positive predictor of reading achievements for students with low self –efficacy in multiple choice comprehension scores but not of constructed-response comprehension scores. For students with high self-efficacy in reading, reading self-efficacy did not account for additional variance in either item format (Solheim, 2011).

The contribution of intrinsic regulation to reading achievements was supported by De Naeghel et al. (2012). Their findings suggest that recreational autonomous reading motivation is linked to more positive reading behaviour and better reading performance. They found reading motivation does not influence reading comprehension through reading frequency or reading engagement. Figure 5.2 describes the relationship among reading comprehension, reading engagement, reading frequency, reading self-concept, recreational/ academic autonomous motivation, recreational/ academic controlled motivation (De Naeghel et al., 2012, p. 1009).

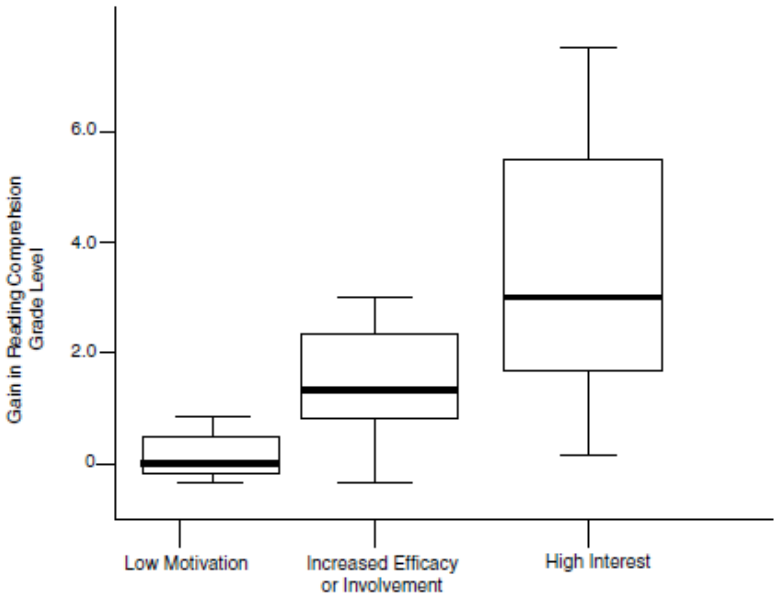

Figure 5.1. Gains in reading comprehension associated with reading motivation profiles (Guthrie et al., 2007)

Klauda and Guthrie (2015) conducted a longitudinal study on the development of reading motivation, engagement, and reading competence in 183 pairs of seventh grade students by comparing interrelations of these variables in struggling and advanced readers. Reading motivations, engagement and comprehension for information texts, general reading comprehension and reading fluency were assessed twice during the school year.

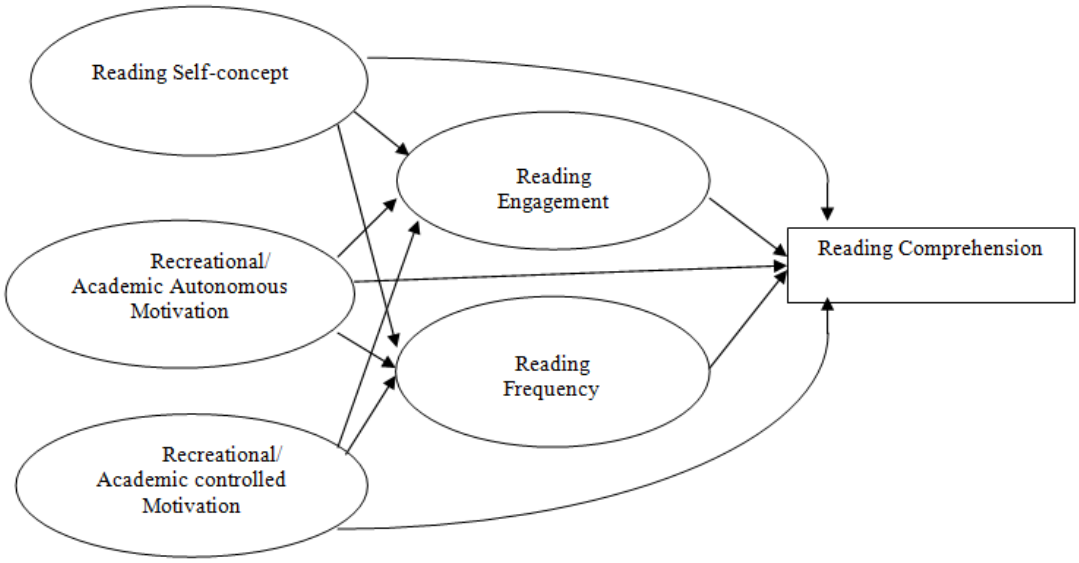

Figure 5.2. Relationship among reading motivation and reading comprehension (De Naeghel et al., 2012)

Advanced readers showed stronger relationships of motivation and engagement with reading performances than struggling readers. However, engagement and growth in engagement was predicted by motivation both for struggling and advanced readers. These results support the hypothesis that cognitive challenges limit the relations of motivation and engagement to achievement for struggling readers. Cognitive challenges determine the improvements in reading proficiency even if the struggling readers invest effort, time, and persistence in reading activities (Klauda & Guthrie, 2015).

Becker et al. (2010) addressed intrinsic and extrinsic reading motivation in longitudinal research. 740 students were assessed in grades 3, 4 and 6. According to their findings extrinsic motivation had a statistically significant negative effect on later reading achievement; however, intrinsic motivation had no concurrent positive effect on later reading achievements (Becker et al., 2010).

Dahti and Damanik (2018) addressed 60 students' motivation in the tenth grade in South Jakarta and gave reasons for the students' motivation in reading English texts. The survey included 50 statements of 11 domains of motivation (Wigfield & Guthrie, 1997). They also conducted interviews to investigate the students' views. The outcome of the research revealed that reading curiosity is the most important factor of the students' motivation, and social reasons for reading is the lowest. Other important factors were challenge, compliance, competition in reading, reading importance, reading involvement, recognition, reading for grades, reading efficacy, avoidance and social reasons (Dakti & Damanik, 2018).

5.5. The Development of Reading Motivation in Girls and Boys

A number of research papers examine boys' and girls' reading motivation. Some researchers found that girls value reading higher (Marinak & Gambrell, 2010; Szenczi, 2013), some studies claim that girls' and boys' reading motivation show similar values (Carroll & Fox, 2017). However, some studies show that boys and girls show different values in different aspects of reading motivation (McGeown et al., 2012).

Coddington and Guthrie (2009) tapped into the differences between teachers and students' perceptions of student motivation. They tested Efficacy for Reading, Reading Orientation and Perceptions of Difficulty in Reading in 84 first grade students. They (2009) found that students' self-efficacy and their perceptions of how difficult a task will be have a significant impact on motivation. They suggest that dimension "perception of difficulty in reading" is the most significant predictor of reading; they established that in the case of boys teachers and students had similar perceptions about student motivation regarding self-efficacy and perceived difficulty. Girls reported higher levels of reading motivation and self-efficacy in reading than boys. Student perceived difficulty predicted word-identification scores. It seems that boys evaluated their reading abilities on the basis of their cognitive skills (Coddington & Guthrie, 2009).

Marinak and Gambrell (2010) examined 288 students in the third grade; self-concept as a reader and the value of reading were examined. Girls and boys assessed themselves similarly for reading proficiency; however, girls valued reading higher than boys. Boys read less because they did not value reading as high as girls. Average achieving boys read less than girls because they did not think that reading was important. The study calls the attention to the decreasing motivation in boys. It suggests addressing the boys' motivation by developing meaningful tasks which make boys value reading more and take part in reading activities (Marinak & Gambrell, 2010).

Carroll and Fox (2017) examined the relationship between self efficacy and word reading in 179 children (86 boys and 93 girls). The students who took part in the research were between 8 and 11 years of age; they completed a self-report questionnaire of reading self-efficacy and tests assessing reading comprehension, word reading, working memory, auditory short-term memory, phonological awareness, and vocabulary. The research questions were related to the role of motivational factors such as self-efficacy in reading progress. It was also investigated how these two constructs influence each other. The study examined the relationship among self-efficacy, word reading and reading comprehension across the range of reading abilities after controlling for reading-related cognitive factors. Results suggest that boys and girls showed similar levels of achievements and reading self-efficacy. Reading self-efficacy was related to word reading, but not to reading comprehension in either boys or girls. It was found that reading self-efficacy was closely associated with a child's reading proficiency. Girls and boys achieved similar scores (Carroll & Fox, 2017).

McGeown et al. (2012) examined the differences between girls and boys in reading skills and reading motivation, investigating whether these differences could be better explained by sex, or by gender identity. 182 children (98 males) aged 8–11 completed a reading comprehension assessment, a reading motivation questionnaire and a gender role questionnaire. No sex differences were found in reading skills or in extrinsic reading motivation, girls had significantly higher intrinsic reading motivation. It was hypothesised that reading motivation is more closely associated with feminine identity than with masculine identity (McGeown et al., 2012).

5.6. Decreasing Motivation towards Reading

In general research studies found that reading motivation is decreasing with age (Józsa et al., 2014; Józsa & Józsa, 2014; Szenczi, 2013). Szenczi (2013) investigated different aspects of children's reading motivation in grades 4-8. The horizontal examination showed that reading motivation was gradually decreasing. The greatest difference was observed between grades 4-6. A moderate to strong relationship was found between the individual motives for reading in both lower and upper grades. Józsa et al. (2014) examined the development of word reading,

reading comprehension and reading motivation among typically developing children and children with mild intellectual disabilities in 1,550 students in grades 3, 5 and 7,610 participants were students with mild intellectual disabilities. They tested word reading and reading; students also completed a reading motivation questionnaire. The results showed that reading motivation diminished with age for both samples; nevertheless, for students with mild intellectual disabilities in grades 3 and 7 the decrease in motivation was smaller. Reading motivation in both students with mild intellectual disabilities and in typically developing students showed a significant weak correlation with reading achievement.

Józsa and Józsa (2014) investigated the link between reading comprehension, reading motivation and reading strategies in 200 students in grades 6 and 8. A self-developed reading comprehension test, a self-reporting questionnaire, a self-developed reading motivation scale and a reading strategy scale were implemented. Intrinsic and extrinsic dimensions of reading motivation were assessed. The findings indicated that reading comprehension developed between grades 6 and 8, while reading motivation and strategy use showed a decreasing tendency. Reading proficiency showed a moderate positive correlation with intrinsic reading motivation and a weak positive relationship with global reading strategies. Extrinsic reading motivation did not affect reading comprehension (Józsa & Józsa, 2014). In contrast, Carroll and Fox (2017) found that reading self-efficacy was slightly higher in older children. They conducted research investigated children aged 8-11 years.

The relationship between reading and motivational aspects is widely researched. Nevertheless, very few studies have investigated the relationship between cognitive linguistic skills and reading motivation (Carroll & Fox, 2017). The research showed that cognitive linguistic skills are related to reading self-efficacy. However, it is not clear how reading motivation is related to morphological awareness and how it differs in girls and boys.

5.7. Conclusion

This part of the dissertation aimed to give a theoretical background to this research. First, in the introductory part, the aim and purpose of the study were specified highlighting the importance of morphological awareness in reading comprehension.

In the first chapter, the basic terms of the research were clarified and different definitions of morphological awareness were listed. It also summarised different concepts related to reading acquisition; for example, the role of metalinguistic awareness and morphological knowledge. Lately morphological awareness has received an increasing research interest as research findings show its contribution to reading comprehension (Rastle, 2019).

In the second chapter, the contribution of morphological awareness to reading comprehension was analyzed. Different models of reading acquisition were discussed and different approaches to learning to read were reviewed. The relationship of reading acquisition models to the importance of morphology was investigated.

In the third chapter, various reading models and theories were presented with special attention to how they related to morphological knowledge and its importance in the process of reading. Starting from the traditional bottom-up models, interactive and connectionist models were summarized. These models overlap and the current ones combine the features of different traditional approaches. Word identification came into the limelight in the most current models since the importance semantics and morphology was recognised (Verhoeven & Perfetti, 2017)

In the fourth chapter, the assessment and development of morphological awareness were discussed. The possible instruments and measurements were presented as well. The role of

morphological knowledge in reading comprehension was ignored in the past. However, recent studies show that morphological awareness influences reading comprehension and spelling abilities. It is hypothesized that morphological awareness contributes to the comprehension of words, sentences and texts. It seems that both the age group and the language itself influence how strong the relationship is between morphological awareness and reading comprehension. According to studies, morphological awareness develops throughout primary school years and it increasingly influences reading comprehension performances. Additionally, the possibilities of intervention programmes for developing morphological awareness and reading comprehension were reviewed. The importance of morphological instruction in reading acquisition, some intervention programmes specialized in morphological instruction and the findings in connection with digital and game-based intervention programmes were delineated.

In the fifth chapter, different aspects of reading motivation were presented. Reading motivation aims to explain reading performances; therefore, it is worth taking a closer look at it. The chapter includes the definition of intrinsic and extrinsic reading motivation. It discusses various instruments for measuring reading motivation, the relationship between reading motivation and reading comprehension. It also analyses research studies on the development of reading motivation in girls and boys and the decreasing motivation towards reading.

I have identified several research gaps in the literature. First, morphological awareness got relatively little research interest in shallow orthographies. Second, morphological awareness has mostly been measured with face-to-face methods. Although digital assessment tools are used in some task types an entirely online instrument has not been implemented in grades 2-4. Third, morphological skills have not been researched in Hungarian pedagogical research. Fourth, the development of morphological awareness among boys and girls has not been investigated extensively in deep orthography languages either. However, based on findings which prove there are differences between boys and girls in reading comprehension, we suppose that there must be a similar difference between boys' and girls' 'achievements in morphological awareness. Fifth, although reading motivation proved to be positively linked to reading comprehension there are no research studies investigating the relationship between morphological awareness and reading motivation. Since morphological awareness is a cognitive linguistic skill, a precursor of reading, we suppose that there must be similar relationship between morphological awareness and reading motivation as between reading comprehension and reading motivation.

6. PROBLEM STATEMENT, RESEARCH QUESTIONS AND HYPOTHESES

This chapter contains the aims of this research and the problem statement. The research questions cover the research gap concerning the assessment and development of morphological awareness. The main aim of this research is to create an online instrument measuring morphological awareness. Besides developing the online instrument some additional examinations are planned. The following background variables will be investigated: reading comprehension subtest measuring literary reading skills, and a reading motivation questionnaire which includes reading self-concept, motivation for printed and digital media. The research questions are followed by the hypotheses.

6.1. The Aim of the Research and Problem Statement

In the previous chapters the theoretical foundations of the research were laid for the empirical research. According to recent theories and empirical findings morphological awareness is one of the factors which affect word recognition; and through word recognition it contributes to the development of literacy skills. By supporting the reading acquisition it contributes to children's cognitive development as well. It is linked to other areas of cognitive development since better comprehension skills are important to make progress in all school subjects. Morphological awareness helps children analyse and manipulate words and create new words by using analogies. In addition, children start to recognise the changes in the word meanings when a different suffix is added to the base word. This skill is essential when children must understand complex structures, for example, when they study foreign languages and when they must solve a word problem in mathematics. Consequently, it is important to offer reliable instruments for assessing the construct which would include all the dimensions of the skill; and as well as research-based intervention programmes which would provide the opportunity for children to improve morphological awareness skills.

In the previous chapters the most commonly used instruments for assessing morphological awareness skills have been discussed. This study aims to develop a reliable instrument for assessing morphological awareness in grades 2-4. This research fills a gap because no such instrument has been developed up to the present in Hungary. The other new direction concerning this research is that it intended to create an online instrument which is easy to use, reliable and suitable for testing a number of children in the same circumstances within a 45-minute lesson. These surveys endeavoured to get a wider picture about the dimensions of the construct by encompassing as many different aspects of the skill as we could. By including more and more dimensions of morphological awareness into the research, the construct validity was increased. This research focused on grade 2-4 children because this is the age group where the basic reading skills develop and it lays the foundation for further development of literacy skills. The instrument concentrates on morphological structures. The existing instruments use judgement, production, identification and analytical measurements which test the awareness of the different levels of morphological awareness. They measure the ability to perform different manipulations with morphemes, for example, composition, decomposition blending and segmentation (Apel et al, 2013; Apel, 2014; Berko, 1958; Carlisle, 1995, 2000; Kirby et al, 2012; Nippold & Sun, 2008). It was a challenge to construct the instrument since the measurements mentioned above were tailored for the English language which is an analytical/ isolating language with an opaque orthography while Hungarian has a shallow orthography and a rich morphology. Due to the online testing some production type exercises had to be omitted and turned into multiple choice items. In addition, instead of oral testing, which was common for assessing morphological awareness written

tasks were used. The first version of the test consisted of 20 items, the second one 40 items and the fourth one 59 items.

The other challenge was to constantly increase the reliability and the validity of the construct by including more types of measures: finally, the instrument included composition, decomposition, identification and segmentation related to inflections, derivation and compounds. This research also aimed to see the growth of the skill throughout grades 2-4. According to the existing research findings, morphological awareness shows constant development, and it has an increasing influence on reading comprehension.

These surveys were conducted in grades 2-4 which allowed us to get an insight into how morphological awareness and reading comprehension skills developed together. This dissertation endeavoured to enrich the special literature by collecting all the possible research data for both theoretically and empirically to lay a foundation for this research. Morphological awareness has received an increasing attention in the last few decades, mainly, in writing systems with opaque orthography since the number of research evidence has proved the contribution of morphological awareness to reading comprehension (Apel et al., 2013; Carlisle, 2000; Casalis et al, 2011; Deacon et al.; Kinanti et al.,2012; 2014; Nagy et al., 2014). This dissertation discussed some research findings even from agglutinative languages with a shallow orthography and a rich morphology, (e.g., Finnish, Turkish) to emphasize the necessity and expedience of measuring and developing morphological awareness in daily educational and pedagogical practice (Aro, 2017; Borleffs 2017; Durgunoğlu, 2017; Torppa et al., 2010). Besides measuring different dimensions of morphological awareness, reading comprehension, and reading motivation were also tested in the large sample survey. These studies compared the performance in different grades and different classes, and compared children's performance in the different subtests and demonstrated the growth of the constructs throughout grades 2-4. The development of the reliable instrument was the primary aim which would fit into an Online Item Bank, the Electronic Diagnostic Assessment System (eDia) developed by Szeged University, Doctoral School of Pedagogy (Csapó & Molnár, 2019). This Electronic Diagnostic Assessment System aims to support teachers' work by providing opportunities to plan the online learning-teaching process and to assess the students' work.

Table 7.1. The time frame of the research activities

Time	Research activity
March –May, 2019	The pilot study of the instrument in grades 2-4
January- March, 2020	The large sample survey in grades 2-4

In summary, this research consisted of two main parts. The primary aim of the empirical research was to develop an online instrument for assessing morphological awareness in grades 2-4. The aim of the pilot study was to prepare the planned large sample survey; to get preliminary results about the operation of the test, and gain preliminary data about the development of the morphological awareness in grades 2-4. The large sample survey endeavoured to determine the reliability and the validity of the online instrument, yield more data about the construct and make more precise estimations about children' morphological awareness skills and its development in grades 2-4.

6.2. Research Questions and Hypotheses

The topics of this research encompass the basic questions of the assessment and the development of morphological awareness. On the one hand, they cover the questions which refer to the instrument, the structure, dimensions and operations of morphological awareness

and its relationship with background variables, as well as the questions related to the development of the ability.

I. The questions related to the structure of the morphological awareness

Is the instrument suitable for measuring morphological awareness in the examined age group?
Are the psychometric properties of the test acceptable for the research?
Is the validity of the construct acceptable?
Can the subconstructs be differentiated within the morphological awareness test?
What relationships can be found among the subconstructs?

II. Research questions related to morphological awareness, reading comprehension, background variables and the development of the ability

How does morphological awareness change in the examined grades?
What relationships can be found between the background variables?
What are the main differences between the boys' and girls' performances in morphological awareness and reading comprehension?
How does reading motivation influence performances in morphological awareness and reading comprehension?
What relationships can we find between morphological awareness and reading motivation among boys and girls?
What relationship can be found between basic reading skills and reading motivation in boys and girls?

The hypotheses are in agreement with the research questions
I. Hypotheses referring to the instrument
$H_{1:}$ Our instrument gives a reliable estimation about the development of the students' morphological awareness, and the psychometric features of the tests are acceptable.
H_2 There is a moderate correlation among the subtests.

II. Hypotheses about the development of the morphological awareness and its relationship to the background variables
Basic reading comprehension skills and reading motivation are also measured but only as background variables which assessed their relationship to morphological awareness.
H_3 There will be a difference in the levels of development of morphological awareness in the different grades (Carlisle, 2000).
H_4 Morphological awareness develops throughout grades 2-4 (Gabig & Zaretsky, 2013).
H_5 There will be moderate correlations between morphological awareness and reading comprehension (Kirby et al., 2012).
H_6 There will be gender differences between the performances in morphological awareness and in reading comprehension. Based on the findings which prove that there are differences between boys' and girls' achievements in reading and language skills (Reilly et al., 2019), we hypothesise that there must be gender differences in morphological awareness skills as well.
H_7 Reading motivation will be linked to both morphological awareness and reading comprehension. Studies prove that there is a positive relationship between reading motivation and reading comprehension (Marinak & Gambrell, 2010); therefore we suppose that morphological awareness has a similar positive relationship with reading motivation since morphological awareness is a precursor of reading.

7. AN ONLINE INSTRUMENT ASSESSING THE RELATIONSHIP BETWEEN MORPHOLOGICAL STRUCTURE AWARENESS AND READING COMPREHENSION IN HUNGARIAN 2-4 GRADERS - PILOT STUDY

7.1. Introduction

This chapter gives account of the results of the pilot study conducted in grades 2-4. The chapter describes the objectives, the methods of the research, the procedures and the results of the pilot study. The pilot test aimed to get preliminary insight into the structure of morphological awareness. The online instrument contained several types of exercises for measuring different dimensions of morphological awareness and morphological knowledge. Various task types were implemented e.g., affix identification, compounds, derivation and nonwords tasks. The results of the research posed further questions regarding the inner structure of the construct and its relationship to the background variables. The experiences of the pilot study gave encouragement to develop the instrument further and conduct a large sample examination. [1]

7.2. Objectives

The study had three main objectives. First, the first version of the instrument was to be empirically tested. Secondly, it was an attempt to see how the skills of morphological awareness and reading comprehension developed together between the second and the fourth grades of primary school. Thirdly, the relationship between morphological awareness and reading comprehension was analysed. According to the literature there is a positive correlation between morphological awareness and reading comprehension, therefore, we only wanted to measure basic reading skills to measure if there is a relationship between the two constructs. The following guiding research questions were formulated.

1. Can morphological structure awareness be measured by our four-dimensional instrument?
2. How does the online test work in grades 2-4?
3. What are the psychometric properties of the instrument like?
4. What relationships can be found between the subtests in the different grades?
5. Do the results regarding morphological awareness and reading comprehension show similarities to the ones measured in languages with deep orthographies?
6. Does the short reading comprehension subtest for measuring basic reading skills work well?
7. What additional data can be yielded from the research?

7.3. Methods

7.3.1. Participants

The participants were second graders (N=124 age: M=8.7, SD=0.40 years), third graders (N=137 age: M=9.6, SD=0.45 years) and fourth graders (N=97 age: M=10.4, SD=0.63 years);

[1] This chapter is based on our study Varga, S., Pásztor, A. & Steklács, J. (2020) An online instrument assessing the relationship between morphological structure awareness and reading comprehension in Hungarian 2-4 graders. Ilkogretim Online - Elementary Education Online, 2020; 19 (4): pp. 2322-2334

altogether 356 children were tested (age: M=9.5, SD=0.81 years). Three children started, but did not finish the test. 48.03 % (171) girls and 47.47% (169) boys completed the test, 4.49% (16) children did not answer the gender question.

7.3.2. Instruments

Our aim was to design a test which measures morphological awareness in a reasonable timeframe that is children could complete it in a forty-five minute lesson. The online test consisted of five sections: affix identification/real words (10 items), compound words (10 items), derivation (10 items), affix identification/nonwords (10 items), reading comprehension (10 items). The intention of the first four sections of our instrument was to test children's awareness of the basic grammatical structures and the ability to manipulate them. The fifth section assessed reading comprehension.
The selection criteria for the task types I used in the test were primarily set by the requirements of the curricula in grades 2-4, literature (dimension, instruments) and the features of online platform. Inflectional morphology was tested by affix identification real and nonwords. Testing inflectional morphology with real words was done by the task which required children to separate the root words from the inflected words because the inflectional morphology was tested on the level of words. The children had to make a decision about which is the root word and which is the inflected word. The affix identification for nonwords task aimed to assess children's skill to identify inflections when they cannot rely on the meaning of the word only on morphological skills. The task was chosen based on Berko (1958) and Apel et al. (2013). The two inflectional tasks tested inflectional morphology in two ways. They were chosen to evaluate more advanced judgments skills on morphological awareness. The compound words and derivation subtests assessed morphological awareness skills based on commonly used instruments (Berko, 1958; Carlisle, 2000). The students had to make judgements on sentence level which evaluated their derivational and compound morphology skills.

Table 7.1. Dimensions of morphological awareness

	Number of Items	Morphological knowledge
Affix Identification for Real Words	10	recognition of the stem and affixes identifying inflections: *-án -on, -en, - ön (bödön, kövön)*
Affix Identification for Nonwords	10	awareness of syntactic functions of morphemes recognitions of inflections for singular and plural nouns *(marinosz- marinoszok)* orthographic awareness *(tatal- tattal, tatel, tatval)* identification of nominal inflections: *(zangurán-zanguránokat)* Grammaticality of sentences, subject-verb agreement *A zangurán zelenált/zelenáltak/zelenálni/zelenáltam*
Derivation	10	identifying the syntactic knowledge of morphemes *édes/édességet/édességet/édességet* distributional knowledge: Awareness of how morphemes are constrained by the stem they are attached to. *Panni mindig hazamegy ... tanítós/tanítások/tanítás/tanítani.*
Compound Words	10	recognising compounds identifying real and pseudo compound *(mosógép-villamos)*

In the first section the participants were given affix identification tasks based on analogy and judgement (Carlisle, 2000; Apel et al, 2013). Children had to separate base words from inflected words by placing a word into the correct category boxes of base words affixed words (Figure 7.1). The instructions were the following: "You can see two boxes on the screen. Drag the base words from the menu into the base word box and inflected words into the affixed word box. We have already put one word into each box as an example. If you click on the question mark, you can learn what base word means and what affixed word means. „If students clicked on the word *szótő* - "base word", the definition for base word was shown, if they clicked on the word *toldalék* - "affixes", the definition of affix was displayed. Examples and help were provided to ensure that the task measured the skill, and to decrease the effects of a lack of lexical knowledge about the concepts. This task tested how children could recognise base words, when they had the same ending as some inflected words (*oceán* - "ocean "*; táblán*- "on the board"*; bödön*- "pot";*, kövön*- "on the stone"*; banán* - "banana"; *párnán*-"on the pillow" *etc.)* The difficulty of the task was that the endings of both types of words had the same ending, for example, *ocean, táblán,* but ocean is a base word without suffixes, however, the word *táblán* has a suffix-n which means - "on". This task intended to test whether children were aware of the suffixes attached to the base word when both types of words had the same endings. 60 % of the stems of the words used in these tasks were frequently used words (Oravecz, Váradi & Sass, 2014; Váradi, 2002). The affixes students had to identify were common suffixes which are presented even in the curriculum in grade 2.

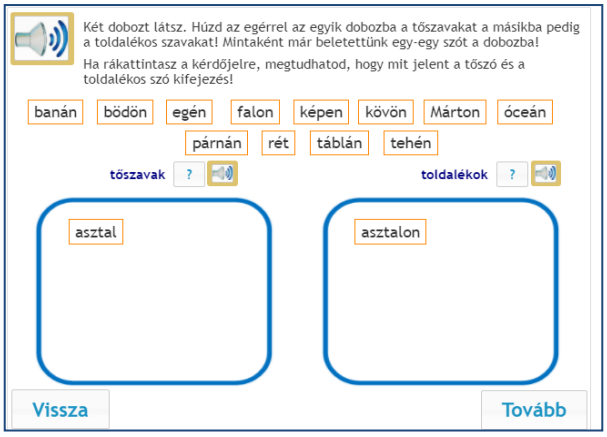

Figure 7.1 Sample item from the Affix Identification Real words Subtest

Figure 7.2. Sample Item from the Compound Words Subtest

The second subtest included compound nouns. Children chose the compound nouns from four words (Figure 7.2), the instruction said: "Choose the compound word which is made up of two words. Answer by clicking on the correct word. " All the four words had the same base word *(mos* - "wash"*; mosás*- "washing"*; mosógép* -"washing machine"*; mosni*- "to wash", *villamos* - "tram"). Six items out of ten contained pseudo-compounds like *villamos*- "tram". These words contained two simple words inside them but still they were not compound words because their meaning separately had nothing to do with the meaning of the word. (*villa* - "villa" or fork; " *mos* - "wash"*; villamos* - "tram") (Apel et al., 2013). One part of the compound word consisted of a frequent word and more frequent words were combined with less frequent words see Table 7.3 (Oravecz, Váradi & Sass, 2014; Váradi, 2002). Several pseudo-compounds in the sentence were used which looked like compound words to distract, for example, *felhő*- "cloud" which had two words in it inside - "up"and - "heat"; *rabló* - "robber", is a simple word, but it has the words *rab*- "prisoner" and *ló* "horse" inside it; vadász - "hunter", the word vadász has the *vad*-"game" and *ász* "ace" inside of it. Nagy et al. (2014) make a distinction between awareness, conscious knowledge and tacit knowledge.

This task tests tacit knowledge rather than awareness since the children had to recognise the real compounds. However, according to Pléh (2000), it can be called the lowest level of awareness which needs a conscious consideration of all the items.

The third subtest was a derivation task with using real words (Figure 7.3, 7.4). Children were asked to choose one from the four word choices to complete the sentence (Apel et al., 2013; Carlisle, 2000). All the given words had different correct or incorrect versions of the same base word; however, only one had the right derived form. In the derivation subtest the children got the following instruction: "Complete the following sentence. Drag the appropriate word onto the dotted line." *Panni mindig hazamegy …….. után./ tanítós/tanítás/tanítani/tanítások/.* "Panni always goes home after ……..…. teacherly/teaching/teach/teachings/".

Table 7.2. Characteristics of the subtests

	Category (word frequency ranges)			
	1(-1,000)	2 (1,000-5,000)	3 (5,000-10,000)	4 (>10,000)
Affix Identification for Real Words (10 item)	-	60	20	20
Derivation (10 item)	30	30	20	20
Compound (10 item)	5	40	35	20

Note: The categories include frequency ranges of words used in the morphological test (Oravecz, Váradi & Sass, 2014; Váradi, 2002).

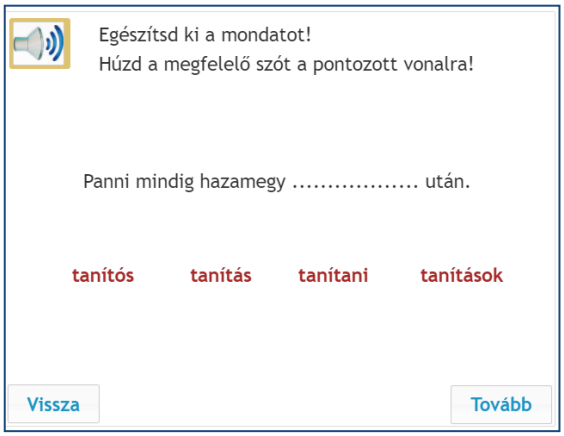

Figure 7.3. Sample tem from the Derivation Subtest

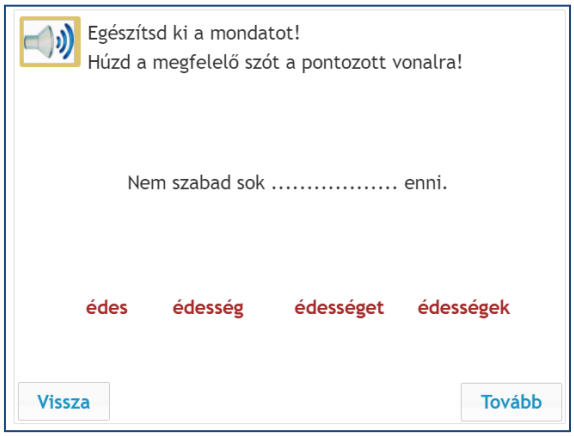

Figure 7.4. Sample tem from the Derivation Subtest

80 % of stems in derivation subtest contained words with frequency below 10,000 words. (Oravecz, Váradi & Sass, 2014; Váradi, 2002). I used only productive and common suffixes in this subtest (Keiffer, 1997). The derivation task measured how children could identify the appropriate suffix corresponding to the meanings. The options consisted of real or nonsense derived forms. In this task children were given orthographically similar forms to test how well they could make a distinction between the constituent morphemes (Nippold & Sun, 2008; Tyler & Nagy, 1989).

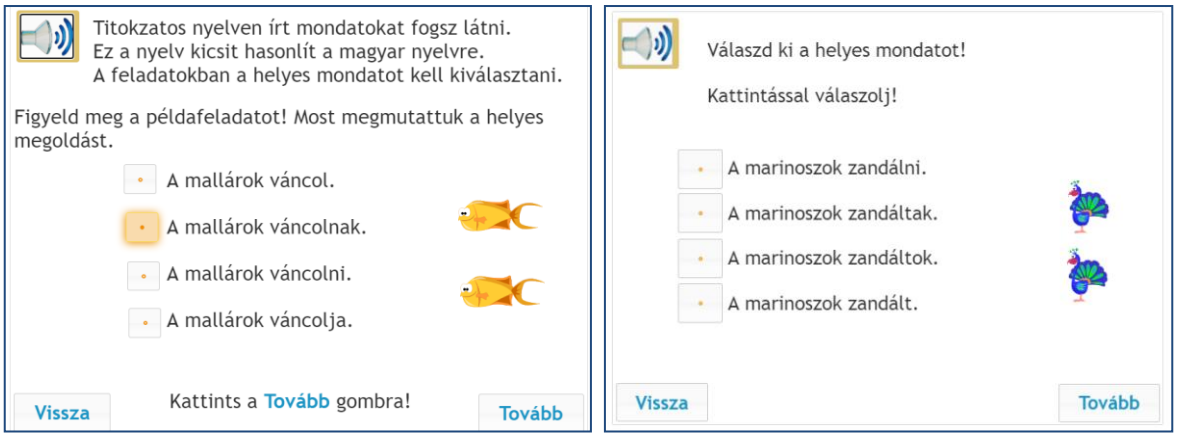

Figure 7.5. Sample items from the Affix Identification/Nonwords Subtest

The fourth subtest contained nonwords testing identification of affixes using nonwords to which real affixes were attached (Berko, 1958; Apel et al., 2013). Identification of affixes of singular and plural nouns, present and past of frequent verbs, and objective and instrumental cases of nouns were assessed. Two types of tasks were given. Either a question had to be answered by clicking on the correct sentence, or the correct sentence had to be selected from the four choices (Figure 7.5.). In the nonword, children got the following information: *Ezek marinoszok.* - "These are marinoszes". What do you say if there is only one animal in the picture? Answer by clicking. a) *Ez egy marinosza*. - "This is a *marinosza*", b*) Ez egy marinosz*. - "This is a marinosz”., c) *Ez egy a marinoszt* - "This is a marinoszt. " d) Ez egy marinoszi. - "This is a marinoszi." The first 5 items tested the awareness of plural noun suffixes. The children got one sample sentence to familiarize them with the task. Children usually got either the singular or the plural form of the noun. If they were given the plural form, they had to select the singular form and vice versa. The difficulty of the task was that children did not know the meaning of the word, therefore, they had to think about the plural suffixes, and they had to analyse the word, and find the base word, separate the base word from the suffixes. In Hungarian there is an objective case of both in singular and in plural.

As a distracter the pseudoword mallár was used with an inflected form using the suffix of the objective case both in a singular and plural pseudoword. In the English nouns are usually not inflected except for plural forms; therefore the English words for a.) and b.) as well as c.) and d.) options will be the same. What do you call them if you see more than one of them? These are a.) Ezek *mallárokat*, - "These are mallars"; Ezek *mallárok* - " these are mallars; c.) *Ezek mallárt* - "These are mallar". d.) Ezek mallár. - "these are mallar". The task was similar to the Wug test (Berko, 1958); children use the same morphological manipulation on a different word or sentence pair (Nunes et al., 1997, p. 649.); however, a multiple choice version was implemented (Nippold & Sun, 2008; Tyler & Nagy, 1989).

The next task tests whether the children are aware of the Hungarian vowel harmony. There are 14 vowels in Hungarian. Vowel harmony is a basic rule of the Hungarian language. It means that many word endings have two or three different versions, each to be applied under different conditions. These conditions are based upon which vowels are present in a word. This animal is called a tat. What would you call them if you saw many of them? There three incorrect suffixes and children have think about which suffix suits into the pseudoword. *a.)Ezek tatok* - "These are tats". *b.) Ezek taták.* - "These are tatas" *c.) Ezek tatek* - "These are tates "*d.) Ezek tatik.* -" These are tatis".

There are other examples for testing the awareness of the Hungarian vowel harmony. For example, this animal is a roffa: Now, you can see more of these animals. What kind of animals are they? a.) *Ezek roffák*. - "These are roffas.” b.) *Ezek roffok*. - "these are roffos.” c.) *Ezek roffát* . - These are roffat. " d.) *Ezek roffákról* - "These are about roffas. "

The other five items included more than one pseudowords. The first five items were the beginners' level where only one pseudoword was in the sentence and in the second five sentences children were expected to choose from sentences. They had to choose the correct sentence from four options. The children got some instructions about the tasks. It said that: " You are going to read sentences in a mysterious language. This language is a bit similar to the Hungarian language. You will have to choose the correct sentence. Now, we have shown you the correct option. a.) *A mallárok váncol*. - "The mallars is vancing." b.) *A mallárok váncolnak*. - The mallars are vancing c.) a m*allárok váncolni*. - " The mallars to vance" d.) *A mallárok váncol*. - "The mallars is vance." The tak is testing the awareness of the verbal inflection both in present and past tenses, objective and instrumental cases of nouns.

The pilot test partly measured morphological knowledge (tacit knowledge), that is, whether children could use word formation rules (derivation, compound words), and partly it tested morphological structure awareness in affix identification of real words and affix identification in nonwords tasks. In the affix identification of real words task children had to select the base from the affixed words when the orthographic forms were very similar and in the affix identification nonwords task, children had to identify the correct inflections without relying on the meaning of words.

The fifth subtest was the reading comprehension test. In the second grade, children start acquiring the first (literal comprehension) and second levels of reading comprehension (interpreting or inferential level). However, we only wanted to test literal reading skills for two reasons. First, because we wanted that children would complete the morphological test and the reading comprehension test in a 45-minute lesson. Second, morphological awareness is a precursor of reading and therefore it is primarily connected to the word recognition and basic reading skills. We only wanted to examine reading comprehension as a "sort of" background variable in order to see whether there is a correlation between the morphological test and the reading comprehension subtest. An important selection criterion for the text was that its topic had to be student-centered, but still suitable for assessing basic reading comprehension skills. That was the reason for choosing a text about a children's festival. The original text contained 949 words (https://csipero.eu/csipero/index), the structure of the text was simplified, and the final version of the reading comprehension text contained 161 words. The vocabulary of the text contained common expressions, activities; the longer more difficult sentences were shortened. The continuous text was followed by ten multiple choice questions (Figure 7.6.). The following instructions were given: "Read the following text and answer the question by clicking on the correct answer." Sample question: "How often is the festival organised? a) every year b) every six months c) every month d) every second year" Children had to retrieve detailed information from the text. The questions followed the order of the events in the text, which was about an imaginary festival for children. The text contained a great deal of detailed information; therefore, different reading strategies were needed; for instance, scanning through the text to find the right answers. The text was displayed with the questions; therefore a student could refer to the text if it was needed. The text was adapted from a brochure about a festival; some names and data were modified and the text was made simpler and shorter for children. The test assessed literal comprehension skills; that is the understanding of information and facts directly stated in the text. It covers the most basic level of reading comprehension. Students utilize literal comprehension skills (searching for keywords, skim reading and scanning) to locate information efficiently. The basic competence in literal reading skills are required by the curriculum in grade 2.

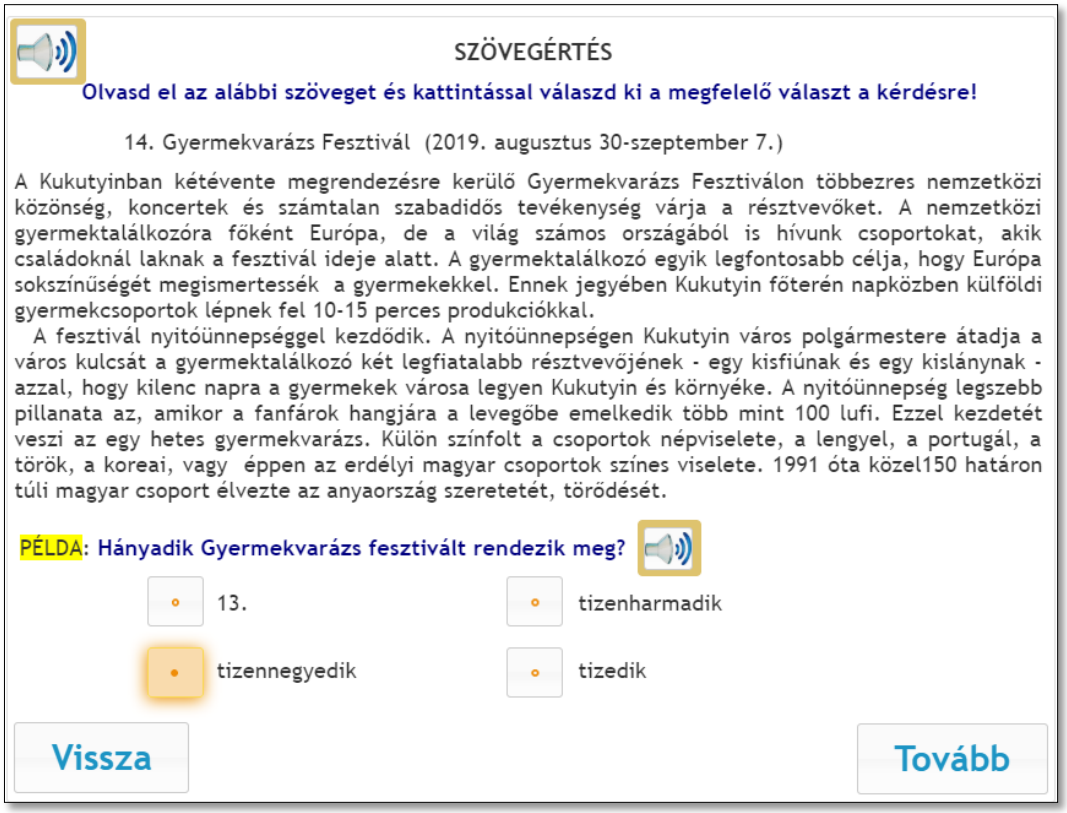

Figure 7.6. Sample Item from the Reading Comprehension Subtest

In the reading comprehension subtest the questions contained simple question words, for instance, *mikor* - "when", *milyen gyakran* "how often", *hol* "where", *hogyan* "how", *milyen* "what kind of", *mennyi ideig*" " how much time", *melyik* "which". The answers could be found in the test, or could be inferred from the text. The questions followed the order of events in the text since it was more logical for the students.

7.3.3. Procedures

Data collection was carried out in Hungary in spring 2019. The tests were delivered through the eDia platform (Csapó & Molnár, 2019). Children were given an identification code to log in to the test. Parental consents were asked from the parents, and only the students whose parents granted consent participated in the experiment.

Children could only listen to the instructions and the questions by using headphones. Before the test, pupils took a demographic questionnaire about their age and gender. Altogether, the test contained two drag-and-drop exercises with 20 items about affix identification of real words and derivation. The other 30 items were multiple choice questions, where children had to click on their answer choice using the radio button. Before all the tasks an example was provided to familiarize a child with the requirements of the particular task. The test was conducted in a group setting. The entire test took approximately 30 minutes to complete (second grade: M=27.3, SD=9.1 minutes; third grade: M=23.8, SD=6.3; fourth grade: M=25.4, SD=11.0 minutes).

7.4. Results

The overall Morphological Structure Awareness and the Reading Comprehension tests showed a good reliability in all grades (see Table 7.3). The subtests also showed good or still acceptable reliabilities, except the derivation subtest in grade 3. All individual item scores were positively correlated with the tests scores, therefore further improvement of the Cronbach's alpha values could not be carried out by removing some items. Despite these lower reliabilities, both subtests measured important aspects of morphological awareness. Thus, they were important for the validity of the test; and were kept for further analyses. The highest performances were in grade 4, except the Affix Identification/Nonwords subtest.

Table 7.3. The reliabilities of the whole test and the subtests

	All grades (N=356)	Grade 2 (N=122)	Grade 3 (N=136)	Grade 4 (N=98)
The Whole Test (50 items)	.90	.89	.87	.90
Morphological Structure Awareness (40 items)	.87	.87	.83	.88
Affix identification Real Words (10 items)	.83	.83	.71	.88
Compound Words (10 items)	.84	.89	.79	.84
Derivation (10 items)	.64	.67	.54	.68
Affix Identification Nonwords (10 items)	.68	.62	.71	.66
Reading comprehension (10 items)	.79	.73	.79	.80

Table 7.4 Goodness-of-fit indices for testing dimensionality of the Morphological Structure Awareness Test

Model	χ^2	*df*	*p*	CFI	TLI	RMSEA (95% CI)
4-dimensional	870.66	734	.001	.966	.964	.023 (.016–.029)
1-dimensional	1455.06	740	.001	.824	.815	.052 (.048–.056)

Note: df = degrees of freedom; CFI = Comparative Fit Index; TLI = Tucker–Lewis Index; RMSEA = Root Mean Square Error of Approximation; χ^2 and *df* are estimated by WLSMV.

Confirmatory factor analyses (CFA) were conducted to test the underlying measurement model for morphological awareness (Table 7.4.). The 4-dimensional model based on the subtests showed good model fit. The chi-squared difference test showed that the 4-dimensional model fits significantly better than the 1-dimensional model (=970.66; p<.01). Thus, the four latent factors of morphological structure awareness can be empirically distinguished.

7.4.1. Means, Standard Deviations, Development of Morphological Awareness

The means and standard deviations are shown in Table 7. 5. In general, the achievements were high, in all cases the means of the subtest scores were above 50%. Regarding the Morphological Structure Awareness test, the scores were above 70%. However, there were differences in the different subtests, mean scores ranged between 57 to 95%. The Affix Identification/Real Words tasks were the easiest for the students; actually it seemed that this subtest had a ceiling effect in all grades. The most difficult tasks were connected to the Affix Identification/Nonwords subtest in all grades. Standard deviations showed that in general, the tests had good differential power in all grades, except the Affix Identification/Real Words subtest in grade 3 (SD=11.5%). There is a tendency that standard deviations were higher in grade 2 compared to the other two grade levels. In the case of Reading Comprehension, the

scores ranged between 52 and 73%. The standard deviations were high, indicating that these tasks could differentiate students' reading comprehension skills well. High standard deviations also showed that there were large individual differences especially in the achievements of the Compound Words, the Affix Identification/Nonwords and the Reading Comprehension subtests.

Table 7.5. Means and standard deviations in grades 2-4

	Grade 2 Mean (*SD*)	Grade 3 Mean (*SD*)	Grade 4 Mean (*SD*)	Effect of grade (F)
Morphological Structure Awareness	72.09 (*17.03*)	80.35 (*13.28*)	82.47 (*14.53*)	15.50 p<.01
Affix Identification, Real Words	87.98 (*20.32*)	94.89 (*11.51*)	92.96 (*17.72*)	5.80 p<.01
Compound words	69.59 (*31.40*)	81.10 (*22.30*)	81.02 (*23.40*)	7.81 p<.01
Derivation	73.08 (*20.93*)	81.32 (*16.09*)	85.30 (*17.12*)	13.46 p<.01
Affix identification Nonword	56.89 (*22.23*)	64.12 (*24.17*)	70.61 (*21.58*)	9.93 p<.01
Reading Comprehension	52.13 (*26.51*)	68.38 (*27.11*)	73.16 (*26.19*)	19.72 p<.01

ANOVA test showed that students' grade had a significant effect on all performances (see Table 7.5). The post hoc comparisons using Tukey's-b test indicated that all mean scores for grade 2 were significantly different from the mean scores in grade 3 and grade 4. However, the mean scores in grade 3 did not significantly differ from the results in grade 4 in all tests, except in Affix Identification/Nonwords subtest. Figure 7.7. shows the developmental tendencies from grade 2 to 4.

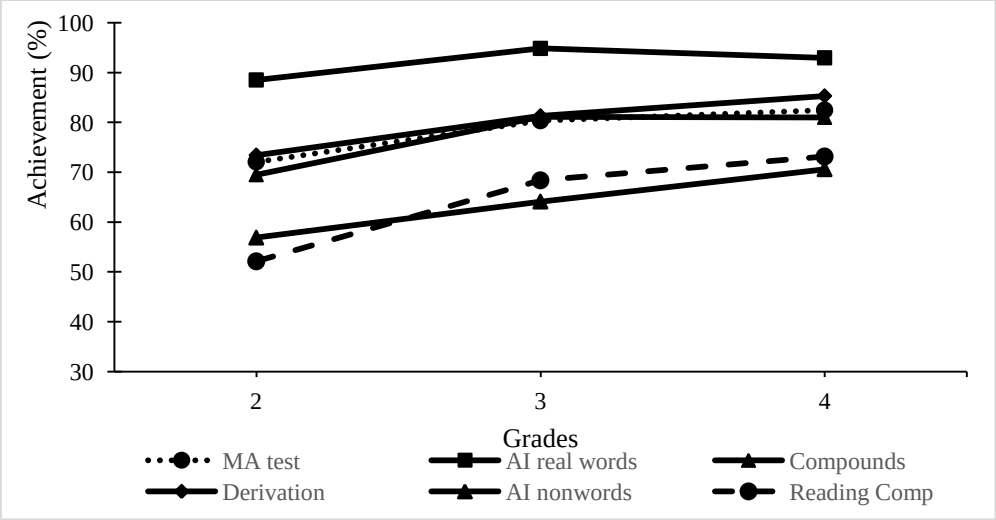

Figure 7.7. The development of morphological structure awareness in grades 2-4

7.4.2. Morphological Awareness and Reading Comprehension

Significant positive correlations were in all grades between the Morphological Structure Awareness and the Reading Comprehension test achievements, the values were similar in magnitude (values range between .56 to .62, see Table 7.6.). Moderate correlations were also found regarding the subtests between the Morphological Structure Awareness tests except for

the Affix Identification/Real Words subtest where the coefficients were lower, range between .23 to .17. The Affix Identification/Nonwords subtest showed the strongest relationships with Reading Comprehension. The weakest correlations were found between the Affix Identification/Real Words subtest and the reading comprehension scores.

Table 7.6. Correlations between the subtests

	MSAT grades: 2 – 3 – 4	AIRW grades: 2 – 3 – 4	CW grades: 2 – 3 – 4	D grades: 2 – 3 – 4	AINW grades: 2 – 3 – 4
Affix identification/real words	.59 .46 .67				
Compound words	.78 .79 .73	.20* .30 .25*			
Derivation	.78 .70 .71	.33 .17* .39	.48 .39 .32		
Affix identification /nonwords	.73 .79 .79	.36 *.14* .40	.34 .42 .42	.48 .41 .44	
Reading Comprehension	.56 .60 .62	.27 .23 .24*	.40 .34 .42	.37 .39 .51	.58 .64 .63

Note: Morphological Structure Awareness Test (MSAT), Affix identification/real words (AIRW), Compound words (CW), Affix identification/non words (AINW), Derivation (D), Reading Comprehension (RC) Unmarked correlations are significant at the .01 level. Correlations marked with * are significant at the .05 level. Correlation in italics is not significant.

The subtests of the Morphological Structure Awareness test were also correlated with each other, except the Affix Identification/Real Words and the Affix Identification/Nonwords subtests. The coefficient was positive, too, but not significant (r=.14). In general, the Affix Identification/Real words subtest had weaker correlations with all the subtests as well. Nevertheless, the values ranged from. 17 to .48 indicating that the constructs behind the subtests were worth measuring separately; they represented important factors of morphological awareness.

7.4.3. Gender Differences

Table 7.7. shows gender differences in morphological awareness and reading comprehension in grades 2-4. We found that girls performed better than boys in all the grades. Girls keep their advantage even in grade 4. It seems that the differences between boys' and girls' performances do not decrease, in some cases they are increasing, for example in the case of the Morphological Structure Awareness Test and differences remain on the same level; in the case of the Affix Identification Nonwords they seem to slightly decrease, however, in reading comprehension, girls increased their advantage by the grade 4.

Table 7.7. Gender differences in morphological awareness and reading comprehension in grades 2-4

	Morphological Structure Awareness (%)	Affix Identification Nonwords (%)	Reading comprehension (%)
grade 2 boys (N=57)	70.26(16.54)	53.86 (21.77)	49.65 (25.70)
grade 2 girls (N=65)	74.02 (17.35)	60.16 (22.07)	54.69 (27.25)
grade 3boys (N=64)	78.57 (14.62)	62.54 (24.62)	66.83 (28.56)
grade 3 girls (N=60)	82.83 (10.63)	65.83 (24.03)	72.17 (25.38)
grade 4 boys (N=49)	78.26 (27.15)	66.73 (22.40)	86.65 (10.00)
grade 4 girls (N=47)	67.76 (10.00)	74.68 (20.52)	78.72 (24.00)

Table 7.8. shows significant differences between boys and girls performances only in grade 4 and in the whole sample. I analysed the boys' and girls' performances, and the analysis (independent samples T-test) did not find significant differences in the performances in the morphological test and in the reading comprehension subtest in grades 2-3. However, in grade four significant differences were found between boys' and girls' performances. The boys gave weaker performances in both tests. Regarding the whole sample significant differences were found between boys' and girls' performances in the Morphological Structure Awareness Test and in the Reading Comprehension Subtest at the 0.05 level.

Table 7.8. Differences between boys' and girls' performances

Grade 2	Boys M (SD)	Girls M (SD)	F (p)	t (p)	d
MSAT test	70.26 (16.54)	74.02 (17.35)	.00 (.95)	-1.22	0.22
RC Subtest	49.65 (25.70)	54.69 (27.25)	.93 (.34)	-1.04	0.19
Grade 3					
MSAT test	78.57 (14.62)	82.83 (10.63)	4.53 (.04)	-1.84 (.07)	0.17
RC Subtest	66.83 (28.56)	72.17 (25.38)	1.93 (.17)	-1.09 (.28)	0,21
Grade 4					
MSAT test	78,26 (17.15)	86,65 (10.00)	15.94 (.01)*	-2.91 (0.05)	0.62
RC Subtest	67,76 (27.78)	78.72 (24.00)	1.76 (.19)	- 2.94 (0.01)	0.42
All grades					
MSAT test	75,68 (16,40)	80,58 (14,35)	15.94 (.01)*	-2.91 (0.05)	0.32
RC Subtest	61,30 (28,48)	67,42 (27,55)	1.76 (0.19)	-2.07 (0.04)	0.22

Note: MSAT test =Morphological Structure Awareness Test, RC= Reading Comprehension Subtest * p< 0.01 level.

7.5. Discussion

The pilot test was aimed to prepare the planned large sample survey. The purpose of the pilot study was to get preliminary data about the operation of the online instrument for assessing morphological awareness in the second, third and fourth grades of primary school. This study also attempted to follow how morphological awareness and reading comprehension skills develop during the second grade through the fourth grade and, to examine the relationship between morphological awareness and reading comprehension skills in the Hungarian language. The relatively small sample gave us an opportunity to empirically test how the instrument is working before testing a bigger sample of students.

7.5.1. Development of an Online Test for Assessing Morphological Awareness

The overall psychometric properties and the construct validity of the Morphological Structure Awareness and the Reading Comprehension tests were acceptable in all grades. The Reading comprehension subtest which only had 10 items also showed acceptable Cronbach Alpha values. The Derivation and Affix Identification/Nonwords subtests should be further improved. Standard deviations showed that almost every subtest could differentiate students' abilities especially, among children who had a lower skill level. It is recommended to improve the test with addition of more difficult tasks on the Affix Identification/Real Words subtest, to address the low standard deviation and high mean scores. These additional items should still allow the test to be administered in a reasonable timeframe. In general, our online test is suitable for the assessment of different aspects of morphological awareness and reading comprehension. Due to the advantages of technology-based assessment the whole measurement, including reading comprehension, could be carried out in a 45-minute lesson.

7.5.2. Development of Morphological Awareness and Reading Comprehension

The analysis of the performances of the three age groups showed that there was a significant improvement between grade 2 and grade 3. An improvement tendency was observed between grade 3 and 4 as well; however, the differences were not statistically significant except in the case of the Affix Identification/Nonwords subtest. Nevertheless, our results suggest that morphological awareness skills are changing parallel with reading comprehension skills in grade 2 to 4. One reason for the lack of larger developmental gap between grade 3 and 4 could be the high mean scores, especially in the achievements of the Affix Identification/Real words subtest. The inclusion of more difficult items will help further investigate this phenomenon. An interesting result was that the largest performance differences were between the two subtests assessing affix identification: the mean scores were the lowest with nonwords and highest with real words. The reason for that might be that in exercises using nonwords children cannot rely on the meaning of the words; and therefore; they must rely on their morphological awareness skills.

7.5.3. Morphological Awareness and Reading Comprehension

Examination of the correlations in second, third and fourth grade implies that the participants' performance showed a significant positive correlation between Morphological Structure Awareness and Reading Comprehension tests. The Affix Identification with Nonwords subtest had the strongest correlation with reading comprehension. This strong relationship gives evidence that these nonwords tasks are representing an important factor of children's reading comprehension performances. These exercises expect a more complex cognitive effort from children to understand the rules of forming singular and plural nouns and verbs using suffixes compatible with nouns. Students had to rely only on the structure without knowing the meaning of the word. The examinations tapped into the differences between boys' and girls' achievements. Girls outperformed boys in both tests. Regarding the whole sample significant differences were found between boys' and girls' scores in the Morphological Structure Awareness Test and in the Reading Comprehension Subtest at the 0.05 level. The results related boys' and girls' 'achievements in reading comprehension were in line with other findings (Hódi, 2018).

7.5.4. General Discussion

These results are in line with international research findings (Carlisle, 2000; Kuo & Anderson, 2006; Levesque et al., 2017) and support that morphological awareness helps learners decompose unknown morphologically complex words into their constituent morphemes and apply morphological rules to derive meanings of unknown words (Apel et al., 2013; Carlisle, 1995; Carlisle, 2000; Casalis et al, 2011; Green & Volter, 2011; Kinanti et al., 2015). The correlations between students' morphological structure awareness and their reading comprehension suggest that reading comprehension skills are influenced by their morphological structure awareness skills (Apel, et al., 2013; Casalis et al., 2011; Green & Wolter, 2011,). This relationship supports the approach that teaching the structure of the language is essential for the effective reading instruction and developing reading skills (Kuo & Anderson, 2006). Our research results also suggest that morphological awareness seems to work similarly in a language with a shallow orthography and a rich morphological system that is morphological knowledge has an impact on reading skills (Varga, 2020; Verhoeven & Perfetti, 2017,).

7.6. Limitations and Directions for Further Research

The study has two limitations, the first related to the psychometric properties of the test and the second to a small sample size. The low reliabilities and the high mean scores regarding some subtests are already mentioned as a main focus for the further research. The future test development could contribute to a more precise and reliable assessment tool as well as the developmental tendencies could be further investigated. In addition, some other dimensions of the constructs could also be included in test development as a means to better understand how awareness of morphological structure influences reading comprehension. Furthermore, adding more background variables would also be a fruitful endeavour in future research in order to examine other influencing factors of the test achievements.

Although the overall sample size was not small (N=359), the number of participants in each grade level significantly reduced the generalizability of the findings. Thus, in future research a larger sample size is an essential step. Applying the advantages of technology-based assessment a large-scale study should be carried out in order to raise the generalizability of the results. The large sample size will allow us to apply more advanced statistical methods such as structural equation modelling to examine the nature of the constructs in different grade levels, and their relationship to each other and other factors as well. In addition, a large-scale study will also provide a more reliable and general picture about the development of the measured constructs.

8. THE LARGE SAMPLE SURVEY — THE RELATIONSHIP AMONG MORPHOLOGICAL AWARENESS, READING COMPREHENSION AND READING MOTIVATION IN HUNGARIAN 2-4 GRADERS

8.1. Introduction

The chapter gives an overview of the main features of the large sample survey which was conducted to test the final version of the test. The chapter analyses the data yielded from the survey. Psychometric features of the instrument are evaluated. The chapter investigates the development of morphological awareness skills and its subskills in grades 2-4 by different statistical analyses. The chapter explores the development of morphological awareness and the relationship between morphological awareness and reading comprehension in grades 2-4. The results extend to the analysis of the correlations and differences between genders. The development of reading motivation in grades 2-4, the relationship between reading motivation and morphological awareness and reading performances are reported.

8.2. Objectives

After the pilot test had been conducted, its results were analysed; some modification were made in the test to increase construct validity. Since the morphological test and the short reading comprehension test worked well the structure of the instrument was kept and it was further developed. The main objective of the large sample survey was to test the operation of the test on a big sample. The first version of the test was modified, and a fifth dimension of morphological awareness (morpheme segmentation) was added. The instrument also included a short reading comprehension subtest and a reading motivation questionnaire. It was an important aim that the morphological test, the reading comprehension subtest and the reading motivation questionnaire could be completed in a 45 minute lesson. The primary objective of the large sample test was to tap into the structure of morphological awareness and examine its development in grades 2-4. Also, the large sample survey gave a chance to get a general insight into how the relationship among morphological awareness, reading comprehension and reading motivation changes in grades 2-4.

The following research questions were raised:

How does the instrument for measuring morphological awareness work on a large sample?
Are the psychometric features of the test acceptable?
How does morphological awareness develop in grades 2-4?
What relationships can be found among the different subtests?
What relationship does morphological awareness have with reading comprehension?
How does this relationship change throughout grades 2-4?
How do boys' and girls' achievements in morphological awareness change in grades 2-4?
What is the relationship between morphological awareness and reading motivation?
How does this relationship change throughout grades 2-4?
How does reading motivation change throughout grades 2-4?
What is the relationship between basic reading skills and reading motivation?
How do girls' and boys' reading motivation differ and change throughout grades 2-4?
How do different aspects of reading motivation relate to morphological awareness and basic reading skills in grades 2-4?

8.3. Methods

8.3.1 Participants

4,134 children in 94 Hungarian schools were examined. The number of students in grades 2-4 was 1,310, 1,291, and 1,533 respectively. In grades 2-4, 2,026 boys; 637 (grade 2), 629 (grade 3) and 760 (grade 4) were tested. The sample consisted of 1,877 girls; 597 (grade 2), 602 (grade 3) and 678 (grade 4). 231 students did not give information on their gender (Table 8.1.)

Table 8.1. The number of participants

Number of participants in different grades

	All grades	Grade 2	Grade 3	Grade 4
total	4,134	1,310	1,291	1,533
boys	2,026	637	629	760
girls	1,877	597	602	678
no information	231	76	60	95

The total age of the children tested were M= 9.51, SD=1.03 years (see Figure 9.1). In grades 2, 3, 4 the average age was 8.42, 9.47, 10.48 years respectively; the age of boys in grades 2, 3, 4 was 8.48, 9.55 and 10.50 years. The average age for girls in grades 2, 3, 4 were 8.36, 9.39, and 10.44 years respectively (Table 8.2).

Table 8.2. Age means and standard deviations of the participant in grades 2-4 (years)

	Total M (SD)	Grade 2	Grade 3	Grade 4
Total	9.51 (1.03)	8.42 (0.54)	9.47 (0.57)	10.48 (0.63)
Boys	9.56 (1.01)	8.48 (0.55)	9.55 (0.56)	10.50 (0.59)
Girls	9.44 (1.02)	8.36 (0.51)	9.39 (0.55)	10.44 (0.62)

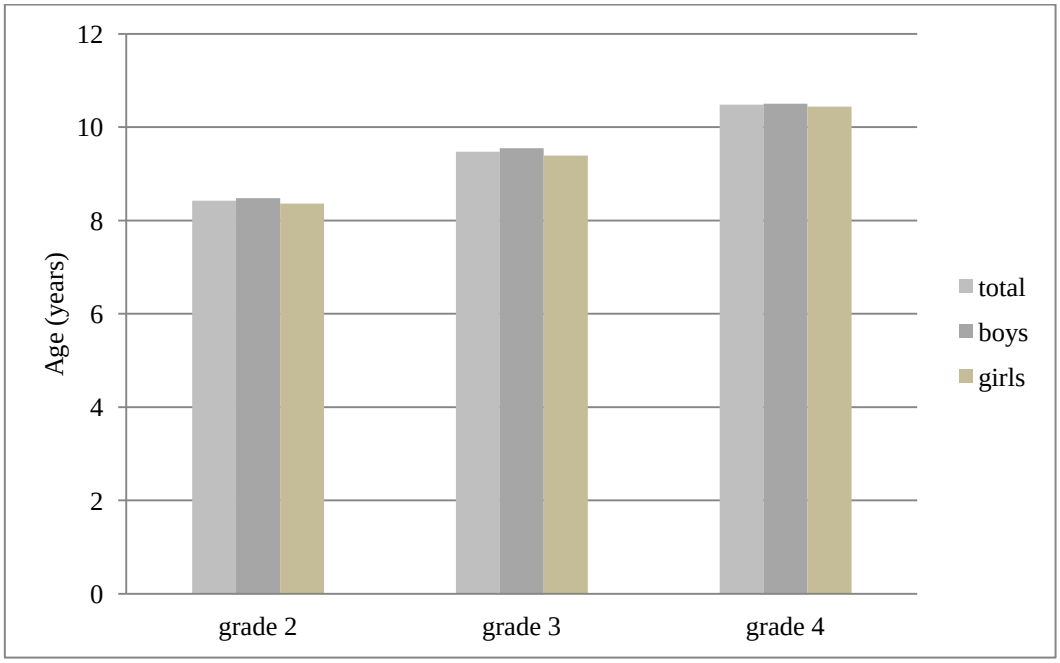

Figure 8.1. The age of participants

8.3.2. The Development of the Instrument Measuring Morphological Awareness

In the previous chapter, I described the main phases of the development of the instrument. The results of the pilot test were published (Varga et al., 2020). This subchapter shows what was modified in the pilot test to increase the construct validity; it also delineates all the new features of the final version of the morphological structure awareness test. The large sample survey was a milestone in the development of the online instrument measuring morphological structure awareness and reading comprehension. The pilot test paved the way for the final version of the instrument. The final version of the test contains 59 items all together and short reading comprehension subtest which evaluates basic reading comprehension skills (10 items). Table 8.3. describes the development of the instrument.

Table 8.3. The Development of the instrument for assessing morphological awareness

Factors of Morphological Awareness	Number of Items Pilot Study	Number of Items Large Sample Survey
Morphological Structure Awareness	40	59
Affix identification Real Words	10	12
Compound Words	10	12
Derivation	10	12
Affix Identification Nonwords	10	12
Reading Comprehension	10	10
Morphological. Segmentation.		12

The morphological structure awareness test covers a wide selection of subskills related to morphological awareness, and one more dimension was added to the first version of the instrument consisting 2 parts morpheme segmentation for nonwords (Apel et al., 2013) and morpheme segmentation for real words (relatives task) (Carlisle, 2000). Besides the new dimension the final version of the instrument contained, the same task types as the pilot test, however, two more items were added in each task types (affix identification/non words, affix identification/real word, derivation and compound words). Therefore, the number of items was increased from 10 to 12 items in each subtest (identification of affixes/real words (12 items), compound words (12 items), derivation (12 items) and identification of affixes with nonwords (12 items). The morpheme segmentation subtest consisted of 12 items (6 items for morpheme segmentation (for nonwords) and 6 items for morpheme segmentation for real words (relational task). These tasks were included for measuring how children can identify relational relationships within the word (Carlisle, 2000).

The Affix Identification for Nonwords subtest aimed to demonstrate how efficiently children could identify different morphemes when they could not rely on the meaning of the word. In affix identification for nonwords subtest, children had to complete sentences; they had to choose from four options and had to click on the correct word or they had to choose the correct sentence from four options. The sentences consisted of one or two nonwords. Real inflections were attached to the nonwords. This task included a number of language elements: children had to identify the correct inflections in the case of nouns, and verbs. Children were given examples to familiarize them with the task. The first three items were comprised of the identification of inflections for single and plural nouns. The examples and images given to the children represented the difference between singular and plural nouns; they were given either the singular or the plural form of the nonwords. The children had to find correct singular form if the plural form was given or the correct plural form if the singular form was presented. Comparing the results of the first three items it was found that children did the third item much better than the first two, and this tendency was observed in all the three grades; probably the students got some proficiency in identifying singular and plural

inflections. The highest performance was reached in roffák item where the students had to put the word "roffa" into plural form (Table 8.4).

In the affix identification for real words task, children had put the words in the menu into two boxes: one box was for the root words and one for the inflected words. Examples were shown; the words had to be dragged into the correct box. If the children clicked on the question mark on the screen, the definition of the term "root word" and the term "affix" were displayed. The children had to make a decision about which word was infected and which was not (Table 8.4)

The Morphological segmentation subtest had a second part (relational task). The task included six items. The aim of the subtest was to assess the awareness of identification of multimorphemic words. The children had to identify whether the first word was formed from the second word or not. They answered by clicking on the word yes (*igen*) or no *(nem).* The subtest was challenging since the second word was orthographically similar to the first word; for example, *szellő, szel; borsó, bor; körte, kör; ügyeskedik, ügyes* (Table 8.4).

Table 8.4. Factors of morphological awareness (large sample survey)

	Number of Items	Morphological knowledge
Affix Identification for Real Words	12	recognition of the stem and affixes identifying inflections: -án -on, -en, - ön (tehén, egén)
Affix Identification for Nonwords	12	awareness of syntactic functions of morphemes recognitions of inflections for singular and plural nouns (marinosz- marinoszok) orthographic awareness (tatal- tattal, tatel, tatval) identification of nominal inflections: (zangurán-zanguránokat) g rammaticality of sentences, subject-verb agreement A gilimbóc a zandálás/zandálást/zandál/zandálni tanulja.
Derivation	12	identifying the syntactic knowledge of morphemes olvas/olvashat/ olvashat/olvasható distributional knowledge: Awareness of how morphemes are constrained by the stem they are attached to. Az étel teljesen ehet/éhes/ehetetlen/ehető
Compound Words	12	recognising compounds identifying real and pseudo compound (hattyúk, hatemeletes)
Morpheme segmentation nonwords 1	6	identifying the number of morphemes: attaching real affixes to nonwords (elzandálni, robotlambóc)
Morpheme segmentation 2 (relational task)	6	relational knowledge: identifying whether one word comes from another word: (borsó-bor, lépcső-lép)

In the derivation subtest, 12 sentences had to be completed by dragging the correct word onto the dotted line. The correct answers were selected from four words. Examples were given to make sure that children understood the task. I used frequent and less words to tap into awareness of derivational morphology in children (Table 8.4).

In Compound Words subtest the awareness of compound morphology was assessed. Children saw four words on the monitor, and they had to click on the compound word. Each item consisted of one real compound and three inflected or derived words.

The primary aim of the morphological segmentation subtest was to investigate children's skills in segmenting words into morphemes. Nonwords were implemented because I wanted to avoid confound with vocabulary. If children do not know the meaning of the word they have to rely on their morphological awareness skills. Real affixes were attached to pseudowords; for example, robotlambóc, zelenálok, lambóctalanság. Children were asked to count how many morphemes the word contained (1-4). The answers were given by clicking

on the correct number (1, 2, 3, and 4). Examples were given to children before starting the subtest (Table 8.4).

In the task Affix Identification for Real Words I used the analogical tasks used by Kirby et al. (2012). The task had to be adapted to be suitable for the online media. The example was given, and the students identified the base and inflected words by dragging them into the correct box. Berko (1958) employed pseudowords to test children's inflectional morphological skills. I used nonwords in tasks which required identification of nominal and verbal inflections In the derivation task I used the task type used by Nipold & Sun (2008) in which students had to identify the correct derived word from four options. The compound word task was inspired by Berko (1958) and Apel et al. (2013). However, the idea that the students had to choose the compound word from four options where a pseudocompund was also present was certainly a new approach. The morpheme segmentation originally was an oral task used by a number of researchers. I had to turn it into a written multiple choice task Using nonwords in segmentation task was inspired by Apel et al. (2013). The second morpheme segmentation task which implemented real words is similar to the one used by Carlisle (2000), it is also called "comes from" task, but Carlisle (2000) (Table 8.5).

Table 8.5. Instruments used for developing the Morphological Structure Awareness Test

Factors of morphological awareness	Instruments
Affix Identification for Real Words	Kirby et al., 2012
Affix Identification for Nonwords	Berko, 1958
Derivation	Carlisle, 2000, Nippold &Sun, 2008; Tyler & Nagy, 1989
Compound Words	Apel et al., 2013; Berko, 1958; Carlisle, 2000; Nippold & Sun, 2008; Tyler & Nagy, 1989;
Morpheme Segmentation for Nonwords	Apel et al., 2013
Morpheme Segmentation (relational task)	Apel et al., 2013; Carlisle, 2000

The instrument focuses on the evaluation of different subskills integrated into morphological awareness. It encompasses different aspects of morphological awareness assessing inflectional, derivational and compound morphology through testing relational, syntactical and distributional knowledge (Kuo & Anderson, 2006; Tyler & Nagy, 2014). The tasks aimed at testing morphological skills required in grade 2-4. The words in the subtests were carefully selected. As far as the base words are concerned relatively frequent words were used. In Affix Identification for Real Words task, a very frequent suffix (án, -en, -on, ön) was used. In affix identification task, the inflections of present and past tense of verbs, singular and plural of nouns, objective and instrumental cases of nouns had to be identified which are also regarded to be common inflections (Table 8.6).

Table 8.6. Characteristics of the Morphological Test

	Category (word frequency ranges)			
	1(-1,000)	2 (1,000-5,000)	3 (5,000-10,000)	4 (>10,000)
Affix Identification for Real Words (12 item)	-	53.84	20.67	25
Derivation (12 item)	16.67	41.67	19.17	22.49
Compound (12 item)	12.50	42.60	29.17	15.50
Morphological Segmentation (Relational task) (6 item)	-	41.01	33.5	25.5

Note: The categories include frequency ranges of words used in the morphological test (Oravecz, Váradi & Sass, 2014; Váradi, 2002).

In Derivation subtest only productive inflections were used. In Morpheme Segmentation for Real Words Task, the majority of the base words, were relatively frequent (<10,000). In the

nonwords tasks I used the basic inflectional suffixes the implicit morphological knowledge of which generally develops before the age of 6. According to The Hungarian National Corpus (Oravecz, Váradi & Sass, 2014; Váradi, 2002) more than 70 % of the target words in the morphological test belong to were relatively frequent category (<10,000) (See Table 8.6.).

Figure 8.2. Sample from the instrument

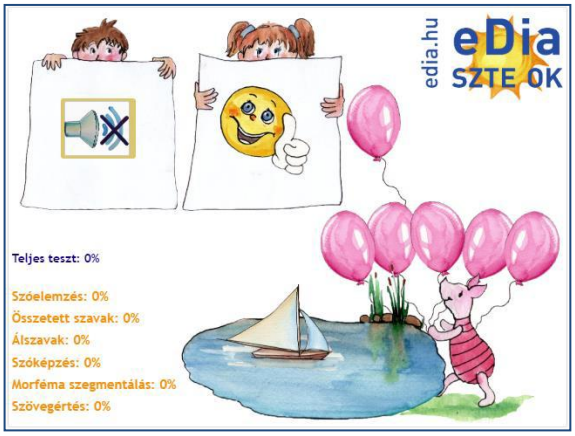

Figure 8.3. Sample from the instrument (result page)

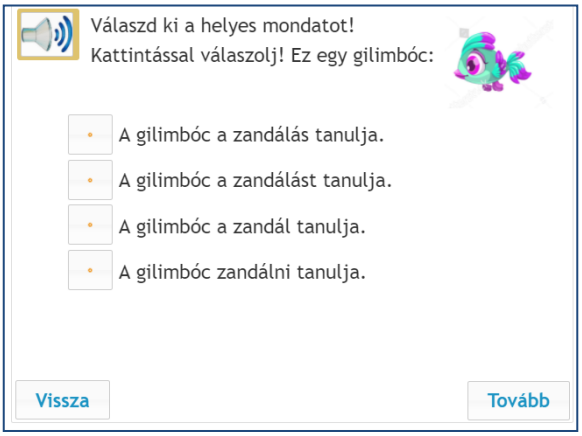

Figure 8.4. Sample item from the Affix Identification Nonwords Subtest

Figure 8.5. Sample Item from the Compound Words Subtest

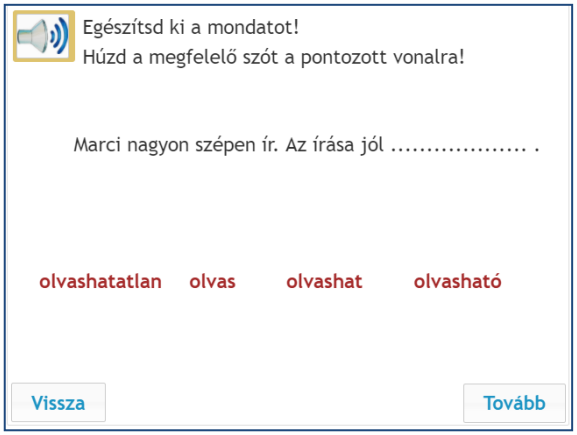

Figure 8.6. Sample Item from the Derivation Subtest

Figure 8.7. Sample Item from the Morpheme Segmentation Subtest

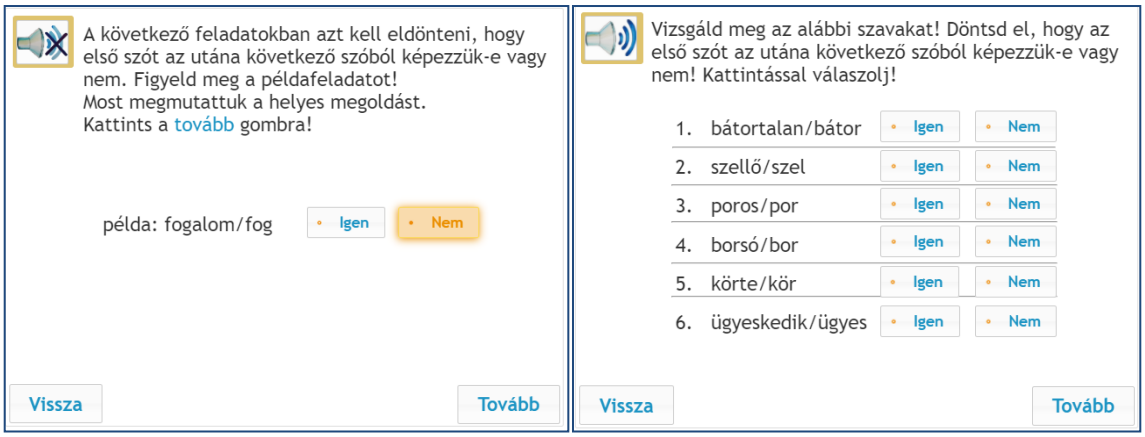

Figure 8.8. Sample items from the Relatives Task

8.3.3. Other instruments, Variables Used in the Research

8.3.3.1 Questionnaire, Demographic Information

After entering the eDia surface the children were asked about their gender and they clicked on the correct image. The aim was to assess both girls' and boys' performances. There was a question about the date of their birth. In addition, a self-made reading motivation questionnaire consisting of ten items was developed. The questionnaire measured reading motivation (7 items), self-concept (1 item), and the motivation for printed texts (1 item) and motivation digital media (1 item). The instrument also included a short questionnaire since it made possible for the children to complete the whole test and the questionnaire within a 45-minute lesson.

In addition to the Morphological Structure Awareness test, I attempted to find some motives which would explain the performances in the morphological test and reading comprehension subtests. Therefore, a questionnaire to assess reading motivations was adapted. The questionnaire included questions related to reading motivation. Table 8.7. demonstrates the items of the reading motivation questionnaire, the subconstructs they represent. Figure 8.7. shows items from the questionnaire. The instrument was developed based on the instruments used in different surveys (see Table 8.8). The questionnaire referred to different factors of reading motivation; for example, to the diversity of reading, interest in reading, reading self-concept, reading curiosity, reading avoidance, reading digital and printed media (Chapman & Tunmer, 2003; OECD, 2010; Wigfield, A., & Guthrie, 1997).

A five-point Likert Scale was implemented to develop a ten-item questionnaire. The questionnaire consisted of seven items which measured reading motivations, and 3 items were analysed individually. The questions which encompassed reading motivation comprised of the following statements:" I like reading different stories, short stories and novels. " (*Szeretek sokféle történetet, elbeszéléseket, regényeket olvasni*; " I like reading." (*Szeretek olvasni*.); "I am interested in reading". (*Érdekel az olvasás*); "When I read something interesting I forget about time. " (*Amikor valami érdekeset olvasok, elfelejtkezem az időről*); "I like exciting stories and exciting books." (*Szeretem a meséket és az izgalmas könyveket*), two reversed coded questions were also used: "I read because it is compulsory." (*Azért olvasok, mert kötelező*) and „I do not like long texts" (*Nem szeretem a hosszú szövegeket*.)

Table 8.7. The items of the questionnaire and the subconstructs

Questions	Subconstruct
Szeretek sokféle történetet, elbeszéléseket, regényeket olvasni. "I like reading all kinds of stories, short stories and novels."	diversity of reading materials
Szeretek olvasni. "I like reading"	enjoyment of reading
Érdekel az olvasás. „I am interested in reading."	interest in reading
Amikor valami érdekeset olvasok, megfelejtkezem az időről. "When I read something interesting I forget about time. "	enjoyment of reading
Szeretem a meséket és izgalmas könyveket. "I like stories and exciting books."	reading curiosity
Azért olvasok, mert kötelező. "I read because it is compulsory."	compliance *reverse coded*
Nem szeretem a hosszú szövegeket. " I do not like long texts"	reading Avoidance *reverse Coded*
Jó olvasó vagyok. I am a good reader."	Reading self-concept
Szívesebben olvasok valódi könyveket, mint monitoron, laptopon és tableten. "I prefer reading real books to reading on a monitor, laptops and tablets."	reading printed media
Szeretek tableten, laptopon, monitoron olvasni. "I like reading on a monitor, laptops and tablets."	reading digital reading

The individual items were related to motivation for printed books, the motivation for the digital media and self-concept. The motivation for the printed media included "I prefer reading real books to reading on monitors, laptops and tablets" (*Szívesebben olvasok valódi könyveket, mint monitoron, laptopon és tableten).* The motivation for digital media was assessed by the question "I prefer reading on tablets, laptops and on monitors." (*Jobban szeretek tableten, laptopon, monitoron olvasni*). The questionnaire also included one item for self-concept: "I am a god reader." *(Jó olvasó vagyok*). Children clicked on the following options to give their answers:"It is never true of me*." (Egyáltalán nem igaz)*, "It is sometimes true of me. *(Ritkán igaz),* "It is often true of me." (*Gyakran igaz),* "It is usually true of me." (*Rendszerint igaz),* "It is always true of me*." (Mindig igaz).*

Figure 8.9. Enter page item on asking about gender information

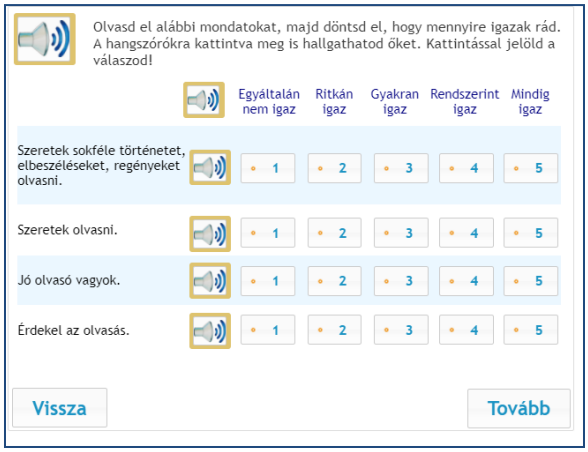

Figure 8.10. Sample from the questionnaire on reading motivations

Table 8.8. Instruments used for the reading motivation questionnaire

Factor	Assessment instrument
diversity of reading materials enjoyment of reading	OECD (2010), *PISA 2009 Results: Learning to Learn: Student Engagement, Strategies and Practices (Volume III)*, PISA, OECD Publishing, Paris
enjoyment of reading interest in reading reading curiosity reading avoidance	Wigfield, A., & Guthrie, J.T. (1997)."Relations of children's motivation for reading to the amount and breadth of their reading," *Journal of Educational Psychology*, 89, 1997, pp. 420–432
reading self-concept	Chapman J. W., Tunmer W. E. (2003). Reading difficulties, reading-related self-perceptions, and strategies for overcoming negative self-beliefs. Read. Writ. Q. 19 5–24. 10.1080/10573560308205.
digital and printed media	OECD (2010), *PISA 2009 Results: Learning to Learn: Student Engagement, Strategies and Practices (Volume III)*, PISA, OECD Publishing, Paris

A short reading comprehension test was also included in the large sample survey. It was the same test as was used in the pilot study. It worked well during the pilot test; therefore it was not changed. The reading comprehension test measured only basic reading skills as it contained a short text and ten multiple choice questions. The description of the reading comprehension test can be found in the previous chapter (Instruments, Pilot Study). The aim of including this short reading comprehension test was to prove that there is a link between morphological awareness and reading comprehension (Carlisle, 2000). Basic competence in literal reading skills is required by the curriculum in grades 2-4. The task was developed considering the curriculum requirements for this age group (grades 2-4).

8.3.4. The Procedures

The large sample survey was a milestone in the development of the online instrument measuring morphological structure awareness and reading comprehension. The first version (pilot study one) and the pilot study paved the way for the final version of the instrument. The final version of the instrument contained two new types of tasks: morpheme segmentation and comes from tasks, and two more items in each task types, for example, in affix identification/non words, affix identification/real word, derivation and compound words and relational task.

Before the test became available, the schools belonging to eDia system received a brief description of the instrument assessing children's morphological awareness and reading comprehension skills. The guideline gave details about the aim of the testing, the subtests; it also explained what skills and subskills it measured, why it could be useful for the children and for the teachers (Appendix B, C); and sample tasks were included as well. The task types were listed: children had to provide their answers by clicking on the right answer, or dragging words into a box on the monitor (Appendix E). The parents' consent form can also be found in Appendix D.

There was a new feature integrated into the test procedure that besides the scores, teachers could also download a detailed description of the test and a personalized feedback for each child (Appendix F). It contained a written feedback for different achievement categories and a spider web diagram which showed the performance of a given child compared to his/her classmates, and the average performance of the given grade. The feedback details provided teachers about a child's performances that could help increase the teaching efficiency (Csapó & Molnar, 2019). The assessment scale was self-made, which was partly inspired by the assessment scales used at schools to describe students' achievements in different subjects and

partly inspired by the descriptions which are generally used for the evaluation of language competence (Council of Europe, 2020). The description of different levels indicated that the test mostly evaluates the ability to recognise the base word and the affixes. In case of higher achievements the students got the feedback that they can always or almost always can recognise morphemes. However, in case of the performances below 50% further practice was suggested. The descriptions of different achievement levels were worded very carefully to give positive encouragement to the students.

It was another feature of the instrument that it was possible for children to check their answers once more before finishing the test since the system asked if they wanted to finish the test when they completed the last item. The assessment scale (Appendix F) helped teachers identify the strengths and weaknesses of the children in identifying different morphemes, segmenting multimorphemic words; it measured how they could identify the correct affixes in inflected, compound and derived words. The instrument also tested basic reading comprehension skills and revealed the relationship between children's morphological and their reading literacy skills. Children could listen to the instructions during the test by clicking on the speaker icon on each slide. The schools were asked to provide headphones for the children willing to take part in the survey.

8.4. Results

8.4.1. The Psychometric Features of the Instrument

The reliability of the instrument showed mostly good and acceptable results. The Cronbach's alpha index for the whole sample was .94. The subtests showed similarly good reliabilities for the whole sample: morphological structure awareness .93, affix identification/ nonwords .75, reading comprehension. .79, affix identification/ real words .88, compound words .91, derivation .80. Unfortunately, morpheme segmentation consisting of two parts (morpheme segmentation for nonwords and relational tasks did not show particularly good reliabilities. However, they had to be kept for the construct validity because they measured important aspects of morphological awareness (Tánczikné-Varga, 2019; Varga, 2020).

The reliabilities for grade 2 indicated lower; however, mostly good or acceptable reliabilities. Morphological structure awareness .93, affix identification/ nonwords .68, reading comprehension 72, affix identification/ real words .87, compound words .91, derivation .80, morpheme segmentation .67, The reliabilities were the same for the morphological awareness, the compound words and the derivation subtest, in other subtests they were lower, and in the case of the relational subtest it was higher than they were for the whole sample. Table 8.9. shows the reliabilities of the instrument: Cronbach's alpha indices for grades 2-4.

Table 8.9. The reliabilities of the instrument

	All grades (N=4,134)	Grade 2 (N=1,310)	Grade 3 (N=1,291)	Grade 4 (N=1,533)
The Whole Test (69 items)	.94	.93	.92	.92
Morphological Structure Awareness (59 items)	.93	.93	.91	.90
Affix Identification/ Nonwords (12 items)	.75	.68	.71	.73
Affix Identification/ Real Words (12 items)	.88	.87	.86	.86
Compound Words (12 items)	.91	.91	.90	.89
Derivation (12 items)	.80	.80	.76	.74
Morpheme Segmentation (11 items)	.67	.67	.61	.64
Reading Comprehension (10 items)	.79	.72	.76	.78

For grade 3, the subtests showed similar tendencies; morphological structure awareness, .91, affix identification/ nonwords .71, reading comprehension 76, affix identification/ real words .86, compound words .90, derivation .76, morpheme segmentation .67.

In grade 4, the reliabilities were for morphological structure awareness .90; affix identification/ nonwords .73, reading comprehension .78, affix identification/ real words .86, compound words .89, derivation .74, morpheme segmentation .64. These values were higher than in grade 3 in affix identification nonwords, reading comprehension, morpheme segmentation. The values were a bit lower than in grade 3 in the morphological structure awareness, the compound words, derivation subtests.

In conclusion, the reliabilities of the test were improved comparing to the previous survey except for the reading comprehension subtest, which remained the same (.79). As far as the new subtests are concerned the lower reliabilities were accepted since they measured important dimensions of morphological awareness which assessed children's morphological awareness regarding the segmentation of words.

Table 8.10. Goodness of fit indices for testing dimensionality of morphological awareness in grades 2-4

Model	χ^2	*df*	*p*	CFI	TLI	RMSEA (95% CI)
Grade 2						
5 dimensions	2815.64	1642	.01	.974	.973	.023 (.022–.025)
1 dimension	7418.58	1652	.01	.873	.868	.052 (.050–.053)
Grade 3						
5 dimensions	2981.73	1642	.01	.962	.960	.025 (.024–.027)
1 dimension	6679.34	1652	.01	.857	.852	.049 (.047–.050)
Grade 4						
5 dimensions	3531.09	1642	.01	.948	.946	.027 (.026–.029)
1 dimension	7390.15	1652	.01	.842	.837	.048 (.046–.049)

Note: df = degrees of freedom; CFI = Comparative Fit Index; TLI = Tucker–Lewis Index; RMSEA = Root Mean Square Error of Approximation; χ2 and df are estimated by WLSMV.

Confirmatory factor analyses (CFA) were conducted to test the underlying measurement model for morphological awareness (Table 8.10.). The 5-dimensional model based on the subtests showed good model fit in all grades. The chi-squared difference test showed that the 5-dimensional model fits significantly better than the 1-dimensional model in all grades (χ^2=960.87; p<.01; χ^2=771.56 p<.01; χ^2=652.87 p<.01 respectively). Thus, the five latent factors of morphological structure awareness can be empirically distinguished. The magnitudes of correlations among the subtests (range between .26-.55) indicate that all dimensions represent important and distinguishable aspects of morphological awareness Table 8.10).

8.4.2. Students' Performances in the Subtests in Grades 2-4

8.4.2.1. Affix Identification for Nonwords Subtest

The Affix Identification/Nonwords subtest measured the identification of different language elements; it contained sentences with nonwords. The means and standard deviations in the affix identification/ nonwords subtest were the lowest in grade 2, the scores were higher in grade 3, and there is an increase in performances between grade 3 and grade 4. An analysis of variance (ANOVA) on these scores yielded significant variation among conditions the Affix

Identification Nonwords subtest at p<.01 level for three conditions [F (2,4131)=338,31, p=0.01]. The Post-Hoc Tukey test showed the scores in grades 2, 3 and 4 were significantly different p< 0.05. The lowest results were observed in the item og_10_tattal_ (M=.25, SD=.43) in grade 2, in grade 3 (M=.32, SD=.47) and in grade 4 (M=41, SD=.49). The item was difficult because children had to use orthographical, grammatical and morphological information at the same time. There were two nonwords in the sentence and children had to identify the correct instrumental case of the pseudowords. The results revealed that the last 6 items were more difficult for the children as they required the identification of more complex morphological and orthographical information. The items og_4_zanguranokat, the item og_05_vakutit_, og_07_zelenálnak, and og_13_vakuti_zelenálást demanded identifying inflections for singular and plural nouns and verbs; for example, item og_4_zanguranokat tested how children could identify the correct inflection of objective case of the plural noun. Our results demonstrated that the subtest differentiated between children quite well. The difference among the performances related to the different items. Table 8.11. demonstrates the means and standard deviations for the Affix Identification Nonwords Subtest.

Table 8.11. Means and standard deviations for the Affix Identification/ Nonwords Subtest

	Grade 2 (N=1,310) M (SD)	Grade 3 (N=1,291) M (SD)	Grade 4 (N=1,533) M (SD)
og_01_tatok	.60 (.49)	.71 (.45)	.73 (.44)
og_02_marinosz	.61(.49)	.72 (.45)	.79 (.41)
og_03_roffak	.76 (.43)	.85 (.36)	.88 (.32)
og_04_zanguranokat	.41 (.49)	.63 (.48)	.74 (.44)
og_05_vakutit	.39 (.49)	.55 (.50)	.64 (.48)
og_07_zelenalnak	.36 (.48)	.50 (.50)	.59 (.49)
og_08_zandaltak	.51 (.50)	.69 (.46)	.74 (.44)
og_09_zelenalt	.47 (.50)	.61 (.49)	.69 (.46)
og_10_tattal	.25 (.43)	.32 (.47)	.41 (.49)
og_11_kuffokkal	.36 (.48)	.52 (.50)	.63 (.48)
og_12_mo	.43 (.50)	.59 (.49)	.68 (.47)
og_13_mo	.35 (.48)	.51 (.49)	.62 (.49)

8.4.2.2. Affix Identification for Real Words Subtest

The means and standard deviations in the Affix Identification/ Real Word subtest show that students coped with this task relatively easily, and it also is important to note there was a gradual increase in the achievements throughout grades 2-4. An analysis of variance (ANOVA) on these achievements yielded significant variation among conditions [F (2, 4,131) = 206.71, p=0.01]. The Post-Hoc Tukey test indicated a significant difference among the grades p < 0.05. This subtest examined the students' morphological awareness related to identifying affixes in real words. The affix identification for real words task was not very difficult even for the second graders. The test was really easy for the four graders. The means increased and the standard deviations decreased in grade 3 and 4. The subtest had one difficult item *egén*; the means was the lowest and standard deviations were the highest. All the words were orthographically similar; therefore, children had to identify the root of the words; for example, *egén* (inflected word), *tehén* (root word). Although this subtest showed ceiling effects especially in the fourth grade, the results revealed important information about children's' awareness of inflections. Table 8.12. indicates the means and standard deviations for the Affix Identification/Real Words Subtest.

Table 8.12. Means and standard deviations for the Affix Identification /Real Words Subtest

	Grade 2 (N=1,310) M(SD)	Grade 3 (N=1,291) M(SD)	Grade 4 (N=1,533) M(SD)
ma_01_10_new_banan	.78 (.41)	.90 (.30)	.94 (.25)
ma_01_10_new_bodon	.70 (.45)	.83 (.38)	.86 (.35)
ma_01_10_new_tablan	.74 (.43)	.88 (.33)	.92 (.27)
ma_01_10_new_tehen	.75 (.43)	.87 (.33)	.91 (.28)
ma_01_10_new_egen	.43 (.49)	.59 (.49)	.69 (.46)
ma_01_10_new_falon	.71 (.45)	.85 (.36)	.89 (.32)
ma_01_10_new_kepen	.75 (.43)	.87 .33)	.91 (.29)
ma_01_10_new_kovon	.73 (.45)	.85 (.35)	.90 (.31)
ma_01_10_new_marton	.67 (.47)	.82 (.38)	.87 (.34)
ma_01_10_new_ocean	.73 (.45)	.86 (.35)	.89 (.31)
ma_01_10_new_parnan	.75 (.44)	.88 (.33)	.92 (.27)
ma_01_10_new_ret	.79 (.41)	.92 (.28)	.94 (.24)

8.4.2.3. Compound Words Subtest

The Compound Words subtest seemed to be harder than affix identification for real words but it was easier than affix identification for nonwords task. There is an increase in performances from the second grade to the fourth grade. Means are the lowest in grade 2 (M=52.66), standard deviations are the highest in grade 2 (SD=35.22). The increase in performances and the decrease in standard deviations show that the children could solve this task more easily in grade 3 (M=67.84, SD=32.0) and in grade 4, (M=77.26, SD=28.00).Table 8.13. indicates the means and standard deviations for the Compound Words Subtest.

The variance analysis (ANOVA) on these scores indicated significant variation among conditions [F (2, 4131) = 214.62, p=0.01]. The Post-Hoc Tukey test showed the achievements throughout the different grades are significantly different $p < 0.05$. Nine items included pseudo compounds; for example*, hattyúk, halász, erdész* seemed to cause difficulty to the students as the means showed. In grade 2 md_04_06_vadetel item was the most difficult, and md_01_03_rajzfilm was the easiest. In grade 3 and 4 md_01_03_mosogep was the most difficult and md_01_03_rajzfilm was the easiest. The subtest worked well in grades 2-4 and showed that children had only a rudimentary knowledge about compounds in the second grade

Table 8.13. Means and standard deviations for the Compound Words Subtest

	Grade 2 (N=1,310) M (SD)	Grade (N=1,291) M (SD)	Grade 4 (N=1,533) M (SD)
md_01_03_mosogep	.49 (.50)	.55 (.50)	.62 (.49)
md_01_03_rablohal	.50 (.50)	.65 (.48)	.75 (.43)
md_01_03_rajzfilm	.62 (.49)	.78 (.41)	.86 (.34)
md_04_06_vadetel	.40 (.49)	.56 (.50)	.70 (.46)
md_04_06_viragagy	.56 (.50)	.72 (.45)	.82 (.39)
md_04_06_viragkertesz	.47 (.50)	.66(.48)	.74 (.44)
md_07_09_erdotuz	.51 (.50)	.68 (.47)	.79(.41)
md_07_09_jatszoter	.49(.50)	.66 (.48)	.78 (.41)
md_07_09_papirbolt	.59(.49)	.74(.44)	.84 (.37)
md_10_12_csatahajo	.60 (.49)	.76 (.43)	.84 (.37)
md_10_12_halkonzerv	.55 (.50)	.71 (.46)	.80 (.40)
md_10_12_hatemeletes	.55 (.50)	.68 (.47)	.74 (.44)

8.4.2.4. Derivation and Segmentation Subtests

The Derivation subtest was easier for children than identifying compounds even in grade 2 (M=61.50, SD=26.38). The increase in means and the decrease in standard deviations show that the task got easier for the fourth graders (M=80.85, SD=19.28). The variance analysis (ANOVA) on these data yielded significant variation among conditions [F (2, 4131) = 269.66, p=0.01]. The Post-Hoc Tukey test showed a significant difference among the achievements of the different grades p< 0.05. In all the three grades the oa_10_eloadast item was the most challenging. The item required a high level of decoding and morphological skills as children had to choose from orthographically similar words *előad, előadás, eladás eladást, előadást*. The easiest item was oa_12_ehetetlen; oa_03_baratsagos in grade 3, oa_09_atismeteljuk in grade 3 and 4 (Table 8.14.)

Table 8.14. Means and standard deviations for the Derivation Subtest

	Grade 2 (N=1,310) M(SD)	Grade 3 (N=1,291) M (SD)	Grade 4 (N=1,533) M (SD)
oa_01_tanitas	.62 (.49)	.81 (.39)	.84 (.36)
oa_02_edesseget	.66 (.47)	.78 (.41)	.82 (.38)
oa_03_baratsagos	.74(.44)	.85 (.36)	.88 (.33)
oa_04_nyereseges	.51 (.50)	.70 (.46)	.76 (.43)
oa_05_eladot	.66 (.48)	.77 (.42)	.86 (.35)
oa_06_melysege	.60 .49)	.79 (.41)	.86 (.35)
oa_07_rejtelyes	.45 (.50)	.61 (.49)	.70 (.46)
oa_08_lakatost	.59 (.49)	.75 (.43)	.80 (.40)
oa_09_atismeteljuk	.70 (.46)	.85 (.36)	.90 (.31)
oa_10_eloadast	.41 (.49)	.47 (.50)	.54 (.50)
oa_11_olvashato	.70 (.46)	.81 (.39)	.86 (.35)
oa_12_ehetetlen	.75 (.43)	.84 (.36)	.89 (.31)

The Morpheme Segmentation subtest consisted of two parts. The first part evaluated morpheme segmentation in nonwords; the second part assessed how children can identify the morphological relationships in real words (relational task). The Morpheme Segmentation for nonwords task originally included 6 items. One item had to be excluded from the analysis since it showed negative correlation with all the other items. The means were quite low and the standard deviations were high we means that this short subtest was the biggest challenge for the children (Table 8.15.). The item mg_1_6_feladat_mo6 was the most difficult for the grades 2 and 4, including the identification of derivational suffixes; the task was to segment the word *lambóctalanság*. The items were almost equally difficult within each grade they showed increase among the grades. In summary, this subtest was the most difficult task throughout all grades. The results in the relational task demonstrated that in grade 2 all the items were difficult for the children. The most difficult item was mg_2_6_feladat_mo5; the students had to find out whether the word *körte* was formed from the word *kör*. In grades 3 and 4 children performed better in the subtest showing greater awareness in derivational morphology (Table 8.15.)

An analysis of variance (ANOVA) on these scores yielded significant variation among conditions [F (2, 4131) =145.60, p=0.01]. The Post-Hoc Tukey test indicated the achievements of the grades differed significantly p<0.05.

Table 8.15. Means and standard deviations for the Morpheme Segmentation Subtest

	Grade 2 (N=1,310) M (SD)	Grade 3 (N=1,291) M (SD)	Grade 4 (N=1,533) M (SD)
mg_1_6_feladat_mo1	.32 (.47)	.42(.49)	.48 (.50)
mg_1_6_feladat_mo3	.30 (.46)	.40 (.49)	.43 (.50)
mg_1_6_feladat_mo4	.30 (.46)	.42 (.49)	.52 (.50)
mg_1_6_feladat_mo5	.20 (.40)	.27 (.45)	.27 (.45)
mg_1_6_feladat_mo6	.23 (.42)	.25 (.43)	.30 (.46)
mg_2_6_feladat_mo1	.62 (.49)	.71 (.46)	.76 (.43)
mg_2_6_feladat_mo2	.57 (.50)	.65 (.48)	.71 (.45)
mg_2_6_feladat_mo3	.63 (.48)	.78 (.41)	.80 (.40)
mg_2_6_feladat_mo4	.46 (.50)	.59 (.49)	.60 (.49)
mg_2_6_feladat_mo5	.44 (.50)	.52 (.50)	.58 (.49)
mg_2_6_feladat_mo6	.65 (.48)	.76 (.43)	.79 (.41)

8.4.3. Reading Comprehension Subtest

The achievements in the Reading Comprehension subtest showed gradual development throughout grades 2-4; (M=44.00, SD= 26.28) in grade 2; (M= 60.65; SD=26.94) in grade 3, (M=69.86, SD=26.19) in grade 4. An analysis of variance (ANOVA) on these scores yielded significant variation among conditions, [F (2, 4131) = 342.17, p=0.01]. The Post-Hoc Tukey test showed the achievements in each grade were significantly different $p< 0.05$. The reading comprehension test assessed only basic reading skills and the data yielded from this subtest was used to examine the relationship between morphological awareness and reading comprehension. The Reading Comprehension subtest included a short text and ten questions which required information retrieval. There were four options, and the answers were provided by clicking on the correct answer. The questions followed the logic of the text. Before children started the text an example was provided. The text was displayed on the monitor and only one question was displayed on one slide; therefore, children could scroll up and down in the text when it was necessary to find the correct answer. The questions were related to the details of the text, and referred to the most important information. The text of the reading comprehension test was adapted, from a website (https://csipero.eu/) about a festival for children; however, the text was simplified, and the data was changed so that background knowledge would not confound the performances. The results showed gradual increase in reading comprehension skills throughout the grades 2-4. However, for grade 2 the subtest was rather challenging; the means were quite low and the standard deviations were high. The item od_09_1991 seemed to be the most difficult for all the grades, and od_01_időpont, od_09_1991 the easiest for all grades. In grades 3 and 4 the means were higher; however, we still found high standard deviations (Table 8.16.).

Table 8.16. Means and standard deviations for the Reading Comprehension Subtest

	Grade 2 (N=1,310) M(SD)	Grade 3 (N=1,291) M (SD)	Grade 4 (N=1,533) M (SD)
od_01_időpont	.55 (.50)	.75 (.43)	.83 (.38)
od_02_ketevente	.43 (.50)	.59 (.49)	.69 (.46)
od_03_elhelyezés	.44 (.50)	.58 (.49)	.66 (.48)
od_04_főtér	.48 (.50)	.62 (.49)	.73 (.44)
od_05_kezdés	.42 (.49)	.55 (.50)	.63 (.48)
od_06_szimbólikus	.37 (.48)	.51 (.50)	.62 (.49)
od_07_mennyi	.33 (.47)	.48(.50)	.57 (.50)
od_08_pillanat	.48 (.50)	.66 (.47)	.75 (.43)
od_09_1991	.55 (.50)	.77 (.42)	.86 (.35)
od_10_nepviselet	.36 (.48)	.55 (.50)	.65 (.48)

8.4.4. Relationships among the Subtests

Table 8.17 shows a strong significant correlation (p<.01) between the results of the Morphological Structure Awareness Test and all the subtests in all the three grades examined. In some cases the correlations got a bit stronger, sometimes a bit weaker, however, all of them were significant at the 0.01 level in all cases.

First of all, the relationships of the Morphological Structure Awareness Test to the subtests have been analyzed. Primarily, three correlations seem to have become stronger throughout grades 2-4: the relationship between the Morphological Structure Awareness Test and the Affix Identification Nonwords Subtest, the relationship between the Morphological Structure Awareness Test and Reading Comprehension subtest and the relationship between the Affix Identification Nonwords and Reading Comprehension subtests.

Correlations among the subtests in grades 2-4 are shown in Table 8.17. The Morphological Structure Awareness Test had a strong positive significant relationship with the Affix Identification Nonwords subtest p< 0.01. The correlation got stronger throughout the three grades. The value is the highest in the fourth grade. A moderate significant relationship was found between the Morphological Structure Awareness Test in grade 2 (r=.60, p<.01) grade 3 (r=.61, p<.01), grade 4 (.64, p<.01) and the reading comprehension subtest. The relationship between the Morphological Structure Awareness Test and the reading comprehension subtest gets stronger throughout the three grades. The relationship between the Morphological Structure Awareness Test and the Affix Identification Real Words subtest showed significant but decreasing tendency throughout the three grades. The decrease is not really big; however, it is enough to turn the strong relationship into a moderate one. The relationship between the results of the Morphological Structure Awareness Test (MSAT) and Compound Words Subtest showed strong but slightly decreasing tendency. However, despite the decrease it was still quite strong even in the fourth grade (r=.78, p<.01).

The correlation between of Morphological Structure Awareness Test and the Derivation subtest indicated a strong, however, volatile tendency. In grade 3 it got lower, however, in grade 4 it got almost as high as it was in grade 2. The Morpheme Segmentation also showed strong moderate slightly decreasing correlations with the results of the Morphological Structure Awareness Test.

Table 8.17. Correlations among the subtests

	MSAT Grades: 2 – 3 – 4	AINW Grades: 2 – 3 – 4	AIRW Grades: 2 – 3 – 4	CW Grades: 2 – 3 – 4	D Grades: 2 – 3 – 4
AI NW (12 items)	.72 73.78				
AIRW (12 items)	.73.69.67	.42.34.39			
CW (12 items)	.83.80.78	.47.43.46	.48.46.42		
D (12 items)	.79.74.78	.52.51.45	.44.41.36	.55.44.39	
MS (11 items)	.65.60.62	.37.34.38	.32.27.26	.45.35.34	.45.33.26
RC (10 item)	.60 .61 .64	.54 .56 .59	.39 .37 .40	.49 .44 .46	.49 .48 .42

Note: Morphological Structure Awareness Test (MSAT), Affix Identification/Nonwords (AINW), Affix Identification/Real Words (AIRW), Compound Words (CW), Derivation (D), Morpheme Segmentation (MS). Reading Comprehension Subtest (RC). Unmarked correlations are significant at the .01 level. (All correlations are significant at the 0.01 level)

Secondly, the relationships among the subtests have been explored. A moderate significant relationship between the Affix Identification Nonwords and the Reading Comprehension subtest; in grade 2 (r=54, p<.01), grade 3(r=.56 p<.01), grade 4(r=.59, p<.01)

was indicated. The relationship got stronger throughout the three grades; however, it was still moderate even in the fourth grade.

The Affix Identification Nonwords subtest indicated a moderate significant decreasing correlation with the Affix Identification Real Words subtest. This relationship also got a bit weaker. The relationship between the Affix Identification Nonwords subtest with the results of Compound Words has shown a significant moderate positive relationship. The relationship got weaker in grade 3 and it got stronger in grade 4.

The relationship between the Affix Identification/Nonwords Subtest and the Derivation subtests has shown moderate relationship; however, volatile tendencies.

The Affix Identification/Nonwords Subtest shows weak significant volatile correlations with the Morpheme Segmentation Subtest. The Reading Comprehension Subtest revealed a moderate significant correlation with the results of the Affix Identification Real Words Subtest. The Reading Comprehension Subtest shows weak significant correlations with the Morpheme Segmentation subtest. The Reading Comprehension Subtest shows a moderate significant decreasing relationship with the other subtests: Compound Words and the Derivation subtests. The Affix Identification Nonwords (AINW) subtests showed significant but decreasing correlation with all the subtests; for example, Compound Words: Derivation, Morpheme Segmentation subtests: The Compound Words subtest also indicated a significant decreasing correlations with all the other subtests; for example, with Derivation Morphological and the Relational subtests.

8.4.5. The Development of Morphological Awareness in Grades 2-4

The standard deviations for grades 2-4 (Table 8.18.) were examined. The results indicated the performance in the test results showed an increasing tendency both in morphological awareness and in reading comprehension as well. Students in grade 2 showed lower performances than the grade 3 and four. The morphological awareness test indicated that students' performance improved from grade 2 to grade 4. The means of performances got higher and the standard deviations got lower, which means that the tasks became easier in higher grades. Children reached the best results in the affix identification/ real words subtest in all the three grades: grade 2 (M=71.01, SD=28.63), in grade 3 (M=84.25, SD=22.48), in grade 4 (M=88.63, SD=19.65). The lowest values were observed in morpheme segmentation task in grade 2 (M=26.82, SD=26.42), in grade 3 (M=35.18, SD=28.55) and in grade 4 (M=39.93, SD=29.78). The subtest affix identification/ nonwords also seemed to be difficult in grade 2 (M=45.80, SD=22.53), in grade 3 (M=59.95, SD=23.19), in grade 4 (M= 68.05, SD=22.85). The performances in grades 2-4 were significantly different in the morphological structure awareness test. Children's morphological awareness skills developed throughout the three grades. An analysis of variance (ANOVA) on morphological awareness scores yielded significant variation among conditions, [F (2, 4,131) = 433.13, p=0.01]. The Post-Hoc Tukey test showed the achievements in each grade were significantly different $p< 0.05$.

Compound words and derivation and the relational subtests seemed to be easier than the morpheme segmentation task and affix identification subtests. The performances in all the three subtests show reading comprehension results seemed to be similar to the results of the Affix Identification Nonwords subtest. The increasing tendencies showed that even these simple reading comprehension tasks were rather difficult for the second graders; they became easier for the children in the third grade and fourth grade.

Table 8.18. Means and standard deviations in grades 2-4

	Grade 2 Mean (*SD*)	Grade 3 Mean (*SD*)	Grade 4 Mean (*SD*)	Effect of Grade (*F*)
Morphological Awareness Structure	54.98 (20.45)	68.20 (17.48)	74.60 (15.85)	433.13 $p<.01$
Affix Identification/ Nonwords	45.80 (22.53)	59.95 (23.19)	68.05 (22.85)	338.31 $p<.01$
Affix Identification/ Real Words	71.01 (28.63)	84.25 (22.48)	88.63 (19.65)	206.71 $p<.01$
Compound Words (12 items)	52.66 (35.22)	67.84 (32.00)	77.26 (28.00)	214.62 $p<.01$
Derivation (12 items)	61.50 (26.38)	75.25 (21.93)	80.85 (19.28)	269.66 $p<.01$
Morpheme Segmentation (11 items)	42.92 (22.61)	52.43 (21.16)	56.71 (21.56)	145.60 $p<.01$
Reading Comprehension (10 items)	44.00 (26.28)	60.65 (26.94)	69.86 (26.19)	342.17 $p<.01$

The test seemed to show the difficulties children had identifying different language elements. The performances in different grades distinguished between children's performances quite efficiently (see Figure 8.11.); therefore, it is assumed that all the subtests of the instrument measured children's morphological skills efficiently and correlations among the different subskills for measuring morphological awareness showed moderate correlations with the reading comprehension subtest which also support construct validity.

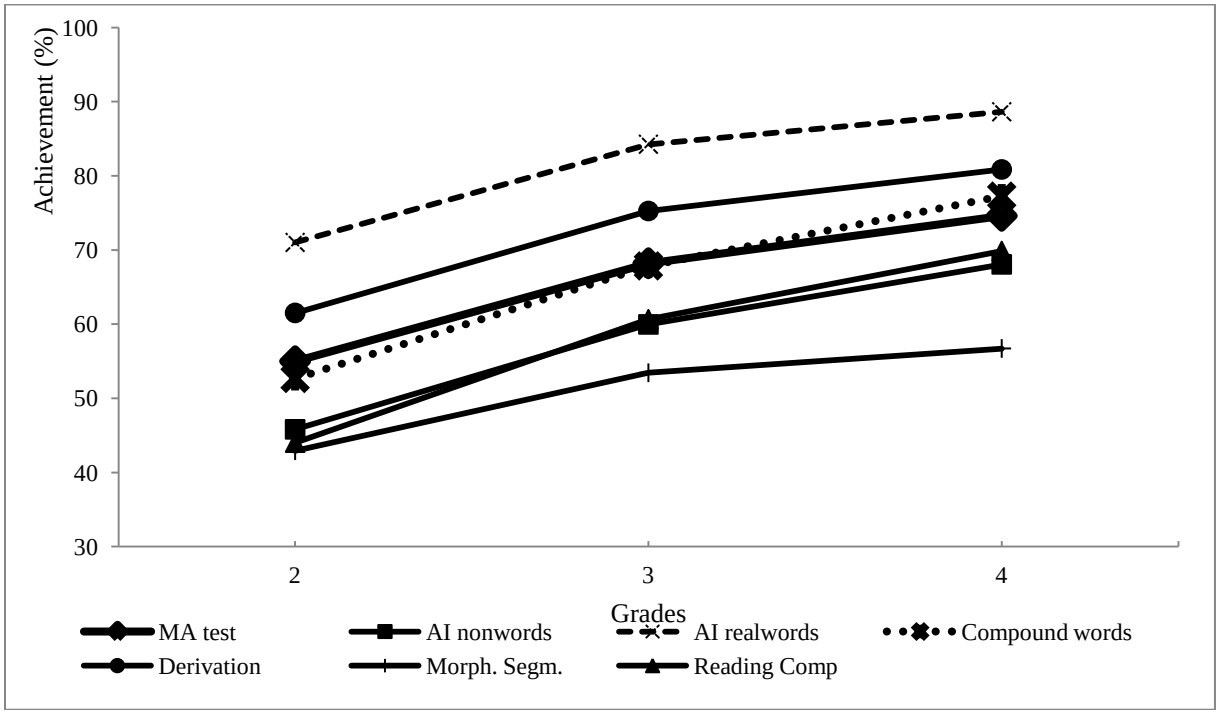

Figure 8.11. Development of morphological awareness and reading comprehension

8.4.6. Gender Differences

8.4.6.1. Gender Differences in Morphological Structure Awareness

2,026 boys (M=57.44, SD=24.17) and 1,877 girls (M=60.76, SD=24.98) were tested in all grades. 231 students did not give gender information. The results indicated that in the Morphological Structure Awareness Test the girls performed slightly better than the boys in all grades.

Table 8.19. Boys and girls performances in the Morphological Structure Awareness Test

	N	M	SD
Grade 2 (Boys)	637	53.86	(20.34)
Grade 2 (Girls)	597	57.03	(20.33)
Grade 3 (Boys)	629	66.75	(17.65)
Grade 3 (Girls)	602	70.27	(16.86)
Grade 4 (Boys)	760	74.21	(15.49)
Grade 4 (Girls)	678	76.15	(15.60)
All grades (Boys)	2,026	57.44	(24.17)
All grades (Girls)	1,877	60.76	(24.98)
no answer	231		

Table 8.20. presents the differences between genders in the Morphological Structure Awareness test and in the subtests (59 items). The analysis revealed the girls achieved higher scores in the Morphological Structure Awareness Test and in all the subtests as well. The table illustrates the both boys and girls produced the best scores in the Affix Identification/Real Words subtest. The girls (M=83.37, SD=23.22) did slightly better than the boys (M=80.71, SD=25.86). Morphological Segmentation was the most difficult for both boys (M=33.66, SD=28.43) and girls (M=35.39, SD=29.22). However, the girls were proved to be better in this task as well. The differences between boys' and girls' performances are relatively small, however, in the Morphological Segmentation and in the Derivation Subtests they were really small. The scores in the Morphological Structure Awareness test, Compound Words and the Relational Subtests were similar. Another similarity which can be seen from the table is that reading comprehension achievements are comparable to the Affix Identification Nonwords Subtest; Boys' (M=57.44, SD=24.17) in the Affix Identification Nonwords; and (M=56.92, SD=28.70) in the Reading Comprehension Subtest; however, girls scores were higher (M=60.76, SD=24.98) in the Affix Identification Nonwords Subtest; and (M= 61.62, SD=28.22) in reading comprehension.

Table 8.20. Means and standard deviation for boys and girls in the MSAT Test and in the subtests

	MSAT M (SD)	AINW M (SD)	RC M (SD)	AIRW M (SD)	CW M (SD)	D M (SD)	MS/NW M (SD)	MS/RT M (SD)
Boys	65.50 (19.70)	57.44 (24.17)	56.92 (28.70)	80.71 (25.86)	65.21 (33.74)	72.45 (23.62)	33.66 (28.43)	64.04 (28.23)
Girls	68.18 (19.34)	60.76 (24.98)	61.62 (28.22)	83.37 (23.22)	69.06 (32.29)	74.21 (24.03)	35.39 (29.22)	66.16 (27.40)

Note: Affix Identification/Nonwords (AINW), Reading Comprehension (RC), Affix Identification/Real Words (AIRW), Compound Words (CW), Derivation (D), Morpheme Segmentation for Nonwords (MS/NW), Morphological Segmentation for Real Words /Relational Task (MS/RT),

Table 8.21. presents the differences between boys' and girls' performances for the Morphological Structure Awareness Test and the subtests in all grades. The gender differences were noticeable both in the Morphological Structure Awareness Test and in the

subtests as well. The means and standard deviations show that the same tasks proved to be the most challenging both for girls and boys. Table 9.22. demonstates boys' and girls' performances in all grades and in grades 2-4.

Table 8.21. Boys and girls performances in the subtests in grades 2-4

	AINW	RC	AIW	CW	D	MS/NW	MS/RT
Grade 2 boys N=637	44.57 (27.76)	41.73 (25.73)	69.26 (29.73)	51.19 (35.59)	60.79 (25.46)	26.25 (26.00)	56.17 (28.90)
Grade 2 girls N=597	48.02 (23.23)	47.22 (27.00)	73.74 (26.87)	55.37 (34.67)	63.10 (27.15)	27.73 (26.74)	57.17 (66.67)
Grade 3 Boys N=629	59.02 (22.98)	58.04 (27.49)	82.98 (24.20)	65.42 (32.52)	73.87 (22.18)	33.93 (28.39)	65.55 (26.76)
Grade 3 Girls N=602	61.75 (23.35)	63.90 (26.31)	85.99 (20.05)	71.22 (30.82)	77.00 (21.48)	36.48 (26.63)	68.69 (25.31)
Grade 4 boys N=760	66.91 (22.24)	68.72 (26.14)	88.43 (19.63)	76.80 (28.29)	81.05 (18.66)	39.66 (29.99)	70.35 (27.20)
Grade 4 Girls N=678	71.10 (22.79)	72.29 (25.46)	89.51 (19.39)	79.19 (26.73)	81.53 (19.30)	41.15 (30.39)	71.89 (25.50)

Note: Affix Identification/Nonwords (AINW), Reading Comprehension (RC), Affix Identification/Real Words (AIRW), Compound Words (CW), Derivation (D), Morpheme Segmentation for Nonwords (MS/NW), Morphological Segmentation for Real Words/Relational Task (RT).

Table 8.22. compares the boys' and girls' performances in different grades. Both genders seem to show increase in all subtests throughout grades 2-4. In the second grade all the achievements were lower than in the third and the fourth grades. The table shows growth in the subskills, however, the differences between the genders are obvious even in the fourth grade; in addition, in some cases the differences seem to be growing.

Table 8.22. Differences between boys' and girls' performances in the MSAT Test and the RC Subtests in grades 2-4

grade 2	Boys M (SD)	Girls M (SD)	F (p)	t (p)	d
MSAT test	53,86 (20,34)	57,03 (20,33)	0.00 (0.99)	-2.73 (0.01)	0.16
RC Subtest	41.72 (25.73)	47.21 (27.01)	2.97 (0.85)	-3.66 (0.01)	0.21
grade 3	Boys M (SD)	Girls M (SD)	F (p)	t (p)	d
MSAT test	66.75 (17.65)	70.27 (16.86)	1.87 (0.17)	-3.58 (0.01)	0.20
RC Subtest	58.04 (27.49)	63.90 (26.31)	2.78 (0.01)	-3.81 (0.01)	0.22
grade 4	Boys M (SD)	Girls M (SD)	F (p)	t (p)	d
MSAT test	74.21 (15.49)	76.15 (15.60)	0.48 (0.83)	-2.35 (0.02	0.12
RC Subtest	68.72 (26.14)	72.29 (25.46)	1.19 (0.28)	-2.61 (0.01)	0.14
All grades	Boys M (SD)	Girls M (SD)	F (p)	t (p)	d
MSAT test	65.50 (19.70)	68.18 (19.34)	1.36 (0.31)	-4.29 (0.01)	0.13
RC Subtest	56.92 (28.70)	61.62 (28.21)	1.87 (0.17)	-5.16 (0.01)	0.17

The difference is slightly bigger in the fourth grade than in the second grade. However, the table shows the opposite tendency in the case of the Reading Comprehension Subtest. The

difference between the boys' and girls' performances is decreasing; in grade 2 boys (M=41.73, SD=25.73); the girls' (M=47.22, SD=27.00), in the third grade boys (M=58.04, SD=27.49), the girls' (M=63.90, SD=26.31), in the fourth grade the difference is smaller between boys and girls: boys (M=68.72, SD=26.14), girls (M=72.29, SD=25.46) than it was in the second grade. The constant decrease in the differences in the boys' and girls' performances also stands out from the table in the case of Affix Identification/Real Words, Compound Words, and Derivation subtests. However, in the case of Reading Comprehension, Morpheme Segmentation, and Relational Task the difference either do not change or get slightly bigger.

In summary, the analysis of the means and constant deviations showed that boys' performances got closer to the girls' performances in most subtests; the Reading Comprehension, Affix Identification/Real Words, Compound Words, Derivation subtests, however, in the Affix Identification/Nonwords, the Morpheme Segmentation subtest and the Relational task the differences got bigger. I analysed the differences between boys' and girls' performances in the Morphological Structure Awareness Test and Reading Comprehension Subtest by the independent samples T test (Table 8.22.). There was a significant difference between males' and females' performances in both tests at the 0.01 level in grades 2 and 3, in grade 4; the difference was significant at the 0.05 level in the case of the MSAT test. In the achievements of the Reading comprehension subtest the difference was significant among the grades at the 0.01 level. Table 8.23. shows significant differences between boys' and girls' performances at the 0.01 level. The girls performed slightly better than boys.

8.4.6.2. Correlations in Boys' and Girls' Performances

Significant correlations $p<.01$) have been found among the performances in the Morphological Structure Awareness Test and subtests results in boys' and girls' achievements. The correlations are stronger for the girls' performances between the Morphological Structure Awareness Test and Affix Identification/Nonwords Subtest while for the boys the correlation is weaker. The correlation between the Morphological Structure Awareness Test and Reading Comprehension subtest is moderate, and it is also stronger for the girls' than for boys' achievements. The relationship between the Morphological Structure Awareness Test and Compound Words indicates equally strong relationships for girls ($r=.82$, $p<.01$) as for boys ($r=.82$, $p<.01$). The correlations between the Morphological Structure Awareness Test and Derivation subtest indicated almost as strong relationship for girls' performances as for boys' performances.

Almost equal moderate correlations were observed between the Morphological Structure Awareness Test and the Morpheme Segmentation subtests. The correlation between the Morphological Structure Awareness Test and Relational subtest is also stronger in the case of girls than for boys' achievements. The correlations between the subtests indicate that there is a significant correlation between the subtests in both girls' and boys' performances.

The correlations among the Affix Identification/Real Words and other subtests showed that the relationship is weaker in the girls' performances than in the boys' performances.

The correlations between the Affix Identification/Real Words and the Compound Words for show stronger relationship for boys ($r=.52$, $p<.01$) than for girls ($r=.48$, $p<.01$). The same pattern can be seen in the correlations between the Affix Identification/Real Words and the Derivation subtest for boys ($r=.48$, $p<.01$), for girls ($r=.45$, $p<.01$). The correlation between the Affix Identification/Real Words and Morpheme Segmentation is also stronger for boys ($r=.25$, $p<.01$) than for girls ($r=.21$, $p<.01$).

8.4.7. Reading Motivation, Morphological Awareness and Reading

A new variable was created from the seven items which assessed reading motivation. The reliabilities of reading motivation variable is acceptable especially in the fourth grade: Cronbach Alpha for all grades (.69), grade 2 (.60), grade 3 (.66), grade 4 (.76). The means in each year group were compared. Reading motivation was found to be increasing throughout grades 2-4. Table 8.23. indicates the change in Reading Motivation in Grades 2-4.

Table 8.23. The change in reading motivation in grades 2-4

	Grade 2 (N=1252) M (SD)	Grade 3 (N=1277) M (SD	Grade 4 (N=1520) M (SD
Reading Motivation	3.31 (.86)	3.37 (.85)	3.42 (.90)

The one-way ANOVA variance analysis revealed that the scores in reading motivation were significantly different throughout the different grades at p<.01 level for three conditions [F (2, 4046) = 5.179, p=0.006]. The Post-Hoc Tukey test showed the achievements in each grade were significantly only in grades 2 and 3 different p< 0.05, but the achievements were not significantly different between grades 3 and 4.

8.4.7.1. Correlations among Morphological Awareness, Reading and Reading Motivation

Correlations among reading motivation, MSAT test and reading comprehension in grades 2-3-4 are presented in Table 8.29. The correlation analysis revealed a weak significant positive correlation (p<.01) between reading motivation, the Morphological Structure Awareness test in all the three grades. The correlations between reading motivation and the MSAT test were also significant (p<.01), but weak; in grade 2(r=.24, p<.01), in grade 3 (r=.28, p<.01), in grade 4 (r=.29, p<.01). The correlations seem to be increasing.

Table 8.24. Correlations among reading motivation, reading comprehension and the MSAT Test

	Reading Motivation 2-3-4	Reading Comprehension 2-3-4
Reading Comprehension	.21**.26** .27**	
MSAT test	.24**.28** .29**	.60**.61**.64**

Note: All correlations are significant at the 0.01 level

The correlations among the items testing reading self-concept, motivation for print media, motivation for digital media, Reading Comprehension subtest (MSAT) and Morphological Structure Awareness Test results were examined (Table 8.25.). The correlations are usually positive, weak and significant among the results the Morphological Structure Awareness Test and the Reading Comprehension subtest results and the different components of the reading motivation. The correlations seem to be higher in the third grade than in the second grade, however, they show lower values in grade 4. (See Table 8.25.). However, the motivation for the digital media item shows weak negative correlations both with the test performances and with the other components of reading motivation. Correlation analysis showed that there was a weak significant correlation (p<.01) between reading comprehension and reading self-concept item "I am a good reader" in grades 2-4; in grade 2 (r=.17 p<.01), in grade 3 (r=.28, p<.01), in grade 4 (r=.23, p<.01). The strongest correlation was found in grade 3, in the fourth grade the relationship was stronger than in the second grade; however it was found to be

weaker than in the third grade. The correlation between reading self-concept and the Morphological Structure Awareness Test was weak, however, it was significant at the 0.01 level ($p<.01$), it seemed to be the same in all the grades examined. Reading self-concept also showed weak significant correlations with the motivation for print media "I prefer reading real books to reading on the monitor" in all the three year groups; in grade 2($r=.22$ $p<.01$), in grade 3 ($r=.26$, $p<.01$), in grade 4 ($r=.23$, $p<.01$). Reading self-concept showed a weak negative correlation with the item assessing the preference for digital media ($r=.06$, $p<.05$) in grade 4. In the other two grades the correlations were not significant.

The correlation analysis indicated that there was a weak significant correlation ($p<.01$) between reading comprehension and the preference for the printed media item "I prefer reading real books to reading on the monitor." in grades 2-4 (Table 8.25).

Table 8.25. Correlations among reading motivations, reading comprehension and the MSAT Test in grades 2-4.

	RC Grades 2-3-4	MSAT Grades 2-3-4	Self-concept Grades 2-3-4	Motivation for print media Grades 2-3-4
Self-concept	.17.28.23	.27.27.27		
Motivation for Print Media	.13.18.16	.12.20.15	.22.26.23	
Motivation for Digital Media	-.18-.21-19	-22-.19-.19	-.10-.10-.06*	-.26-.35-.45

Note: Reading Comprehension (RC), Morphological Structure Awareness test (MSAT)
All correlations are significant at the 0.01 level, the correlation marked with * are significant at the 0.05 level.

The correlation was the strongest in grade 3. In grade 4, the relationship became stronger than it was in the second grade; however it was not as strong as it was in the third grade. The correlation analysis between the motivation for printed media and the Morphological Structure Awareness Test indicated a weak significant relationship ($p<.01$); in grade 2($r=.12$ $p<.01$), in grade 3 ($r=.20$, $p<.01$), in grade 4 ($r=.15$, $p<.01$). The strongest correlation was indicated in grade 3. The correlations between the motivation for printed media item and the motivation for digital media item were analysed. A weak significant negative relationship was revealed throughout the three grades. The negative correlation was becoming stronger in grades 2-4. The correlation analysis demonstrated that there was a weak negative significant correlation ($p<.01$) between reading comprehension and the motivation for the digital media item "I prefer reading real books to reading on the monitor" in grades 2-4. The negative correlation was the strongest in grade 3, in the second grade and fourth grade it was weaker.

It was an interesting result that the motivation for digital media showed a negative relationship with both the morphological test results and all the components of reading motivation. For example, the Morphological Structure Awareness Test demonstrated a weak negative significant relationship ($p<.01$). The strongest correlation was found in grade 2. In the third and fourth grades the correlation coefficients showed the same values. The correlations between reading self-concept and the preference for digital media in the girls and boys were investigated. A weak significant negative relationship was revealed throughout grade 4 ($r=-.06$, $p<.05$). In the other two grades the correlations were not significant.

As correlation analyses showed significant relationships among reading motivation, morphological awareness and reading; therefore, we decided to tap more deeply into the relationships among the constructs by creating quartile groups based on the morphological awareness and reading comprehension test performances in order to see whether reading motivation is linked to morphological and reading comprehension.

8.4.7.2. Reading Motivation and Morphological Structure Awareness

Based on the results of the correlation analyses, we wanted to get a deeper insight into the relationships among reading motivation, morphological structure awareness and reading comprehension. Quartile groups based on the achievements in Morphological Structure Awareness Test and the Reading comprehension subtest were created. The quartiles divide the data into quarters so that 25% of the measurements are less than the lower quartile, 50% are less than the mean, and 75% were less than the upper quartile. Two new variables were formed based on the results of the MSAT test results and the Reading Comprehension Subtest.

The quartile groups were formed based on MSAT test performance based on examinations in SPSS. (N= 3,983, missing=151). 25.9 % of the students belonged to the lowest achievers (quartile group 1; scores were between 0.00-52.5424%). 25.8 % of the students were included in group 2 who performed between 52.5425-71.1863%. Quartile group 3 consisted of 22.67 % of the students who scored between 71.1864-81.3559%; the highest achievers (25.4%) were in quartile group 4 (81.3560-100%).

The quartile groups were formed based on the reading comprehension results (N=4,134). The first group (25.6%) performed between 0-30.00%; the second group consisted of 28.6% of the students, (31.00-60.00%), 21.6% of students belonged to group 3 (61.00-80,00%); and group 4 (24,1%) performed between 81.00 and 100%.

The relationship between the reading motivation and MSAT quartile groups: and morphological awareness quartile groups in grades 2-4 were investigated.

Table 8.26. presents that in the second grade children who belonged to the lowest performance group in the morphological structure awareness 1= (0.00-52.54%) had the lowest value in reading motivation. However, the children who produced the highest test results (81.3560-100%) in the morphological awareness test had the highest motivation (M=3.70, SD=.88). The one-way ANOVA revealed that there was a significant difference in reading motivation related to the students' performances in the Morphological Structure Awareness test performances at $p<.01$ level for three conditions [$F(3, 1231)= 26.64$, $p=0.01$].

In the third grade similar values are presented, the lowest performers in the morphological awareness test belong to the lowest quartile group for reading motivation (M= 3.04 SD=.81), the most motivated children (M=3.70, SD=.83) scored the highest in the morphological awareness test (81.3560-100%). According to the one-way ANOVA a significant differences in reading motivation depending on the students' performances in the Morphological Structure Awareness test performances were found at $p<.01$ level for three conditions [$F(3, 1216)= 34.78$, $p=0.01$].

Table 8.26. The relationship between quartile groups based on the MSAT Test results and reading motivation

Quartile groups	All Grades			Grade 2			Grade 3			Grade 4		
	N	M	(SD)	N	M	(SD)	N	M	(SD)	N	M	(SD)
Group 1	974	3.08	(.85)	553	3.12	(.88)	262	3.04	(.81)	159	2.98	(.83)
Group 2	1015	3.22	(.81)	345	3.30	(.80)	339	3.21	(.81)	331	3.18	(.83)
Group 3	896	3.46	(.85)	209	3.60	(.77)	310	3.45	(.84)	377	3.39	(.90)
Group 4	1013	3.71	(.87)	128	3.70	(.88)	309	3.70	(.83)	576	3.71	(.88)

Note: Morphological Structure Awareness Test (MSAT)

Note: The quartile groups based on MSAT test performance: 1= (0.00-52.5424%). 2= (52.5425-71.1863). 3= (71.1864-81.3559%). 4= (81.3560-100%)

In grade 4 the lowest performers in group 1 (0.00-52.5424%) had the lowest motivation to read (M=2.98 SD=.83), the children who achieved the best results in the morphological awareness test (group 4) showed the highest values in reading motivation (M=3.7, SD=.88). The whole sample showed the same tendency, namely, the lowest motivation values were related to the weakest performances and the highest scores were connected to the most motivated children. The further analysis showed a significant differences of reading motivation related to the students' performances in the Morphological Structure Awareness test performances at p<.01 level for three conditions [F(3, 1439)= 44.64, p=0.01].

8.4.7.3. Reading Motivation and Reading

The relationship between the reading motivation in grade 2-4 and the reading comprehension quartile groups was examined. Struggling readers (1= 30 % or less.) and proficient readers (4=81-100%) were identified. I analysed how the performances in the Reading Comprehension subtest were related to reading motivation. The analysis showed that within one year group better performances in reading comprehension were linked to higher reading motivation values (Table 8.27.).

Table 8.27. The relationship between reading comprehension quartile groups and reading motivation

	All Grades			Grade 2			Grade 3			Grade 4		
Quartile groups	N	M	SD	N	M	SD	N	M	SD	N	M	SD
Group 1	1019	3.11	(.87)	545	3.16	(.86)	266	3.05	(.84)	208	3.06	(.93)
Group 2	1156	3.27	(.83)	411	3.33	(.84)	405	3.26	(.83)	340	3.20	(.83)
Group 3	883	3.45	(.87)	173	3.51	(.83)	297	3.49	(.82)	413	3.39	(.91)
Group 4	991	3.71	(.83)	123	3.72	(.81)	309	3.68	(.82)	559	3.71	(.84)

Note: Reading Comprehension (RC)
Note: the quartile groups based on reading comprehension subtest performance: 1= 30 % or less, 2=31-60%. , 3=61-80%., 4=81-100%

Table 8.27. shows that the proficient readers in grade 2 were more engaged in reading than the struggling readers. In grade 2 there were a significant differences in reading motivation related to the students' performances in the Reading Comprehension test performances at p<.01 level for three conditions [F(3, 1248)= 19.51, p=0.01]. The same pattern was found in the third and fourth grades. The struggling readers in grade 3 seemed to be less motivated than the advanced readers. In grade 3 a significant differences in reading motivation related to the students' performances in the Reading Comprehension test performances was revealed at p<.01 level for three conditions [F(3, 1273)= 31.53, p=0.01].
In the fourth grade there was a difference between the struggling readers' and the proficient readers' reading motivation. An analysis of variance (ANOVA) on scores in reading motivation depending on the students' performances in reading comprehension yielded significant variation among conditions [F(3, 1516)= 40.77, p=0.01].

8.4.7.4. Reading Self-concept, Morphological Awareness and Reading

I examined the effect of three items of the questionnaire on the results of the Morphological Structure Awareness test and the Reading Comprehension subtest. One of these items was reading self-concept "I am a good reader". (*jó olvasó vagyok).* Frequencies show the number of children who believed that they were good readers was decreasing throughout grades 2-4.

In the second grade, more children thought they were good readers (36.66%) than in third grade (31.82%), in the fourth grade even less (27.65%). On the other hand, the number of children who considered themselves as weak readers is showing a volatile tendency. In grade 2, 7.57% of the students believed that they were weak readers; in the third grade (8 %), in the fourth grade (6.96%) (Table 8.28.). However, the number of those children who said they "usually" regarded themselves as good readers is increasing. Those children who thought that they were weak readers belonged to the low achievers in both morphological awareness and reading comprehension.

Table 8.28. The relationship among MSAT, reading comprehension results (%) and reading self-concept

	Grade 2			Grade 3			Grade 4		
Self-concept	Frequencies (%)	MSAT	RC	Frequencies (%)	MSAT	RC	Frequencies (%)	MSAT	RC
It is never true of me.	7.57	44.92 (15.54)	35.27 (20.40)	8.00	59.99 (15.11)	47.32 (22.29)	6.96	66.07 14.09	58.06 26.60
It is sometimes true of me.	14.79	54.01 (18.70)	41.17 (24.48)	15.91	64.55 (16.34)	52.69 (25.19)	18.53	71.05 14.61	62.48 25.04
It is often true of me.	22.14	55.73 (18.80)	43.16 (25.60)	21.60	67.42 (16.92)	59.73 (26.05)	22.25	73.33 14.70	69.19 25.12
It is usually true of me.	18.14	62.40 (17.98)	52.75 (26.73)	22.67	71.79 (15.77)	64.55 (26.03)	24.34	79.49 12.99	76.50 24.17
It is always true of me.	36.66	62.80 (18.27)	49.36 (27.45)	31.82	74.12 (15.20)	69.84 (25.71)	27.65	78.82 14.76	75.50 25.07

Note: Reading Comprehension (RC), Morphological Structure Awareness test (MSAT)

Table 8.28. shows that the students who believed that they were not good readers achieved the lowest scores in morphological awareness and in reading comprehension. The students who declared to be good readers showed the best performances. In grade 2, the ANOVA test showed differences in reading comprehension results related to self-concept [$F(4, 1097)= 11.07$, $p<0.01$]. The Post hoc comparisons revealed three groups among which there were significant differences ($p< 0.05$) in reading comprehension performances. One of the groups contained children who answered "never" or "sometimes", the second group consisted of the ones who answered "often". The students who answered "usually" or "always" belonged to the third group. Related to morphological awareness ANOVA examination showed significant differences $p<.01$ [$F(4, 1097) = 24.50$, $p=0.01$]. However, Post Hoc examinations revealed significant differences among three groups ($p<0.05$). Students who belonged to the highest achievers answered "usually" or "always", the ones who answered "sometimes" or "often" belonged to the second group and the lowest achievers were the ones who answered "never".

In grade 3, 8% of the children thought they were not good readers, and their results reflected their views since this group showed the lowest scores in morphological awareness and in reading comprehension as well. The higher scores on the agreement scale were attached to higher performances in morphological awareness and in reading comprehension. The ones who believed that they were good readers gave the best performances in both tests. The ANOVA analysis revealed that there was a significant effect of self-concept on the students' performances in morphological awareness test performances $p<.01$ for three conditions [$F(4, 1208) = 24.10$, $p=0.01$]. The Post hoc Tukey HDS test identified significant differences ($p< 0.05$) among three groups: group 1 answered "always"or "usually", group 2 "often", group 3 "sometimes or "never".

In grade 4, the same tendencies were observed related to the relationship between reading self-concept and reading comprehension as in grades 2-3. The Post hoc test identified

significant differences ($p< 0.05$) among the performances of students who answered “always” or “usually” regarded themselves as good readers and the ones who answered “never” or ” sometimes”. Reading self-concept and morphological awareness was found to be linked as well ($p<.01$). The tendencies related to the relationship between reading self-concept and morphological skills are similar to ones found between the reading comprehension and reading self-concept. The ANOVA analysis showed significant differences among children’s performances depending on their reading self-concept in grade 4, [$F (4174) =22.96$ $p=0.01$]. The Post hoc tests also revealed significant differences ($p<0.05$) among children’s morphological performances who answered “always” or “usually” (group 1) “often”, “sometimes” (group 2), “never” (group 3). In summary, morphological awareness and reading comprehension test performances corresponded to children’s reading self-concept. The number of children who believed that they were “sometimes”, “often”, "usually" good readers is growing throughout grades 2-4. However, the number of children who thought that they were “never” or “always” good readers is decreasing.

8.4.7.5. Motivation for Printed Media, Morphological Awareness and Reading

The item "I prefer reading real books to reading on a monitor, laptops and tablets" evaluated how children relate to printed media. Most children in all the three grades preferred reading real book to reading on a monitor, laptops and tablets. Surprisingly, the second largest group of children consisted of the ones who did not like reading real books at all. Table 8.29. shows highest achievers in both tests belonged to the groups which expressed their preference for real books "It is usually true of me" or "It is always true of me", however the ones who did not prefer reading real books achieved the lowest scores.

In the second grade the lowest achievements in both tests were attached to the group of children who did not prefer reading real books at all. The highest scores were achieved in MSAT by the group who answered "It is always true of me." The highest scores in RC ($M=50.09$, $SD=25.96$) were achieved by the students who answered "It is usually true of me". However, it is surprising that the group of children who answered "It is sometimes true of me" scored almost as high in MSAT as the group who answered "It is always true of me." The further analysis showed that there was a significant effect of the preference for printed media on the students’ performances in the Morphological Structure Awareness test performances at $p<.01$ level for three conditions [$F(4, 1,162)= 6.14$, $p=0.01$].

Table 8.29. The relationship among MSAT, reading comprehension and motivation for print media

	Grade 2			Grade 3			Grade 4		
Motivation for print media	Freq. (%)	MSAT	RC	Freq. (%)	MSAT	RC	Freq. (%)	MSAT	RC
It is never true of me.	23.09	52.55 (18.68)	40.22 (25.12)	22.29	63.95 (16.91)	52.99 (26.50)	20.26	71.82 (15.64)	64.05 (26.41)
It is sometimes true of me.	13.28	59.02 (19.10)	42.84 (26.48)	14.36	66.12 17.00	59.26 (27.55)	16.62	72.53 (16.36)	66.72 (26.96)
It is often true of me.	13.83	55.85 (19.77)	43.73 (26.00)	14.51	69.10 16.50	61.07 (26.52)	15.20	74.67 (14.54)	69.91 (25.85)
It is usually true of me.	9.68	58.83 (18.12)	50.09 (25.96)	11.75	72.39 15.69	66.32 (24.77)	10.63	77.73 (14.68)	74.62 (23.58)
It is always true of me.	39.59	59.28 (19.62)	48.16 (27.24)	36.46	72.23 16.24	65.35 (26.81)	37.28	77.34 (15.08)	74.33 (24.88)

Note: Frequencies (Freq.), Reading Comprehension (RC), Morphological Structure Awareness test (MSAT)

The ANOVA analysis also revealed that there was a significant effect of the motivation for printed media on the students' performances in the Reading Comprehension test performances at p<.01 level for three conditions [F(4, 1,162)= 5.38, p=0.01].

In grade 3 the students who answered "it is never true of me" achieved the lowest scores in MSAT. However, the students who answered "It is usually true of me" in MSAT achieved the highest scores. The further analysis revealed that there was a significant effect of the motivation for the printed media on the students' performances in the Morphological Structure Awareness test performances at p<.01 level for three conditions [F(4, 1,221)= 13.75, p=0.01]. The analysis also indicated that there was a significant effect of the relationship to printed media on the students' performances in the Reading Comprehension subtest performances at p<.01 level for three conditions [F(4, 1,221)= 10.99, p=0.01].

In grade 4 the students who did not like reading real books got the lowest test scores in MSAT and in RC. However, the students who answered "it is usually true of me" got the highest scores in MSAT and in RC. In grade 4 the further analysis found a significant effect of the motivation for the printed media on the students' performances in the Morphological Structure Awareness Test performances at p<.01 level for three conditions [F (4, 1,481) = 9.38, p=0.01]. In addition, there was a significant effect of the motivation for the printed media on the students' performances in the Reading Comprehension subtest performances at p<.01 level for three conditions [F (4, 1,481) = 10.29, p=0.01].

8.4.7.6. Motivation for Digital Media, Morphological Awareness and Reading

The item "I prefer reading on tablets, laptops and on the monitor" assessed the relationship to digital media. In grade 2 40.98% of students answered that they did not prefer reading on tablets, laptops and on the monitor. These students got the highest scores in both MSAT test and in RC subtest. The students who answered "it is usually true of me." scored the lowest in the MSAT test and the students who answered "It is always true of me." got the lowest scores in RC

The variance analysis (ANOVA) indicated a significant effect of the interest in digital media on the students' performances in the Morphological Structure Awareness Test performances at p<.01 level for three conditions [F (4, 1,098) = 15.98, p=0.01]. According to the analysis in grade 2 there was a significant effect of the interest in digital media on the students' performances in the Reading Comprehension test performances at p<.01 level for three conditions [F(4, 1,098)= 10.63, p=0.01].

Table 8.30. The relationship among MSAT, reading comprehension and the motivation for digital media

	Grade 2			Grade 3			Grade 4		
Motivation for digital media	Freq. (%)	MSAT	RC	Freq. (%)	MSAT	RC	Freq. (%)	MSAT	RC
It is never true of me.	40.98	62.66 (18.11)	51.86 (27.15)	42.89	72.28 (16.31)	66.16 (25.60)	37.59	78.31 (13.65)	75.28 (23.81)
It is sometimes true of me.	14.23	60.34 (19.78)	44.97 (27.70)	18.12	70.58 (16.26)	65.50 (27.10)	19.58	76.63 (14.06)	72.79 (25.14)
It is often true of me.	10.42	54.61 (19.18)	41.30 (24.30)	10.97	68.22 (17.09)	59.70 (25.41)	12.82	75.24 (14.58)	69.89 (25.67)
It is usually true of me.	9.52	52.09 (19.12)	41.81 (23.57)	8.23	64.56 (16.69)	56.46 (28.30)	8.53	72.00 (17.19)	66.12 (26.97)
It is always true of me.	24.84	53.16 (18.17)	40.33 (24.80)	19.78	64.68 (15.60)	51.89 (25.91	21.76	71.22 (14.87)	63.04 (27.26)

Note: Frequencies (Freq.), Reading Comprehension (RC), Morphological Structure Awareness test (MSAT)

In grade 3 the pattern was similar to the one found in the second grade. In the third grade 42.89% answered that they did not prefer reading on digital media. The high achievers in both MSAT test and in RC subtest answered "it is never true of me". Therefore, it is proposed that the best readers do not like reading on tablets, laptops and monitors. The weak achievers in MSAT test belonged to the group that answered "It is usually true of me"; in RC subtest, students who the lowest scores had belonged to the group of students who answered "It is always true of me" (Table 8.29.). In grade 3, a variance analysis (ANOVA) revealed that there was a significant effect of the interest in digital media on the students' performances on the Morphological Structure Awareness test performances at $p<.01$ level for three conditions [F (4, 1,198) = 11.65, $p=0.01$]. In grade 3 there was a significant effect of the interest in digital media on the students' performances in the Reading Comprehension test performances at $p<.01$ level for three conditions [F (4, 1,198) = 14.47, $p=0.01$].

In the fourth grade 37.59% of the students who thought that they did not prefer reading on digital media, they achieved the best results both in MSAT test and RC subtest. 21.76% of answerers admitted that they preferred reading on digital media. These students got low scores in MSAT Test and in RC subtest. An analysis was conducted to examine the effect of the motivation for the digital media on the MSAT and RC test results. In grade 4, there was a significant effect of the interest in digital media on the students' performances in the Morphological Structure Awareness test performances at $p<.01$ level for three conditions [F (4, 1,461) = 14.46, $p=0.01$]. The analysis also showed that there was a significant effect of the interest in digital media on the students' performances in the Reading Comprehension test performances at $p<.01$ level for three conditions [F (4, 1,461) = 13.29, $p=0.01$]

8.4.8. Reading Motivation for Boys and Girls in Grades 2-4

Girls showed slightly higher values in reading motivation throughout the three grades. Girls' reading motivation was found to be higher in the third grade than in the second grade. However, the values for the girls in the third and fourth grade were very similar. The boys showed almost the same values in grades 2-4 (Table 8.31.). The further statistical analysis showed the same tendencies. There was no significant difference among reading motivation values for boys throughout grades 2-4. However, there was a significant effect of grade on the reading motivation for girls only between grades 2 and 3 at $p<.01$ level for three conditions [F (2, 1,836) = 12.05, $p=0.01$]. The differences were not statistically significant between grades 3 and 4 for the girls either.

Table 8.31. Means and standard deviations related to boys' and girls' reading motivation in grades 2-4

	N	Mean	SD
Grade 2 (Boys)	610	3.27	.85
Grade 2 (Girls)	570	3.36	.86
Grade 3 (Boys)	622	3.25	.88
Grade 3 (Girls)	595	3.51	.81
Grade 4 (Boys)	752	3.29	.89
Grade 4 (Girls)	674	3.60	.89

The correlations among the boys' and the girls' reading motivation and performances in the Reading Comprehension subtest and the Morphological Structure Awareness test have been analysed. Table (8.32.) shows that significant relationships among the constructs were found. The correlation analysis revealed that the correlation between reading comprehension and reading self-concept was weaker for the boys ($r=.19$, $p<.01$) than for the girls ($r=.20$,

p<.01). The correlation between reading comprehension and the motivation for the printed media was also stronger for the girls (r=.16, p<.01) than for the boys (r=.11, p<.01). Reading comprehension and motivation for digital media showed a stronger negative correlation for the girls than for the boys (see Table 8.32.). Reading comprehension and reading motivation showed a stronger positive correlation for the girls than for the boys.

Table 8.32. Correlations among boys' and girls' reading motivation and performances in the MSAT test and reading comprehension

	RC boys girls	MSAT boys girls	Self-concept boys girls	Preference for Print boys girls	Preference for Digital Media boys girls
MSAT	.66 .68				
Self-concept	.19 .21	.21 .27			
Preference for Print	.11 .16	.10 .18	.27 .22		
Preference for Digital Media	-.15 -.22	-.16. -24	-.05* -.08	-.37 -.32	
Reading Motivation	.22 .28	.21 .33	.41 .42	.42 .37	-.28 -.32

Note: (RC) Reading comprehension subtest (MSAT) Morphological Structure Awareness Test
All correlations are significant at the 0.01 level, the correlation marked with * are significant at the 0.05 level.
Note: 226 children did not give gender information

The correlation table demonstrates mostly weak positive or in the case of the motivation for the digital media negative relationships with the MSAT test and the RC subtest results both for girls and boys. Girls' performances usually show a bit stronger correlations.
There were significant moderate correlations among the components of reading motivation: between reading motivation and reading self-concept as well reading motivation and motivation for print media. The correlations are usually stronger for girls than for boys.
However, there are a few exceptions. The correlation between reading self-concept and preference for printed media was stronger for the boys (r=.27, p<.01) than for the girls (r=.22, p<.01). Another example is the correlation between the motivation for printed media and the motivation for digital media which presented showed a stronger negative relationship for the boys (r=-37, p<.01 than for the girls (r=-.32, p<.01). The correlation between the motivation for printed media and the reading motivation also shows a stronger relationship for the boys (r=.42, p<.01) and for the girls (r=.37, p<.01).

In some cases the correlations are very similar, for example, reading self-concept and the Reading Comprehension Subtest indicates the same weak positive correlation both for boys and girls. As it was mentioned in the case of girls the correlations are a bit higher, for example, Morphological Structure Awareness Test and the motivation for print media.
Reading self-concept and the Morphological Structure Awareness Test also show higher correlation values for girls than for the boys. In addition, there is a stronger negative relationship between Morphological Structure Awareness Test and motivation for digital Media for the girl than for the boys. Reading self-concept and reading motivation also showed a bit stronger moderate correlation for the girls. Other components of reading motivation demonstrate this pattern as well; for example, the correlation between Morphological Structure Awareness Test and the reading motivation.
It is quite surprising that the preference for the digital media shows negative correlations with both the Morphological Structure Awareness Test and the Reading Comprehension Test results as well as with all the other components of reading motivations. The relationships are weak and significant; however, there is a moderate negative correlation between the

motivation for the digital media and the motivation for the print media as well as the motivation for digital media and reading motivation.

8.5. Discussion of the Results of the Large Sample Survey

This research attempted to create an online instrument for assessing morphological structure awareness and reading comprehension in grades 2-4. The main objective to understand how different aspects of morphological awareness change in the second, third and fourth grades. I also aimed to follow how morphological awareness develops in the Hungarian language and what relationship it has with basic reading comprehension skills and reading motivation as well as how these relationships change in grades 2-4. Statistical analyses were conducted to study the data by applying background variables defined by the research aims.

The psychometric features of the instrument in grades 2-4 were analysed, and these investigations revealed that this instrument was an appropriate instrument for assessing morphological awareness and reading comprehension in the whole sample and in grades 2-4. The reliabilities and validity of the morphological awareness test and the subtests were good and acceptable except for two subtests (morpheme segmentation and the relational task); however, these subtests were essential because they evaluated important aspects of morphological awareness; therefore they were kept for the analyses. As far as the background variables are taken into account, the reliability of the instrument for reading motivations was also acceptable, especially in grade 4.

In this part of the study the hypotheses of the research are discussed. H^1 The first hypothesis supposed that this instrument is suitable for assessing morphological awareness in a reasonable time frame. The reliability of the instrument is proved by the Cronbach Alpha values. The construct validity of the instrument is supported by the positive significant correlation among the subtest. The validity is also supported by CFA examinations which revealed a 5-dimensional instrument which consisted of the 5 subtests which were constructed within morphological awareness. It is a benefit of the technology-enhanced assessment the entire testing procedure within a 45-minute lesson. The automatic scoring made it possible to get an immediate feedback on students' performances. The teachers could download the results from the eDia system and see the differences in the performances within and between classes and the different grades. Therefore, it is a useful tool for teachers to get an objective picture of the development of the morphological skills and reading comprehension. These features make this instrument a practical tool for teachers which could give additional information to other assessment tools. It offers a systematic way of collecting data about the development of morphological awareness. Based on the accomplishments teachers and students had the opportunity to identify the subskills which were the most challenging for them, and which subskill they would like to improve within morphological awareness.

H^2 supposed that there would be a moderate correlation among the subtests. The findings of this research support this hypothesis because significant moderate correlations among the subtests were found. The positive significant correlations prove that the subtests are integral parts of the construct, thus they also demonstrate construct validity.

H^3 hypothesised that there would be a difference in the levels of morphological awareness throughout grades 2-4. This hypothesis is definitely justified because the investigations indicate that a variance analysis (ANOVA) and Post-Hoc Tukey test showed that the scores in grades 2, 3 and 4 were significantly different $p< 0.05$.

H4 hypothesised that there would be growth in the performances in all the examined constructs throughout grades 2-4. This hypothesis has been also proved. The performances

both in morphological structure awareness test and in the subtests improved from grades 2 to grade 4. The analyses confirmed that morphological awareness skills improved significantly in all the grades examined. ANOVA and Tukey tests demonstrated that the differences were statistically significant throughout the three grades. The analysis of the means and standard deviations shed the light on the differences in students' performances regarding the subtests in grades 2-4. Children had difficulty in identifying morphemes in multimorphemic words especially when they could not rely on the meaning of the words. Therefore, the tasks including nonwords seemed to be the most difficult for the children e.g. Affix Identification /Nonwords, Morpheme Segmentation subtests. Accordingly, children had to use their morphological awareness skills to choose the correct affix. These tasks reflected children's morphological awareness skills the most efficiently. The identification of inflections was less difficult in the Affix identification/Nonwords subtest for children. However, the morpheme segmentation which consisted of the identification of derivational suffixes really challenged children even in the fourth grade. The results related to the nonwords tasks imply that the children's derivational morphological skills improved more slowly than inflectional morphological skills throughout grades. However, this tendency could not be observed in the subtests where I implemented real word items, for example, in Affix Identification/Real Words, Compound Words, and Derivation subtests. According to these findings, the increasing performances in morphological structure awareness and the statistical differences among the grades seem to justify the hypothesis that children's morphological skills develop rapidly in grades 2-4.

H^5 hypothesis supposed that there would be a moderate positive relationship between morphological awareness and reading comprehension. This hypothesis has been justified because significant positive correlations ($p<.01$) were found between the Morphological Structure Awareness test and the Reading Comprehension subtest throughout the three grades. These correlations between the Morphological Structure Awareness Test and Reading Comprehension subtest and the relationship between the Affix Identification Nonwords and Reading Comprehension subtests got stronger throughout grades 2-4. The subtest for measuring basic reading skills worked well and it assessed literal comprehension. The significant moderate positive correlations between morphological awareness and reading comprehension indicate that morphological awareness has an important role in word reading which is linked to reading comprehension (Kirby et al., 2011). In addition, it was an interesting finding that one of the subtests of the morphological test, the Affix Identification Nonwords subtest had a moderate increasing significant correlation with basic reading comprehension skills. The findings suggest that nonwords tasks demonstrate morphological skills the most efficaciously (Berko, 1958). The developmental patterns confirm that morphological awareness and reading comprehension are interdependent. The relationships between the subtests show moderate significant slightly decreasing tendencies, which implies that all of them are very important subconstructs of the measured skill.

H^6 hypothesis supposed that there would be differences between boys' and girls' results in the Morphological Structure Awareness Test and in the subtests in grades 2-4. This hypothesis was proven to be correct too. The girls performed slightly better than boys. Although both the boys' and girls' performances improved throughout the three years the differences between the two genders were noticeable even in the fourth grade. The differences seemed to increase or remain on the same level in the Affix Identification for Nonwords, in the Morpheme Segmentation subtests. In all the other subtests, the boys seemed to catch up with the girls. The subtests where the girls kept their advantage were the ones which required a higher level of morphological awareness, for example, identifying inflectional and derivational suffixes in nonwords tasks or identifying relationships within a word. There were small differences between the correlations related to the Morphological Structure awareness

Test and subtest results for the boys and girls; they mostly indicated positive moderate significant relationship for both genders.

H^7 hypothesis supposed that reading motivation is linked to both morphological awareness and basic reading skills as well. This hypothesis was also proved to be correct. The relationship among reading motivation, morphological awareness test and basic reading skills in grades 2-4 indicated there that there is a significant positive relationship among the constructs. Based on the results in morphological awareness and reading comprehension subtest achievements quartile groups were created. The investigations revealed how the test results related to the reading motivation. Reading motivation, morphological awareness and reading comprehension were entwined in grades 2-4. The children who were more engaged in reading activities performed better in morphological awareness and in reading comprehension as well. The different achievement levels for morphological awareness and reading comprehension had a statistically significant effect on reading motivation in each grade. It was also examined how reading self-concept, motivation for printed media and the motivation for digital media are related to morphological awareness. Reading self-concept and motivation for the printed media positively was positively linked to morphological awareness and basic reading comprehension skills. However, the motivation for the digital media negative relationship with the test performances. The variance analysis (ANOVA) showed that there was a significant effect of reading self-concept, motivation for printed media and motivation for digital media on morphological awareness and on basic reading comprehension. The relationship between reading performances and self-concept indicated that the students' beliefs about their capabilities corresponded to their reading achievements.

The correlations analysis showed that reading motivation had a weak positive significant relationship with both morphological awareness and reading comprehension. The correlations among reading motivation and morphological awareness; reading motivation and reading comprehension were slightly increasing throughout the three grades, however, they were still considered to be weak. The correlations among reading self-concept, motivation for printed media, morphological awareness and reading comprehension indicated that reading self-concept had a weak significant positive relationship with the results of the Morphological Structure Awareness test and the Reading Comprehension subtest. The reading self-concept had an increasing but still weak positive correlation with reading comprehension. The motivation for the printed media also revealed a weak positive significant relationship with both test results; the correlation was the strongest in grade 3, and in the third grade it seemed to be decreasing. The motivation for digital media showed significant weak negative correlations with morphological awareness and reading comprehension. The students who liked reading on the screen had lower achievements both in morphological awareness and reading comprehension.

The investigations demonstrated how reading motivation changes for boys and girls in grades 2-4. Girls showed slightly higher values in reading motivation throughout the three grades. The boys showed almost the same values in reading motivation in grades 2-4. The further statistical analysis showed the same tendencies. There was no significant difference among reading motivation values for boys throughout grades 2-4. The girls' reading motivation showed a significant difference between grades 2 and 3 ($p<.01$) level. The differences were not statistically significant between grades 3 and 4 for the girls either. The correlations among boys' and girls' reading motivations, performance in reading comprehension and the morphological awareness demonstrated similar tendencies for boys' girls'. The correlations between the subconstructs of the reading motivation seemed to be slightly stronger for girls than for boys.

8.6. General Discussion

The topics of my research encompassed the basic questions of the assessment and the development of morphological awareness. On the one hand, they covered the questions which referred to the instrument, the structure; dimensions and operations of the morphological awareness and its relationship with the background variables, as well as the questions were related to the development of the ability.

This instrument seemed to give a reliable estimation about the development of the students' morphological awareness and the psychometric features of the tests were acceptable. The construct validity was confirmed by the significant positive moderate correlations between the Morphological Structure Awareness test and the Reading comprehension subtest. Differences were found in the levels of development of morphological awareness in the different grades. The variance analyses revealed that there are statistical differences among the achievements of the examined grades. Growth was observed in morphological awareness and reading comprehension throughout grades 2-4. The differences among the performances of different grades were indicated.

A significant moderate increasing correlation was found between morphological awareness and basic reading comprehension skills $p<0.01$. Therefore, these findings suggest that morphological awareness supports the development of reading skills, however, further examinations are needed to explore how exactly morphological awareness or other skills might contribute to the development of reading skills.

Differences were discovered between the performances of girls and boys. Growth was found in boys' and girls' performances throughout grades 2-4. The differences seemed to decrease, for example, in reading comprehension; however, in the most difficult morphological tasks the differences increased or remained on the same level.

The significant positive relationships between reading motivation and the achievements in morphological awareness and reading performances were revealed. These investigations showed that the two constructs were probably interdependent; the relationship between reading motivations and reading comprehension was also supposed to be bidirectional.

In summary, there are three important results of this research:

(1) Both morphological awareness and reading comprehension showed growth throughout grades 2-4; this finding was supported by the statistical differences among the performances throughout grades 2-4.

(2) Morphological awareness and basic reading comprehension seemed to be interdependent since morphological skills were linked to word identification, which underpin reading skills. The relationship was supported by the moderate significant correlations between morphological awareness and reading comprehension.

(3) The performances in morphological awareness and reading comprehension showed a weak significant relationship with reading motivation. The link seemed to be bidirectional.

One the one hand, the pedagogical implications of this research suggest that morphological instruction is an important tool to enhance children's reading skills as the skills to manipulate the smallest meaningful parts of the words might be useful when children have to understand multimorphemic words. The automatic scoring allowed the children and the teachers to receive an immediate feedback on the performances. Teachers could download a detailed personalized feedback as well. These properties of the online test make it a suitable assessment tool for everyday teaching practice since it provides teachers knowledge of a child's current level of morphological awareness.

On the other hand, reading motivation shapes children reading performances, and experiences with reading activities also determine their beliefs about these skills; therefore, reading activities must be engaging for children to keep up their interest in reading.

This study has some limitations. First of all, the psychometric features of the two subtests could be further improved. The Morpheme Segmentation subtest was considered as important subcontract as they support construct validity; therefore, the further improvement of test requires adding more items to the subtest. Another future plan is to complement the test with production tasks in which children type in affixes or words which would further increase the construct validity. This instrument implemented only judgement tasks in which children only had to click on items or drag words into boxes since children especially in the second grade might find typing words into the computer quite challenging.

Another limitation of this instrument is that the reading comprehension was short and consisted of only ten items. The literary comprehension test worked well; however, it could be further developed. More items could be added to evaluate more advanced reading skills. The reading motivation questionnaire consisted of only 10 items; therefore it could also be further improved to learn more the structure of reading motivation. These two subtests (reading comprehension and reading motivation) were only included to see what relationship morphological awareness has with these constructs and how these relationships change in grades 2-4.

The third limitation is related to the sample. However, this research gave the opportunity to assess thousands of students; it still cannot be declared that our findings refer to the whole country since only the schools which volunteered took part in the research.

9. SUMMARY

This chapter includes the main findings of my research aimed to develop an online instrument for assessing morphological awareness. First, I summarise the main results of the literature review, which discusses the theories and models as well as the empirical findings related to morphological awareness. Research gaps identified based on literature determined the objectives of the empirical research. Then the main findings of the empirical research are delineated. The process of the development of the online instrument, the results of the pilot study and the large sample survey are outlined. Finally, I describe the limitations, the practical implications of this research and my future research plans.

9.1. The Main Findings of the Literature Review

This research concentrated on morphological awareness, a precursor of reading and a component of metalinguistic awareness. The literature review consists of an extensive exploration of theories of morphological awareness; studies prove that morphological awareness is an important factor in word recognition especially in the case of multimorphemic words. Theoretical and empirical studies confirm that cognitive linguistic skills, e.g. morphological awareness, support the acquisition of basic reading skills. The theoretical chapters review some important reading models, word recognition models in order to discuss how they relate to the importance of morphology. Although studies prove that word recognition lays the groundwork for attaining basic reading skills reading theorists have paid little attention to morphological awareness. Mostly bottom-up and interactive reading models claim that the development of cognitive linguistic skills support the acquisition of basic reading skills in grades 2-4. Research studies found that morphological awareness is related to reading comprehension; however, it is still not clear how exactly it contributes to reading. Therefore, tapping into the inner structure of morphological awareness caught my interest. Conceptualising of the research started with analysing several definitions of morphological awareness. Research literature falls short of creating a unified definition of the construct. I agree with Kuo & Anderson (2006) that morphological awareness is "The ability to reflect upon and manipulate morphemes and employ word formation rules in one's language..." (Kuo & Anderson, 2006, p. 161). Though recent research has found that morphological awareness works across different writing systems; both in deep and shallow orthographies (Verhoeven & Perfetti, 2017); it is a relatively new approach to conduct research on morphological awareness in an agglutinative language with a transparent orthography.The main dimensions (inflectional, compound and derivational morphology), the main cognitive linguistic basics (relational, syntactic and distributional) and measures of this construct paved the way for the empirical research. Its relationship to reading comprehension was reviewed and all the pedagogical implications were explored. The cognitive foundation of the developmental patterns of morphological awareness was built around the standards, and curricula for grades 2-4. As far as Hungarian National Core Curriculum (2020) and the new framework curricula are concerned; morphological skills are given little attention.

I identified several gaps in the research literature which gave me inspiration to start my research. First, although theoretical models of reading mostly tend to ignore the role of morphological awareness, a great number of empirical studies prove that morphological processing influences word identification which is the basis of reading acquisition. Morphological awareness got little research interest in shallow orthographies. Thus, we do not know much about how morphological awareness works in languages with a shallow orthography. Since there is no consensus about the definition of morphological awareness and

researchers used different measures for assessing the construct, it is difficult to compare the results. Second, morphological awareness has been measured orally or with written paper-based methods. However, an entirely online instrument has not been developed yet. Third, morphological skills are underrepresented in Hungarian reading research. Fourth, the further analysis of the literature allows for the conclusion that the development of morphological awareness in boys and girls has not been researched extensively in deep orthography languages either. Fifth, Non-cognitive skills have an impact on achievements in various subject areas, however, there are no research studies investigating the relationship between morphological awareness and reading motivation. Since morphological awareness is a precursor of reading skills I supposed that there might be relationship between morphological awareness and reading motivation.

I decided that the main focus of my research would be developing an online instrument for measuring morphological awareness in grades 2-4; however, I also wanted to examine how morphological skills relate to basic reading comprehension skills and reading motivation.

9.2. The Pilot Test

The aim of the pilot study was to empirically test the online instrument assessing morphological awareness in the second, third and fourth grades of primary school. It was also an important aim to get preliminary information about the operation of the instrument and to tap into different dimensions of morphological awareness. The instrument tested inflectional and derivational and compound morphology. It consisted of four subtests (affix identification for real words, affix identification for nonwords, derivation and compound words). A short reading comprehension test for assessing basic comprehension skills was also included. The aim of including the reading test evaluating literary reading skills was to investigate the relationships between morphological awareness and reading comprehension. Another reason for including only a short reading comprehension test was that this way children could complete both morphological and the reading comprehension test within a 45 minute lesson. The pilot study attempted to follow how morphological skills and reading comprehension skills develop throughout grades 2-4 and to tap into the relationship between morphological awareness and reading comprehension skills in the Hungarian language.

The psychometric properties of the tests were acceptable. The Morphological Structure Awareness and the Reading Comprehension subtests showed good reliabilities in all grades. The Derivation and Affix Identification for Nonwords subtests had to be further improved. In Affix Identification for Real Words subtest, a ceiling effect was observed. Thus, it was planned to include more difficult tasks in the Affix Identification/Real Words subtests. The first version of the online test was suitable for the assessment of different aspects of morphological awareness. An important finding was that there was a significant improvement in performance in morphological awareness between grade 2 and grade 3. An increase in performances was conspicuous between grades 3 and 4 as well; however, the differences were not statistically significant except in the case of the Affix Identification for Nonwords subtest. The results of the pilot study indicated that morphological awareness skills and reading comprehension skills show similar increase in grade 2 to 4. The lack of larger developmental gap between grade 3 and 4 could be explained by the high mean scores, especially in the achievements of the Affix Identification/Real Words subtest. Another interesting finding was that the largest performance differences were found between the two subtests assessing affix identification: the mean scores were the lowest with nonwords and highest with real words. An explanation for this phenomenon might be that when solving nonwords tasks children

cannot rely on the meaning of the words; and therefore; they must rely on their morphological awareness skills.

The examination of the correlations in second, third and fourth grade revealed that the participants' performance showed a significant positive correlation between morphological awareness and reading comprehension tests. The Affix Identification with Nonwords subtest had the strongest correlation with reading comprehension. This strong relationship gives a proof that these nonwords tasks show morphological skills which are related to reading comprehension skills. (Varga, 2020; Varga, Pásztor & Steklács, 2020). The results of the pilot study were in line with international research findings (Carlisle, 2000; Kuo & Anderson, 2006; Levesque et al., 2017) and support that morphological awareness helps learners decompose unknown morphologically complex words into their constituent morphemes and apply morphological rules to derive meanings of unknown words (Apel et al., 2013; Carlisle, 1995, 2000; Casalis et al., 2011). The correlations between students' morphological structure awareness and their reading comprehension suggest that reading comprehension skills are influenced by their morphological structure awareness skills (Apel, et al., 2013; Casalis et al., 2011; Green & Wolter, 2011). This relationship supports the approach that teaching the structure of the language is essential for the effective reading instruction and developing reading skills (Kuo & Anderson, 2006). The research results of the pilot study also suggested that morphological awareness develops similarly in a language with a shallow orthography and a rich morphological system that is morphological knowledge has an impact on reading skills (Verhoeven & Perfetti, 2017, Varga, 2020).

9.3. The Main Findings of the Large Sample Survey

The main objective of the large sample survey was to examine how the instrument works in a large sample and to get more reliable data about how different aspects of morphological awareness change in the second, third and fourth grades. It also attempted to follow how morphological awareness develops in the Hungarian language and what relationship it has with basic reading comprehension skills and reading motivation as well as how these relationships change in grades 2-4.

The reliabilities and validity of the morphological awareness test and the subtests were good and acceptable except one subtest (morpheme segmentation); however, this subtest was essential because it evaluated important aspects of morphological awareness; therefore, it was kept for the analyses. This instrument is suitable for assessing morphological awareness in a reasonable timeframe. Therefore, it is a useful tool for teachers to get information about the development of the morphological skills.

Growth was found in the performances in all the examined constructs, which implies that there is a gradual development in morphological awareness throughout grades 2-4. Despite the growth in morphological skills children had difficulty in identifying morphemes in multimorphemic words especially when they could not rely on the meaning of the words. The increasing performances in morphological structure awareness and reading comprehension as well as the statistical differences among the grades support the hypothesis that children's morphological skills develop in grades 2-4.

Significant positive correlations ($p<.01$) were found between the morphological awareness test and the subtests throughout the three grades which indicates that the subtests were important dimensions of the construct. The findings propose that morphological awareness has an important role in word reading which affects reading comprehension (Kirby et al., 2011). The developmental patterns confirm there is a reciprocal link between

morphological awareness and reading comprehension. The relationship between morphological awareness and reading comprehension seem to get stronger in grades 2-4.

The differences between boys' and girls' results indicate that girls performed slightly better than boys. In some subtests the boys seemed to catch up with the girls. The subtests where the girls kept their advantage were the ones which required a higher level of morphological awareness, for example, identifying inflectional and derivational suffixes in nonwords tasks or identifying relationships within a word (relational task).

This research attempted to inspect how different achievements in morphological awareness and reading comprehension were linked to reading motivation. Statistically significant growth in reading motivation throughout grades 2-4 was found. Reading motivation, morphological awareness and reading comprehension were interdependent in grades 2-4. The children who were more engaged in reading activities performed better morphological awareness and in reading comprehension. The different achievement levels for morphological awareness and reading comprehension had a statistically significant effect on reading motivation in each grade, which implied that reading motivation and morphological awareness were interdependent. The same is true for the relationship between reading motivation and reading comprehension; it was proposed to be bidirectional (Hódi, 2018; Szenczi, 2008, 2013).

Regarding gender differences in reading motivation girls showed higher motivation values than boys. The girls' reading motivation increased between grades 2 and 3; nevertheless, no significant differences were found between grades 3 and 4 for the girls. The boys showed the same values in reading motivation throughout the three grades. The results concerning reading motivation and reading comprehension are in line with international findings. (McGeown et al., 2012). The relationship between morphological awareness and reading motivation has never been explored; this is certainly a new research result. It can also support the hypothesis that morphological awareness is linked to reading skills, and therefore, it is also linked to reading motivation as well.

Different aspects of reading motivation, e.g., reading self-concept and motivation for printed media had a positive relationship with both morphological awareness and reading comprehension. A possible explanation for this might be that children who believe that are better readers have more developed morphological skills. It also proves that morphological skills are related to reading skills and reading motivation. The relationship between achievements in morphological awareness, reading performances and self-concept indicated that the students' beliefs about their capabilities corresponded to their achievements. The students' views must have been shaped by their experiences with reading activities.

There was a weak, positive correlation among reading motivation and morphological awareness; reading motivation and reading comprehension. The correlations were slightly increasing throughout the three grades. However, it is true only for the girls. They showed slightly higher values in motivation than boys.

A novel feature of this research is that morphological awareness has not been measured with an entirely online instrument before; however, some research used partly online instruments. I chose to create an online instrument because eDia surface offered a number of advantages to the students and teachers as well (Csapó & Molnár, 2019). This online instrument is suitable for diagnostic assessment of morphological awareness in everyday teaching practice. The eDia online surface is attractive and child-friendly. Children can listen to the instructions which make the assessment more acceptable for them. Children can see their results when they complete the test. Thanks to the automatic scoring students and teachers get automatic feedback about the students' performances which reduces the time and energy which are required to assess students and obtain the information about children's skill levels (Csapó & Molnár, 2019). Teachers can follow the children's skill development and

plan interventions in the light of the achievements in the test (Pásztor, 2014; Csapó & Molnár, 2019).

The test assesses several dimensions of morphological awareness which allows the teachers and students to make decisions about what skills or subskills are the most challenging for children. The teachers can identify the subskills which should be improved and they can use this information in their teaching practice.

This instrument employed a new approach to assessing for morphological awareness; at the same time it implemented the task types which were commonly used for assessing morphological awareness. The results revealed that the online instrument efficiently distinguished between the children's performances in morphological structure awareness in grades 2-4. Growth found in morphological awareness throughout all the three grades examined which follows the pattern described in literature (Gabig & Zaretsky, 2013). Moderate correlations between morphological awareness and reading comprehension are in line with the international research findings (Apel et al., 2013; Deacon et al, 2014). The relationship between the constructs got stronger throughout the three grades which also corresponded to other research results, which claim that the role of morphological awareness increases throughout primary school years (Carlisle, 2000; Levesque et al, 2017).

The significance of this research is that it enriched the empirical research connected to the linguistic aspects of reading acquisition giving evidence about the link between morphological awareness and reading comprehension. It shed the light on the importance of morphological instruction; in addition, the gender differences in morphological skills might might help teachers and students to identify difficulties in reading comprehension. There was a weak significant positive slightly increasing relationship between reading motivation and morphological awareness, and between reading motivation and reading comprehension. The results prove that reading motivation is linked to reading performances (Hódi, 2018; Klauda & Guthrie, 2015; Szenczi, 2008, 2013). It is a novel finding of this research that reading motivation has a positive relationship with morphological awareness.

In sum, the final version of the online instrument seemed to give a reliable estimation about the development of the students' morphological awareness. These findings suggest that morphological awareness is linked to the development of reading skills. However, further examinations are needed to explore how exactly morphological awareness or other skills might contribute to the development of reading skills (Carlisle, 2000; Casalis et al., 2015; Deacon et al., 2014; Levesque et al., 2017; Tong et al., 2014). Growth was discovered in students' performances in morphological awareness throughout grades 2-4. Inflectional morphological skills develop earlier than compound and derivational morphological skills. These findings are in line with the developmental patterns found in deep orthography languages (Gabig & Zaretsky, 2013). Therefore, I assume that morphological awareness develops similarly in shallow orthography languages as in deep orthography languages.

9.4. Limitations, Practical Implications and Future Plans

Although this work provides contribution to the literature of morphological awareness it has certain limitations. The first limitation of this research is the generalisability of my findings. Despite the great number of the students tested I could not declare that these results represent Hungarian children in grades 2-4. The second limitation concerns the instrument. This test contains judgement tasks with multiple choice questions. Using open-ended questions would have allowed examining the skill from a different angle. The reading comprehension subtest only measures basic reading skills; therefore, it could be further developed. More items could be added to measure more advanced reading skills. The reading motivation questionnaire

could also be further improved to get a deeper insight into the structure of reading motivation. These two subtests (reading comprehension and reading motivation) were only included to see what relationship morphological awareness has with these construct and how these relationships change in grades 2-4.
The third limitation of the research is that I used only quantitative methods. However, using qualitative methods; for example, oral examinations would have provided further information. The fourth limitation is that I tested only typically developing children. If I had examined children with reading difficulties, different findings may have emerged. The fifth limitation is that little information about the participants was collected (gender, date of birth, grade). No information about their mother tongue literacy skills, family background or grades in different subjects were gathered. These data might have given some explanation for their achievements.
My research calls the attention to the importance of morphology instruction. This online instrument developed for children in grades 2-4 measures morphological awareness with a five-dimensional test. It gives information about inflectional, derivational and compound morphological skills; relational, syntactic and distributional knowledge. The test can be a useful tool for teachers to identify children's strengths and weaknesses in morphological awareness and determine which subskills should be improved. It is also a great advantage of the test that the whole testing procedure can fit into a 45-minute lesson, and the results are displayed immediately after the child finishes the test. The results can be downloaded from eDia system and an assessment scale helps to interpret the results (Appendix F).
I believe that morphological instruction is beneficial since it supports understanding word structures. I agree with the opinion that the rules of the language should be taught in a playful way rather than making children repeat grammatical rules (New Hungarian National Core Curriculum, 2020). I assume that children should acquire the ability to recognise the base word and the different affixes (Framework Curriculum, 2020). Vocabulary teaching should include teaching word families and the meanings of different affixes. Children come across a lot of multimorphemic words when they start learning history, physics and other subjects, and it would be useful if they could guess the meaning of unfamiliar words by segmenting the multimophemic words into their constituents. These tasks could also develop their metalinguistic awareness which is important when they start learning a foreign language. Tasks with nonsense words encourage children to think about language as an object and use their morphological skills. Segmentation tasks improve children's morphological skills and it would be beneficial using them as early as in grade 2.

I am finishing this thesis with the description of further research plans. This online instrument could be further improved. More items could be added to the morphological segmentation subtest to get more information about the students' morpheme segmentation skills. Open ended questions could be inserted to test conscious morphological awareness. Also, longitudinal research could follow the developmental tendencies. It would give a detailed picture about how morphological awareness contributes to reading comprehension. Qualitative research methods; for example, eye tracking examinations could also be conducted to see how children solve morphological tasks and what additional information is revealed by the heat maps.

It is also a plan to develop a morphological intervention programme. The reliable and valid instrument for the assessment of morphological awareness is essential for the fulfilment of the intervention. As described in the previous chapter this online instrument was developed and tested and seemed to be reliable; therefore, it will be possible to follow the students' development and the effects of the intervention programme. The students will be pretested by the Morphological Structure Awareness Test. The eDia system will identify the low achievers and offer them the opportunity of the intervention. The eDia system has the possibilities to

offer customised interventions to the students. Thus, students can receive different intervention assignments according to their skills and their results in the pretest. During the intervention the programme will offer different options according to the students' correct and incorrect answers. After students have finished completing the assignments, they will be tested by the Morphological Structure Awareness Test. Such intervention programmes can be beneficial in everyday teaching practice because students can receive interventions in the skills which are the most challenging for them. The planned morphological intervention programme aims to improve language skills in general, inspire children to think about the language and teach explicit grammatical rules. This research might contribute to the enhancement of the efficiency of school education by providing a reliable and valid assessment tool to evaluate morphological skills and the fulfilment of these plans will facilitate the transfer of the skills taught during the intervention (Csapó & Molnár, 2019; Pásztor, 2014; Steklács, 2018a).

ACKNOWLEDGEMENTS

First and foremost, I would like to express my deep and sincere gratitude to Professor János Steklács and Dr. Attila Pásztor, my research supervisors, for their patient guidance, enthusiastic encouragement and useful critiques of my research work.

I would like to thank Professor János Steklács for introducing me to reading research and eye tracking examinations as well as encouraging me to pursue my research interests.

I am deeply indebted to Dr. Attila Pásztor for his dedicated support in planning, organisation of my research and for useful recommendations regarding the analysis. His willingness to give me helpful and encouraging feedback has been very much appreciated.

My grateful thanks are extended to Professor Benő Csapó for his support at the start of my research. His research studies, books and lessons on learning and instruction contributed to my professional growth and encouraged me to become a better researcher.

Special thanks should be given to Professor Gyöngyvér Molnár for introducing me to eDia system, for supporting my research and for providing the institutional support to carry out my research. I am also grateful for getting the chance to work on an intervention programme with the MTA-SZTE Research Group on the Development of Competencies.

I would like to thank the reviewers of the first version of this thesis, Dr. Beáta Szenczi-Velkey and Dr. Ágnes Hódi for reading my dissertation; I am grateful for their constructive feedback and suggestions.

I am extending my gratitude to Ágnes Árva and István Kállai for the technical and organisational assistance throughout my research.

I am very grateful to all the teachers and staff members of the SZTE Doctoral School of Education for familiarizing me with different aspects of educational sciences. I would like to thank Zsóka Sipos for her supportive suggestions and help throughout my research.

I would like to say special thanks to all school principals, teachers and children who took part in the research.

My special thanks go to my family, my husband and my daughter for their support and encouragement throughout this experience.

Finally, my thanks go to all the people who have supported me throughout the research work directly or indirectly.

REFERENCES

Acha, J., Laka, I., & Perea, M. (2010). Reading development in agglutinative languages: evidence from beginning, intermediate, and adult Basque readers. *Journal of Experimental Child Psychology, 105 4, 359-75.*

Adani, S., & Cepanec, M. (2019). Sex differences in early communication development: behavioral and neurobiological indicators of more vulnerable communication system development in boys. *Croatian medical journal*, 60(2), 141–149. https://doi.org/10.3325/cmj.2019.60.141

Adamikné J. A. (2006). *Az olvasás múltja és jelene: Az olvasás grammatikai, pragmatikai és retorikai megközelítésben* [The past and present of reading: A grammatical, pragmatic and rhetorical approach to reading]. Budapest: Trezor Kiadó.

Adams, M. J. (1990). *Beginning to read: Thinking and learning about print*. Cambridge, MA: MIT Press.

Altman, C., Goldstein, T., & Armon-Lotem, S. (2018). Vocabulary, Metalinguistic Awareness and Language Dominance Among Bilingual Preschool Children. *Frontiers in psychology*, 9, 1953. pp.1-16. https://doi.org/10.3389/fpsyg.2018.0195

Amendum, S. J., Vernon-Feagans, L., & Ginsberg, M. (2011). The Effectiveness of a Technologically Facilitated Classroom-Based Early Reading Intervention. *The Elementary School Journal, Vol. 112, 2011*. pp. 107-131.

Apel, K. (2014). A comprehensive definition of morphological awareness: Implications for assessment. *Topics in Language Disorders*, 34, 197-209.

Apel, K., Diehm, E., & Apel, L. (2013). Using multiple measures of morphological awareness to assess its relation to reading. *Topics in Language Disorders*, *33*(1), 42-56.

Aro, M. (2017). Learning to Read Finnish. In L. Verhoeven & C. Perfetti (Eds.), *Learning to read across Languages and Writing Systems* (pp. 393-415). Cambridge: Cambridge University Press.

Aronoff, M., & Fudeman, K. (2011). *What is morphology*. Chichester, West Sussex, U.K. , Malden, MA ,Wiley-Blackwell.

Babarczy, A., Lukács, Á., & Pléh, Cs. (2014). Nyelvelsajátítás [Language Acquisition]. In: Pléh Csaba – Lukács Ágnes (szerk.) Pszicholingvisztika [Psycholonguistics]. 1-2. *Magyar pszicholingvisztikai kézikönyv* [Handbook of Hungarian psycholinguistics]. Budapest: Akadémiai Kiadó,. 445-481

Babayigit, S. (2009). Reading and spelling development in transparent alphabetic orthographies: Points of convergence and divergence. In C. Wood, & V. Connelly (Eds.), *Contemporary Perspectives on Reading and Spelling.* London: Routledge pp.133-148.

Bandura, A. (1986). The explanatory and predictive scope of self-efficacy theory. *Journal of Clinical and Social Psychology*, 4, 359-373.

Baumann, J.F., Edwards, E.C., Boland, E.M., Olejnik, S., & Kame'enui, E.J. (2003). Vocabulary tricks: Effects of instruction in morphology and context on fifth-grade students' ability to derive and infer word meanings. *American Educational Research Journal*, 40(2), 447–494.

Becker, M., McElvany, N., & Kortenbruck, M. (2010). Intrinsic and extrinsic reading motivation as predictors of reading literacy: A longitudinal study. *Journal of Educational Psychology*, *102*(4), 773–785.

Berko, J. (1958). The child's learning of English morphology. *Word, 14*, 150-177. *Retrieved from http://childes.talkbank.org/topics/wugs/wugs.pdf.*

Berninger, V. W., Abbott, R. D., Nagy, W., & Carlisle, J. (2010). Growth in phonological, orthographic, and morphological awareness in grades 1 to 6. *Journal of Psycholinguistic Research*, 39, 141-63.

Bertram, R., Laine, M., & Virkkala, M. M. (2000). The role of derivational morphology in vocabulary acquisition: Get by with a little help from my morpheme friends. *Scandinavian Journal of Psychology*, 41(4), 287–296.

Bialystok, E., Peets, K.F., & Moreno, S. (2014). Producing bilinguals through immersion education: Development of metalinguistic awareness. *Applied Psycholinguistics*.35, 177–191.

Blomert, L., & Csépe, V. (2012). Psychological foundations of reading acquisition and assessment. In B. Csapó & V. Csépe, (Eds.), *Framework for diagnostic assessment of reading (pp. 17-78)*. Budapest: Nemzeti Tankönyvkiadó.

Borleffs, E., Maassen, B., Lyytinen, H., & Zwarts, F. (2017). Measuring orthographic transparency and morphological-syllabic complexity in alphabetic orthographies: a narrative review. *Reading and writing*, 30(8), 1617–1638.

Caldwell, J.S. (2008). *Comprehension Assessment: A Classroom Guide*. UK. pp.103-127 Guilford Press.

Carlisle, J. F. (1995). Morphological awareness and early reading achievement. In L. B. Feldman (Ed.), *Morphological aspects of language processing* (pp. 189-209). Hillsdale, NJ: Erlbaum.

Carlisle, J. F. (2000). Awareness of the structure and meaning of morphologically complex words: Impact on reading. *Reading and writing, 12*(3), 169-190.

Carlisle, J. F., & Fleming, J. (2003). Lexical Processing of Morphologically Complex Words in the Elementary Years. *Scientific Studies of Reading*, 7, 239-254.

Carlisle, J.F. (2010). Effects of Instruction in Morphological Awareness on Literacy Achievement: An Integrative Review. *Reading Research Quarterly*, 45: 464-487.

Carroll, J. M., & Fox, A. C. (2017). Reading Self-Efficacy Predicts Word Reading But Not Comprehension in Both Girls and Boys. *Frontiers in psychology*, *7*, 2056. retrieved from https://doi.org/10.3389/fpsyg.2016.02056 .

Casalis, S., Colé, P., & Sopo, D. (2004). Morphological Awareness in Developmental Dyslexia. Annals of Dyslexia, 54, 114-138. http://dx.doi.org/10.1007/s11881-004-0006-z

Casalis, S., Deacon, S. H., & Pacton, S. (2011). How specific is the connection between morphological awareness and spelling? A study of French children, *Applied Psycholinguistics* 32 (2011), 499–511.

Casalis, S., & Colé, P. (2009). On the relationship between morphological and phonological awareness: Effects of training in kindergarten and in first-grade reading. *First Language*, 29(1), 113–142.

Casalis, S., Quémart, P., & Duncan, L. G. (2015). How language affects children's use of derivational morphology in visual word and pseudoword processing: evidence from a cross-language study. *Frontiers in psychology*, 6, 452.

Castles, A., Rastle, K., & Nation, K. (2018). Ending the reading wars: Reading acquisition from novice to expert. *Psychological Science in the Public Interest*, 19, 5–51. doi: 10.1177/1529100618772271

Chomsky, N., Gallego, Á.J., & Ott, D. (2019). Generative Grammar and the Faculty of Language: Insights, Questions, and Challenges. Catalan journal of linguistics, 229-261.

Clarke, P., Snowling, M., Truelove, E., & Hulme, C. (2010). Ameliorating children's reading-comprehension difficulties: a randomized controlled trial. *Psychological Science*, 2010; 21(8):1106-1116.

Coady, J. (1979). A psycholinguistic model of the ESL reader. In: R. Mackay, B. Barkman, & R. R. Jordan (Eds.), *Reading in a second language*, Rowley, MA: Newbury House, 5-12.

Coddington, C. S., & Guthrie, J. T. (2009). Teacher and student perceptions of boys' and girls'reading motivation. *Reading Psychology, 30*, 225-249.

Coltheart, M. (2005). Modeling reading: the dual-route approach. In: Snowling M.J., Hulme, C., (eds). *The Science of Reading: A Handbook.* Malden, MA: Blackwell Publishing, pp. 6–23.
Coltheart, M. (2006). Dual route and connectionist models of reading: an overview. *London review of education*, 4(1), 5-17.
Common Core State Standards Initiative. (2011). *Common Core State Standards for English Language Arts and Literacy in History, Social Studies, Science and Technical subjects.* http://www.corestandards.org/assets/CCSSI_ELA%20 Standards.pdf
Coppola, S. (2014). Building Background Knowledge. *The Reading Teacher*, 68(2), 145–148 doi: 10.1002/trtr.1314.
Council of Europe (2020), Common European Framework of Reference for Languages: Learning, teaching, assessment – Companion volume, Council of Europe Publishing, Strasbourg, available at www.coe.int/lang-cefr.
Cs. Czachesz, E. (2014). A szókincs és az olvasás kapcsolata iskoláskor előtt [The relationship between vocabulary and reading] in *Könyv és nevelés* [Reading and Education].retrieved from https://folyoiratok.oh.gov.hu/konyv-es-neveles/a-szokincs-es-az-olvasas-kapcsolata-az-iskolaskor-elott
Csapó B. (2015). A magyar közoktatás problémái az adatok tükrében. [Problems of the Hungarian Public Education based on data.] *Iskolakultúra,* 25 (7-8), 4-17.
Csapó, B., & Csépe, V. (2012). Introduction. In B. Csapó & V. Csépe, (Eds.), *Framework for diagnostic assessment of reading* (pp. 9-16). Budapest: Nemzeti Tankönyvkiadó.
Csapó, B. (1992). *Kognitív pedagógia* [Cognitive Pedagogy]. Budapest: Akadémiai Kiadó.
Csapó, B. (2003). *A képességek fejlődése és iskolai fejlesztése. [*The development and school fostering of competencies]. Budapest: Akadémiai Kiadó.
Csapó, B. (2004). A gondolkodás fejlesztése a tanítás tartalmán keresztül [The development thinking through the teaching content]. In B. Csapó (Ed.), *Tudás és iskola* [Knowledge and school]. (pp. 101–131). Budapest: Műszaki Kiadó.
Csapó, B., Molnár, G., & Tóth, K.R. (2009). Comparing Paper-and-Pencil and Online Assessment of Reasoning Skills: A Pilot Study for Introducing Electronic Testing in Large-Scale Assessment in Hungary. In F. Scheuermann & J. Bjórnsson (Eds.). *The Transition to Computer-Based Assessment: New Approaches to Skills Assessment and Implications for Large-Scale Testing.* Luxembourg: Office for Official Publications of the European Communities.
Csapó, B., Ainley, J., Bennett, R., Latour, T., & Law, N. (2010). Draft White Paper 3: Technological Issues for Computer-Based Assessment. *Assessment and Teaching of 21st Century Skills,* The University of Melbourne, Australia. Retrieved from http://www.atc21s.org/GetAssets.axd?FilePath=/Assets/Files/
dc7c5be7-0b3a-4b7d-8408-cc610800cc76.pdf
Csapó, B., Molnár, Gy., & Steklács, J. (2015). *Az olvasás-szövegértés online diagnosztikus értékelésének tartalmi keretei* [Framework for the online diagnostic assessment of reading]. Budapest: Oktatáskutató és Fejlesztő Intézet.
Csapó, B., & Molnár, G. (2019). Online diagnostic assessment in support of personalized teaching and learning: The eDia System. *Frontiers in psychology, 10,* 1522.
Csapó, B., Fejes, J. B., Kinyó, L., & Tóth, E. (2014). Az iskolai teljesítmények alakulása Magyarországon nemzetközi összehasonlításban. In T. Kolosi & I. G. Tóth (Eds.), *Társadalmi Riport 2014* (pp. 110-136). Budapest, TÁRKI.
Csépe, V. (2006). *Az olvasó agy* [The reading brain]. Budapest: Akadémiai kiadó.
Csépe, V. (2014). Az olvasás rendszere, fejlődése és modelljei [The system of reading, reading acquisition and reading models] in Pléh Csaba *Psichoholinguisztika*

[Psycholonguistics]1-2. *Magyar pszicholinguisztikai kézikönyv*. [Handbook of Hungarian psycholinguistics].Budapest: Akadémiai Kiadó. pp. 339-370.
Csíkos, Cs., & Steklács, J. (2010). Metacognition-based reading intervention programs among fourth-grade Hungarian students, In: Szerk. Anastasia Efklides, Szerk.*: Plousia Misailidi Trends and prospects in metacognition research*. New York: Springer-Verlag New York, Inc., 2010. pp. 345-366.
Dąbrowska, E. (2015). What exactly is Universal Grammar, and has anyone seen it? *Front Psychol*. 2015 Jun 23; 6:852. Review.PMID:26157406
Dakhi, S., & Damanik, I. S. (2018). "Students' Motivation in Reading English Text: a Qualitative Study in EFL Context." *Journal of English Teaching*, vol. 4, no. 2, 2018, pp. 81-93, doi:10.33541/jet.v4i2.832.
Davis, M. H., Tonks, Hock, S. M., Wang, W., & Rodriguez A. (2018). A review of reading motivation scales. Reading Psychology, 39:2, 121-187.
Davoudi, M., & Moghadam, H.R. (2015). Critical Review of the Models of Reading Comprehension with a Focus on Situation Models. *International Journal of Linguistics*, 7, 172-187.
De Naeghel, J., Van Keer, H., Vansteenkiste, M., & Rosseel, Y. (2012). The relation between elementary students' recreational and academic reading motivation, reading frequency, engagement, and comprehension: A self-determination theory perspective. *Journal of Educational Psychology*, 104(4), 1006–1021. https://doi.org/10.1037/a0027800.
Deacon, S. H., Benere, J., & Pasquarella, A. (2012, July 30). Reciprocal Relationship: Children's Morphological Awareness and Their Reading Accuracy Across Grades 2 to 3. *Developmental Psychology*. Advance online publication. doi: 10.1037/a0029474.
Deacon, S. H., Kieffer, M. J., & Laroche, A. (2014). The Relation Between Morphological Awareness and reading Comprehension: Evidence From Mediation and Longitudinal Models, *Scientific Studies of Reading*, 18:6, 432-451.
Deacon, S. H., Tong, X., & Francis, K. (2017). The relationship of morphological analysis and morphological decoding to reading comprehension. *Journal of Research in Reading*, 40: 1– 16. doi: 10.1111/1467-9817.12056.
Deacon, S. H., & Kirby, J. R. (2004). Morphological awareness: Just "more phonological"? The roles of morphological and phonological awareness in reading development. *Applied Psycholinguistics*, 25(2), 223–238. https://doi.org/10.1017/S0142716404001110.
Dehaene, S. (2009). *Reading in the Brain*. New York NY: Penguin Viking.
Derwing, B. L. (1976). Morpheme recognition and the learning of rules for derivational morphology.*The Canadian Journal of Linguistics*, 21, 38–66.
Dhawan S. (2020). Online Learning: A Panacea in the Time of COVID-19 Crisis. *Journal of Educational Technology Systems*, pp.1-18. https://doi.org/10.1177/0047239520934018.
Donaldson (1978). *Children's minds*. Glasgow: Fontana/Collins.
Driege, D, Rayner K., & Pollatsek A. (2008). Mislocated fixations can account for parafoveal-on-foveal effects in eye movements during reading. (2008) in Q. J *Exp. Psychol* (Hove) pp. 1239-1249.
Durgunoğlu, A. (2017). Learning to Read Turkish. In L. Verhoeven & C. Perfetti (Eds.), *Learning to Read across Languages and Writing Systems* (pp. 416-436). Cambridge: Cambridge University Press. doi:10.1017/9781316155752.018.
Durkin, D, (1978). *What classroom observations reveal about reading comprehension*, Bolt Beranek and Newman Inc, Massachusetts.
Ehri, L. C. (1991). Development of the ability to read words. In R. Barr, M. L. Kamil, P. B. Mosenthal, & P. D. Pearson (Eds.), *Handbook of reading research*, Vol. 2 (p. 383–417). Lawrence Erlbaum Associates, Inc.

Ehri, L. C. (2005). Learning to read words: Theory, findings, and issues. *Scientific Studies of Reading*, 9, 167-188. http://dx.doi.org/10.1207/s1532799xssr0902_4
Erhel, S., & Jamet, E. (2013). Digital game-based learning: Impact of instructions and feedback on motivation and learning effectiveness, *Computers & Education*, Volume 67, September 2013, Pages 156-167. https://doi.org/10.1016/j.compedu.2013.02.019.
Flavell, J. H. (1976). Metacognitive aspects of problem solving. In L. B. Resnik (Ed.), *The nature of intelligence* (pp 231-235).Hillsdale NJ: Erlbaum.
Forster, K. I. (1976). Accessing the mental lexicon. In R.J.Wales & E.Walker (Eds.), *New Approaches to Language Mechanisms.* (pp. 257-287). Amsterdam: North-Holland.
Franceschini, S., Gori, S., Ruffino, M., Viola, S., Molteni M, & Facoetti A (2013). Action Video Games Make Dyslexic Children Read Better. *Curr Biol.* 2013;23(6):462-466. DOI: https://doi.org/10.1016/j.cub.2013.01.044.
Gabig, C.S., & Zaretsky, E. (2013). Promoting Morphological Awareness in Children With Language Needs: Do the Common Core State Standards Pave the Way? *Topics in Language Disorders, 33*, 7–26.
Gábor, B., & Lukács, Á. (2012). Early morphological productivity in Hungarian: Evidence from sentence repetition and elicited production. *Journal of Child Language*, 39(2), 411-442. doi: 10.1017/S0305000911000110.
Gambell, T., & Hunter, D. (1999). Rethinking Gender Differences in Literacy. Canadian Journal of Education / Revue Canadienne De L'éducation, 24(1), 1-16. doi: 10.2307/1585767
Garbe, C., Holle, K., & Swantje W. (Eds.) (2010*). Teaching Adolescent Struggling Readers in European Countries. Key Elements of Good Practices.* Frankfurt/M. u.a.: Peter Lang.
Gombert, J.E. (1992). *Metalinguistic Development*. Chicago: University of Chicago Press,.
Goodman, K.S. (1973). *Miscue analysis: Applications to Reading Istruction*. Urbana, Ill: ERIC Clearinghouse on Reading and Communication skills,.
Gordon, P. (1989). Levels of affixation in the acquisition of English morphology. *Journal of Memory and Language*, 28, 519–530.
Gordon, M., & Kochen, M. (1989), Recall-precision trade-off: A derivation. *J. Am. Soc. Inf. Sci.*, 40: 145-151. https://doi.org/10.1002/(SICI)1097-4571(198905)40:3<145::AID-ASI1>3.0.CO;2-I.
Gósy, M., & Krepsz, V. (2017). *Morfémák időzítési mintázatai a beszédben*. [Timing patterns of morphemes in speech]Budapest: MTA Nyelvtudományi Intézet.
Gósy, M. (2008). A szövegértő olvasás [Reading Comprehension]. *Anyanyelv-pedadógia*.2008.1.1.retrieved from:http://www.anyanyelv-edagogia.hu/cikkek.php?id=25
Gough, P. B., & Tunmer, W. E. (1986). Decoding, reading, and reading disability. *Remedial and special education, 7*(1), 6-10.
Grabe, W., & Stoller F. L: (2011). *Teaching and Researching Reading*, Great Britain: Pearson Education Limited.
Green, L. (2004, November). *Morphology and literacy: Implications for students with reading disabilities.* Paper presented at the annual convention of the American Speech-Language-Hearing Association, Philadelphia, PA.
Green, L., & Wolter, J. A. (2011, November). *Morphological Awareness Intervention: Techniques forPromoting Language and Literacy Success.* Paper presented at the annual American Speech Language Hearing Association, San Diego, CA.
Gray, H., Lyth, A., McKenna, C., Stothard, S., Tymms, P., & Copping, L. (2019). Sex differences in variability across nations in reading, mathematics and science: a meta-analytic extension of Baye and Monseur (2016). Large-scale Assessments in Education, 7(1), [2]. https://doi.org/10.1186/s40536-019-0070-9.

Guthrie, J. T., Hoa, L. W., Wigfield, A., Tonks, S. M., Humenick, N. M., & Littles, E. (2007). Reading motivation and reading comprehension growth in the later elementary years. *Contemporary Educational Psychology*, 32 , 282–313.

Guthrie, J. T., Wigfield, A., & VonSecker, C. (2000). Effects of integrated instruction on motivation and strategy use in reading. *Journal of Educational Psychology,* 92(2), 331–341. https://doi.org/10.1037/0022-0663.92.2.331

Haddad, L., Weiss, Y., Katzir, T., & Bitan, T. (2018). Orthographic Transparency Enhances Morphological Segmentation in Children Reading Hebrew Words. *Frontiers in psychology*, 8, 2369.

Hall, T., Hughes, C., A., Filbert, M., (2000). Computer Assisted Instruction in Reading for Students with Learning Disabilities: A Research Synthesis. *Education & Treatment of Children*. West Virginia University Press: University of West Virginia Audience.

Harm, M. W., & Seidenberg, M. S. (2004). Computing the meanings of words in reading: cooperative division of labor between visual and phonological processes. *Psychological Review*, 111, pp.662-720.

Hódi, Á., & Tóth, E. (2013). *Analyses for a better understanding of students' reading achievement along different text formats*. 15th Biennial Conference Earli, Munich, Germany, 27–31 August 2013.

Hódi, Á. (2018). *Testing the model of reading literacy: Examining the cognitive and non-cognitive factors influencing students' reading achievement in different text formats in grade 2*. PhD Dissertation. Szeged: SZTE, Neveléstudományi Doktori Iskola.

Holopainen, L. (2002). Development in reading and reading-related skills: A follow-up study from preschool to the fourth grade. *Jyväskylä Studies in Education, Psychology and Social Research* 200. University of Jyväskylä.

Hoover, W. A., & Gough, P. B. (1990). The simple view of reading. *Reading and Writing: An Interdisciplinary Journal*, 2(2), 127–160.

Horne, J. K. (2017). Reading Comprehension: A Computerized Intervention with Primary-age Poor Readers. *Dyslexia* (Chichester, England). 2017 May; 23(2):119-140. https://doi.org/10.1002/dys.1552.

Hwang, G. J., & Wu, P. H. (2012). Advancements and trends in digital game-based learning research: a review of publications in selected journals from 2001 to 2010. *British Journal of Educational Technology*, 43(1), 6–10.

Hyönä, J. (2011). Foveal and parafoveal processing during reading. In S. P. Liversedge, I. D. Gilchrist, & S. Everling (Eds.), Oxford library of psychology. *The Oxford handbook of eye movements* (p. 819–838).Oxford, England: Oxford University Press.

James, L. (2014). The integration of a computer-based early reading program to increase English language learners' literacy skills. *Teaching English with Technology*. 14(1), 9-22, http://www.tewtjournal.org.

Jamshidifarsani, H., Garbaya, S., Lim, T., Blazevic, P., & Ritchie, J. M. (2018). Technology-based reading intervention programs for elementary grades: An analytical review. *Computers and Education*. https://doi.org/10.1016/j.compedu.2018.10.003.

Jong, M.S. (2015). Does online game-based learning work in formal education at school? A case study of VISOLE. Curriculum Journal, 26, 249 - 267

Jordanidisz, Á. (2009). A fonológiai tudatosság fejlődése az olvasástanulás időszakában.[The development of children's phonological awareness during reading acquistion] *Anyanyelv-pedagógia*. 2009. 4. szám. Retrieved from: http://www.anyp.hu/cikkek.

Jordanidisz, Á. (2010). A gyermekek fonológiai tudatosságának fejlődése 4–6 éves korban. [The development of children's phonological awareness at 4-6 years of age] Paper presented at the 4. Alkalmazott Nyelvészeti Doktorandusz Konferencia, Abstract retrieved from http://www.nytud.hu/alknyelvdok10/proceedings10.pdf.

Józsa, K., Fazekasné, F. M., Szenczi, B., & Szabó, Á. (2014). Tanulásban akadályozott és tipikusan fejlődő gyermekek szóolvasási készségének, szövegértésének és olvasási motivációjának fejlődése [Development of word reading, reading comprehension and reading motivation among typically developing children and children with mild intellectual disabilities]. *Magyar Pszichológiai Szemle,* 69. 1. sz. 123–146.

Józsa, G., & Józsa, K., (2014). Relationship between Reading Comprehension, Reading Motivation and Strategy Use. *Magyar Pedagógia,* 114. Number 2.67-89 (2014)

Just, M. A, & Carpenter, P. A. (1987). *The psychology of reading and language comprehension,* Newton, MA: Allyn & Bacon.

Katz, L., & Frost, L. (1992).The Reading Process is different for Different Orthographies: The Orthographic Depth hypothesis, in *Haskins Laboratories Status Report on speech research,* SR./112, pp.147-160.

Kerettanterv az általános iskola 1–4. évfolyama számára (2020). [Framework Curriculum].https://www.oktatas.hu/kozneveles/kerettantervek/2020_nat/kerettanterv_alt_isk_1_4_evf.

Kiefer Ferenc (1997). A szóképzés. In: Kiefer Ferenc (szerk.): *Új magyar nyelvtan*. [New Hungarian Grammar] Budapest: Osiris Kiadó, 222–60.

Kinanti, K., Setiyadi, A. B., & Suparman, U. (2015). The Relationship Between Students' Morphological Awareness and their Reading comprehension. *U-JET, 4*(4). Retrieved from http://jurnal.fkip.unila.ac.id/index.php/123/article/view/9184

Kintsch, W. (1998). *Comprehension: a paradigm for cognition*, Cambridge: UK Cambridge University Press.

Kirby, J. R., Deacon, S. H., Bowers, P. N., Izenberg, L., Wade-Woolley, L., & Parrila, R. (2012). Children's morphological awareness and reading ability. *Reading and Writing, 25*(2), 389-410.

Kirk, C., & Gillon, G. T. (2009). Integrated morphological awareness intervention as a tool for improving literacy. *Language, speech, and hearing services in schools*. 40(3), 341–351. https://doi.org/10.1044/0161-1461(2008/08-0009)

Kiss, R., Hódi, Á., Tóth, E., & B. Németh, M. (2016). *Egy magyar nyelvű fonológiai tudatosság teszt reliabilitásának és validitásának vizsgálata*. [The investigation of the reliability and validity of a Hungarian Phonological Awareness Test]. In Zsolnai & L. Kasik (Eds*.), XVI. Országos Neveléstudományi Konferencia. Program és absztaktkötet*, (pp. 255). Szeged: SZTE Neveléstudományi Intézet.

Klauda, S., & Guthrie, J. (2015). "Comparing relations of motivation, engagement, and achievement among struggling and advanced adolescent readers". *Reading and Writing*, Vol. 28, pp. 239–269, http://dx.doi.org/10.1007/s11145-014-9523-2.

Ku, Y., & Anderson, R. C. (2003). Development of morphological awareness in Chinese and English. *Reading and Writing*: An Interdisciplinary Journal, 16, 399–422.

Kuo, L. J., & Anderson, R. C. (2006). Morphological awareness and learning to read: A cross language perspective. *Educational Psychologist, 41(3),* 161-180. doi:10.1207/s15326985ep4103_3

LaBerge D., & Samuels, S. J.(1974). Toward a theory of automatic information processing in reading. *Cognitive Psychology*. Vol.6. pp. 293-323.

Larsen, J. A., & Nippold, M.A. (2007). Morphological analysis in school-age children: dynamic assessment of a word learning strategy. *Language, speech, and hearing services in schools*, 38 3, 201-12.

Levesque, K., Kieffer, M.J., & Deacon, S.H. (2017). Morphological awareness and reading comprehension: Examining mediating factors. *Journal of Experimental Child Psychology, 160, 1–20*.

Lewis, G., Solomyak, O., & Marantz, A. (2011). The neural basis of obligatory decomposition of suffixed words. *Brain and Language*, 118(3), 118e127.
Li, L., & Wu, X. (2015). Effects of Metalinguistic Awareness on Reading Comprehension and the Mediator Role of Reading Fluency from Grades 2 to 4, 4. *PLoS ONE* 10(3): e0114417.
Lőrik, J. (2006). A gyermeki fonológiai tudatosság megismeréséről [About understanding children's phonological awareness]. *Beszédgyógyítás*, 17/2, 32–6.
Lowder, M. W., Choi, W., & Gordon, P. C. (2013). Word recognition during reading: the interaction between lexical repetition and frequency. *Memory & cognition,* 41(5), 738–751. https://doi.org/10.3758/s13421-012-0288-z.
Lukács Á, Gábor B, Kemény F, & Babarczy A. (2014). A nyelvtani kategóriák és szabályok elsajátítása [Acquisition of grammatical categories and rules]. In: Pléh Cs, Lukács Á (szerk.) *Pszicholingvisztika 1-2. Magyar pszicholingvisztikai kézikönyv*. [Handbook of Hungarian psycholinguistics]. Budapest: Akadémiai Kiadó, 2014; 483-52.
Lukács, A., Pléh, Cs., Kas, B., & Thuma, O. (2014). A szavak mentális reprezentációja és az alaktani feldolgozás In: Pléh Csaba–Lukács, Á (szerk.) *Pszicholingvisztika.* [Psycholonguistics] *1-2. – Magyar pszicholingvisztikai kézikönyv*.[Handbook of Hungarian psycholinguistics]. Budapest: Akadémiai Kiadó, 169-250.
MacWhinney, B. (1976). Hungarian research on the acquisition of morphology and syntax. *Journal of Child Language* 3. 397-410.
Magyar, A. (2012). Számítógépes adaptív tesztelés [Computer adaptive testing]. *Iskolakultúra*, 22. 6. sz. 52–60.
Manolitsis, G., Grigorakis, I., & Georgiou, G. K. (2017). The Longitudinal Contribution of Early Morphological Awareness Skills to Reading Fluency and Comprehension in Greek. *Frontiers in psychology*, 8, 1793.
Marinak, B. A., & Gambrell, L. B. (2010). Reading motivation: Exploring the elementary gender gap. *Literacy Research & Instruction*, 49(2), 129-141.
Marslen-Wilson, W. (1984). Function and process in spoken word recognition. In *Bouma, H. & Bouwhuis, D. (eds.) Attention and Performance X: Control of Language Processes*. Erlbaum Hillsdale, :N. J. 125-150.
McClelland, J. L., & Rumelhart, D. E. (1981). An interactive activation model of context effects in letter perception: I. An account of basic findings. *Psychological Review, 88*(5), 375–407.
McGeown, S., Norgate, R., & Warhurst, A. (2012). Exploring intrinsic and extrinsic reading motivation among very good and very poor readers. *Educational Research*, *54*(3), 309-322.
McLeod, A. N., & Apel, K. (2015). Morphological awareness intervention study of a child with history of speech and language disorders. *Communication Disorders Quarterly*, 36(4), 208-218. https://doi.org/10.1177/ 1525740114560371
Mioduser, D., Tur-Kaspa, H., & Leitner, I. (2000). The learning value of computer-based instruction of early reading skills. *Journal of Computer Assisted Learning* (2000) 16, 54-63.
Miller, B., & O'Donnell, C. (2013). Opening a Window into Reading Development: Eye Movements' Role Within a Broader Literacy Research Framework. *School psychology review, 42*(2), 123–139.
Molitorisz, A. (2013). *Az olvasási stratégiákról alkotott tanulói meggyőződések vizsgálata* 12–18 éves korban. PhD-értekezés [The examination of students' beliefs on reading strategies]. Szeged: SZTE, Neveléstudományi Doktori Iskola.
Moll, K., Ramus, F., Bartling, J., Bruder, J., Kunze, S., Neuhoff, N., Streiftau, S., Lyytinen, H., Leppänen, P. H. T., Lohvansuu, K., Tóth, D., Honbolygó, F., Csépe, V., Bogliotti, C., Iannuzzi, S., Démonet, J. F., Longeras, E., Valdois, S., George, F., ... Landerl, K. (2014).

Cognitive mechanisms underlying reading and spelling development in five European orthographies. *Learning and Instruction*, 29, 65-77.
Molnár, G. (2011). Számítógépes játék-alapú képességfejlesztés: egy pilot vizsgálat eredményei [Game-based fostering of competences: the results of a pilot testing]. *Iskolakultúra*, 21. 6−7. sz. 3−11.
Molnár, Gy., Makay, G., & Ancsin, G. (2018). *Feladat- és tesztszerkesztés az eDia rendszerben* [Task and test development in the eDia system].Szeged, SZTE Oktatáselméleti Kutatócsoport.
Molnár, G., & Csapó, B. (2019). Making the Psychological Dimension of Learning Visible: Using Technology-Based Assessment to Monitor Students' Cognitive Development. *Frontiers in Psychology*, 10:1368.
Morton J. (1979). Facilitation in Word Recognition: Experiments Causing Change in the Logogen Model. In: Kolers P.A., Wrolstad M.E., Bouma H. (eds) *Processing of Visible Language*. Nato Conference Series, vol 13. Springer, Boston, MA.
Muthén, L.K. & Muthén, B.O. (2010). *Mplus User's Guide*. Los Angeles, CA: Muthén & Muthén.
Moss, G., & Washbrook, D.L. (2016). Bristol Working Papers in Education # 01 / 2016 Understanding the Gender Gap in Literacy and Language Development.
Nagy W.E., Kuo-Kealoha A., Xinchun W., Wenling L., Anderson R.C., & Xi C. (2002). The Role of Morphological Awareness in Learning to Read chinese. In: Wenling L., Gaffney J.S., Packard J.L. (eds) *Chinese Children's Reading Acquisition*. Springer, Boston, MA.
Nagy, J. (1980). *5-6 éves gyermekeink iskolakészültsége.*[The school readiness of our children aged 5-6 years] Budapest: Akadémiai Kiadó.
Nagy, J. (2006). Olvasástanítás: a megoldás stratégiai kérdései. [Reading instruction: strategies for the solution]. *In: Józsa Krisztián (szerk.): Az olvasási képesség fejlődése és fejlesztése* [The development and improvement of reading skills]. Budapest, Dinasztia Tankönyvkiadó. pp 17–42.
Nagy, J. (2016). Az olvasás pszichikus komponensrendszere [The psychic component system of reading]. *Iskolakultúra,* 26.évf. 2.sz. (2016. február),epa.oszk.hu. pp.119-130.
Nagy, W. E., Carlisle, J. F., & Goodwin, A. P. (2014). Morphological Knowledge and Literacy Acquisition. *Journal of Learning Disabilities*, 47(1), 3–12. http://dx.doi.org/10.1177/0022219413509967
Nagy, W.E., Berninger, V.W., & Abbott, R.D. (2006). Contribution of morphology beyond phonology to literacy outcomes of upper elementary and middle-school students. *Journal of Educational Psychology*, 98(1), 134–147. doi:10.1037/0022-0663.98.1.134
Nagy, W.E., Kuo-Kealoha, A., Wu, X., Li, W., Anderson, R.C., & Chen, X. (2002). The role of morphological awareness in learning to read Chinese. In W. Li, J.S. Gaffney, & J.L. Packard (Eds.), *Chinese language acquisition: Theoretical and pedagogical issues* (pp. 59–86).
National Reading Panel (2000). *http*://www.nationalreadingpanel.org.
A Nemzeti alaptanterv kiadásáról, bevezetéséről és alkalmazásáról szóló 110/2012. (VI. 4.) Korm. rendelet módosításáról. 5/2020. (1.31) Korm. rendelet. (2020). *Magyar közlöny*. 2020. évi.17. szám. pp. 290-446.
Nippold, M. A., & Sun, L. (2008). Knowledge of morphologically complex words: A developmental study of older children and young adolescents. *Language, Speech, and Hearing Services in Schools*, 39(3), 365–373. https://doi.org/10.1044/0161-1461 (2008/034).
Nunan, D. (1991). *Language Teaching Methodology.* London: Prentice Hall.
Nunes, T., Bryant P., Bindman M. (1997). Morphological spelling strategies: developmental stages and processes. *Dev. Psychol*. 33 637–649. 10.1037/0012-1649.33.4.637.

Nunes, T., Bryant, P., & Bindman, M. (2006). The effects of learning to spell on children's awareness of morphology. *Reading and Writing*. 19:767–787.
Nunes, T., Bryant, P., & Olsson, J. (2003). Learning morphological and phonological spelling rules: An intervention study. *Scientific Studies of Reading*, 7(3), 289–307.
OECD (2002*).Reading for Change: Performance and Engagement across Countries: Results from PISA 2000*. Paris: OECD Publishing. http://dx.doi.org/10.1787/9789264099289-en
OECD (2010). *PISA 2009 Results: Learning to Learn: Student Engagement, Strategies andPractices (Volume III)*, PISA, OECD Publishing, Paris
OECD (2019). "PISA 2018 Reading Framework", in *PISA 2018 Assessment and Analytical Framework*, Paris: OECD Publishing.
Oravecz, C., Váradi, T., & Sass, B. (2014) *The Hungarian Gigaword Corpus.* In: LREC 2014 Proceedings. ELRA, Reykjavik, pp. 1719-1723. ISBN 978-2-9517408-8-4.
Pásztor, A. (2013). Digitális játékok az oktatásban. [Digital games in education] *Iskolakultúra,* 23(9), 37–48.
Pásztor, A. (2014). Lehetőségek és kihívások a digitális játék alapú tanulásban: egy induktív gondolkodást fejlesztő tréning hatásvizsgálata [Challenges and possibilities in digital game-based learning: effectiveness of a playful inductive reasoning training program]. *Magyar Pedagógia*, 114(4), 281–301.
Pearson, P. D. (2004). The Reading Wars. *Educational Policy*, 18(1), pp. 216-252)
Perfetti, C., & Stafura, J. (2014). Word Knowledge in a Theory of Reading Comprehension, *Scientific Studies of Reading*, 18:1, 22-37. DOI: 10.1080/10888438.2013.827687
Perfetti, C. A. (1997). The psycholinguistics of spelling and reading. In C. A. Perfetti, L. Rieben, & M. Fayol (Eds.), *Learning to spell: Research, theory, and practice across languages* (p. 21–38). Mahwah, NJ. Lawrence Erlbaum Associates Publishers.
Perfetti, C. A., & Hart, L. (2001). The lexical quality hypothesis in Verhoeven L., Elbro C. & Reitsma P. (Eds). *Precursors of functional literacy* pp.189-214. Amsterdam/Philadelphia: John Benjamins.
Perfetti, C. A., & Dunlap, S. (2008). "Learning to read: general principles and writing system variations," in *Learning to Read Across Languages: Cross-Linguistic Relationships in First- and Second-Language Literacy Development*, eds K. Koda, & A. M. Zehler (New York, NY: Routledge), 13–38.
Piaget, J. (1936). *Origins of intelligence in the child*. London: Routledge & Kegan Paul.
Pléh, Cs. (2000). A magyar morfológia pszicholingvisztikai aspektusai [Psycholingvistic aspects of Hungarian morphology]. In F. Kiefer (Ed.), *Strukturális magyar nyelvtan. 3. kötet. Morfológia* [Structural Hungarian Grammar. 3rd Volume. Morphology] (pp. 951-1020). Budpest: Akadémiai Kiadó.
Pollatsek, A., & Rayner K. (1989). Reading .in: Posner M, (ed). *Foundations of cognitive science*. Cambridge, MA: MIT Press; 1989. pp. 401-436.
RAND Reading Study Group, Snow, C. (2002). *Reading for Understanding, toward an R&D Program in Reading Comprehension.* Santa Monica: RAND.
Rastle, K. (2019). The place of morphology in learning to read in English. *Cortex, 116*, 45-54.
Rayner, K., & Pollatsek, A. (1987). Eye movements in reading: A tutorial review. In Coltheart M. (Ed.), *Attention and performance* (Vol. 12, pp. 327-362). London: Erlbaum.
Rayner, K, & Pollatsek A.(1989.) *The psychology of reading*. Englewood cliffs, NJ: Prentice Hall.
Rayner, K., Slattery, T. J., Drieghe, D., & Liversedge, S. P. (2011). Eye movements and word skipping during reading: effects of word length and predictability. *Journal of experimental psychology. Human perception and performance*, 37(2), 514–528. https://doi.org/10.1037/a0020990

Rayner, K. (1998). Eye movements in reading and information Processing 20 Years of Research in *Psychological bulletin*, pp. 372-422.
Reilly, D., Neumann, D. L., & Andrews, G. (2019). Gender differences in reading and writing achievement: Evidence from the National Assessment of Educational Progress (NAEP). The American psychologist, 74(4), 445–458. https://doi.org/10.1037/amp0000356
Roehr, K. (2007). Metalinguistic Knowledge and Language Ability in University-Level L2 Learners. *Applied Linguistics*, 29(2), 173-199.
Rothou, K. M., Padeliadu, S., & Sideridis, G., D. (2013). *Predicting Early Reading in Greek:* The Contribution of Phonological Awareness and Non-Phonological Language Skills, 3rd World Conference on Learning, Teaching and Educational Leadership – WCLTA 2012 (2013) 1504 – 1509.
Rumelhart, D. E. (1980). Schemata. The building blocks of cognition. in R. J.Spiro B. C Bruce. & W. F. Brewer (eds), *Theoretical issues in reading comprehension*. pp. 33-58 Hilldale, New Jersey: Lawrence Erlbaum associates.
Rumelhart, D. E., & McClelland, J. L, (1986). Parallel Distributed Processing. Explorations in the Microstructure of Cognition. Volume 1; *Psychological and Bioligical models*. Cambridge, MA: MIR Press.
Seidenberg, M. S. (2005). Connectionist models of word reading. *Current Directions in Psychological Science*, 14, 238-242.
Seindenberg, M. S. (2007). Connectionist Models of Reading in Gaskell (Ed.), *Oxford handbook of Psycholinguistics*. Oxford: Oxford University Press pp. 235-250.
Seymour, P. H. K., Aro, M., & Erskine, J. M. (2003). Foundation literacy acquisition in European orthographies. *British Journal of Psychology*, 94, 143–174.
Share, D. L. (2008). On the Anglocentricities of current reading research and practice: The perils of overreliance on an "outlier" orthography. *Psychological Bulletin*, 134(4), 584–615.
Shute, V. J., & Rahimi, S. (2017). Review of computer-based assessment for learning in elementary and secondary education. *Journal of Computer Assisted Learning*, 33: 1– 19. doi: 10.1111/jcal.12172.
Shibley-Hyde, J. (2005). The gender similarities hypothesis. American Psychologist, 60 (6), 581-592. DOI: 10.1037/0003-066X.60.6.581 p.581.
Stanovics, K. E. (1980).Toward an interactive- Compensatory model of Individual Differences in the Development of Reading Fluency in *Reading research Quarterly*, vol. 16., No. 1., pp.32-71.
Stanley, J. C., Benbow, C. P., Brody, L., Dauber, S., & Lupkowski, A. (1992). Gender differences on eighty-six nationally standardized aptitude and achievement tests. In N. Colangelo, S. G. Assouline & D. L. Ambroson (Eds.), Talent development: Proceedings from the 1991.Henry B. and Jocelyn Wallace National Research Symposium on Talent.Development (pp. 42–65). Unionville, NY: Trillium Press.
Silva, A. A., & Martins-Reis, V. O. (2017). The influence of morphological awareness on reading and writing: a systematic review. *CoDAS*, 29(1), e20160032. Epub February 16, 2017.
Silvén, M., Poskiparta, E., & Niemi, P. (2004). The Odds of Becoming a Precocious Reader of Finnish. *Journal of Educational Psychology*, 96(1), 152–164.
Snyder, L., Caccamise, D., & Wise, B. (2005). The Assessment of Reading Comprehension: Considerations and Cautions. *Topics in Language Disorders, 25*(1), Retrieved February 8, 2021 from https://www.learntechlib.org/p/70431/.
Solheim, O. J. (2011). The impact of reading self-efficacy and task value on reading comprehension scores in different item formats. *Reading Psychology*, 32(1), 1–27. https://doi.org/10.1080/02702710903256601.

Schroeder, S., Hyönä, J., & Liversedge, S. P. (2015). Developmental eye-tracking research in reading: Introduction to the special issue [Editorial]. *Journal of Cognitive Psychology, 27*(5), 500–510. https://doi.org/10.1080/20445911.2015.1046877

Stanovich, K. E. (1986). Matthew effects in reading: Some consequences of individual differences in the acquisition of literacy. *Reading Research Quarterly*, 21(4), 360–407.

Steklács, J., (2013). *Olvasási stratégiák tanítása és az olvasásra vonatkozó meggyőződés*. [Teaching reading strategies and beliefs about reading]Budapest: Nemzedékek Tudása Könykiadó.

Steklács, J. (2014). A szemmozgás vizsgálatának lehetőségei az olvasás és a vizuális információfeldolgozás képességének a megismerésében [The possibilities of eyetracking examinations in understanding reading and visual information processing skills]. *Anyanyelv-pedagógia*, 2014.3.szám. http://www.anyanyelv-pedagogia.hu.

Steklács, J. (2018a). PISA 2015 után, PISA 2018 előtt. A szövegértő olvasás fejlesztésének, tanításának feladatai [After PISA 2015, before PISA 2018. The tasks of developing and teaching reading comprehension]. *Könyv és Nevelés* [Book and Education], 20, 1, 30–49. http://folyoiratok.ofi.hu/konyv-es-neveles/pisa-2015-utan-pisa-2018-elott

Steklács, J. (2018b). Az olvasás-szövegértés terminológiai kérdései, fogalmának változása és az olvasástanítási rendszerünk [The terminological questions of reading literacy, conceptual changes and our reading instruction]. In: András, C., & Fenyő D. (szerk.): *Alumni Nova: 25 éves a Szakkollégium*. Pécs: PTE BTK Kerényi Károly Szakkollégium, 77–91. https://www.academia.edu/37502280/Alumni_Nova_I

Steklács, J., Molnár, Gy., & Csapó, B. (2015). Az olvasás-szövegértés online diagnosztikus mérések tartalmi kereteinek elméleti háttere.[The theoretical background of online diagnostic assessment of reading] In: Csapó, Benő; Steklács, János; Molnár, Gyöngyvér (szerk.*) Az olvasás-szövegértés online diagnosztikus értékelésének tartalmi keretei* [Framework for the online diagnostic assessment of reading]. Budapest: Oktatáskutató és Fejlesztő Intézet (OFI) (2015) pp. 15-31.

Szenczi, B. (2008). Énkép és tanulás: Nemzetközi kutatási irányzatok és tendenciák [Self-concept and learning: International approaches and tendencies]. *Iskolakultúra Online,* 2, 104–118.

Szenczi, B. (2013). Olvasási motiváció 4., 6. és 8. osztályos tanulók körében [Reading motivation in 10- to 14-year-old schoolchildren]. *Magyar Pedagógia,* 113(4), 197–220.

Szili, K. (2016). A fonológiai tudatosság és a mentális lexikon fejlettségének online vizsgálata kisiskolások körében [The examination of the development of phonological awareness and mental lexicon]. *Magyar Pedagógia,* 116(3), 257-282.

Tánczikné-Varga, Sz. (2017a). Reading models in L1 and L2. *Gradus* 4: 1 pp. 144-156.

Tánczikné-Varga, Sz. (2017b). Factors affecting reading comprehension. *Gradus* 4 : 2. pp. 41-47.

Tánczikné-Varga, Sz., Steklács, J., & Pásztor, A. (2018). *Morfológiai és anyanyelvi tudatosság, valamint az olvasás-szövegértési képesség online mérése és fejlesztése alsó tagozaton* [The online assessment and development os morphological awareness skills in lower primary grades] in Beszédkutatás 2018 Abstraktkötet. pp.10-11.

Tánczikné-Varga, Sz., & Steklács, J. (2018). *The relationship between morphological awareness and reading comprehension, a pilot study.* In: Vidákovich, T.; Fűz, N. (szerk.) PÉK 2018 [CEA 2018] XVI. Pedagógiai Értékelési Konferencia [16th Conference on Educational Assessment]: Program és összefoglalók [Programme and abstracts], Szeged : SZTE Neveléstudományi Doktori Iskola, (2018) pp. 97.

Tánczikné-Varga, S., & Steklács, J. (2019). *Morfológiai tudatosságot vizsgáló feladatok megoldási stratégiáinak vizsgálata szemmozgáskövető módszerrel* [Examination of the problem solving strategies of morphological awareness tasks with eyetracking

examinations].In: Varga, A., Andl, H., & Molnár-Kovács, Z. (szerk.) Neveléstudomány – Horizontok és dialógusok. Absztraktkötet. : XIX. Országos Neveléstudományi Konferencia. Pécs, 2019. november 7-9.p. Pécs: Pécsi Tudományegyetem (2019) p.289.

Tánczikné-Varga, Sz. (2019). *Developing an instrument for assessing the relationship between morphological awereness and reading comprehension: a second pilot study.* TALC3, The 3rd Conference on Theoretical and Applied Linguistics: Language in Use - Linguistic and Pedagogical Perspectives BiaŁystok, Poland, 5th -6th December, 2019.

Tong, X., Deacon, S. H., Kirby, J., Cain, K., & Parrila, R. (2011). Morphological awareness: A key to understanding poor reading comprehension in English. *Journal of Educational Psychology*, 103, 523-534.

Tong, X., Deacon, S.H., & Cain, K. (2014). Morphological and syntactic awareness in poor comprehenders: another piece of the puzzle. *Journal of learning disabilities*, 47,1, 22-33.

Török, T., & Hódi, Á. (2015). A morfológiai tudatosság fejlődése, mérési lehetőségei és az olvasásszövegértéssel való kapcsolata [The development of morphological awareness, its possible measures, and its relation to reading comprehension].*Anyanyelv-pedagógia*.http://www.anyanyelv-pedagogia.hu/cikkek php?id =551.

Török, T. & Hódi, A. (2015). A fonológiai tudatosság fejlődése és szövegértéssel való kapcsolata az általános iskola első négy évfolyamán a szocioökonómiai státusz tükrében. [The relationship between phonological awareness and reading comprehension in light of students' socioeconomic status]. *Magyar Pszichologiai Szemle* (0025-0279 1588-2799): 70 4 pp 807-826 (2015)

Török, T., Hódi, A., & Kiss, R. (2016). A fonológiai tudatosság online mérési lehetőségei az általános iskola első négy évfolyamán. [Online assessment of phonological awareness from grades 1 to 4] Alkalmazott Pszichológia (1419-872X): 16 1 pp 83-99 (2016)

Torppa, M., Lyytinen, P., Erskine, J., Eklund, K., & Lyytinen, H. (2010). Language development, literacy skills and predictive connections to reading in Finnish children with and without familial risk for dyslexia. *Journal of Learning Disabilities*, 43 (4), 308-321.

Tunmer, W.E., & Herriman, M.L. (1984). The Development of Metalinguistic Awareness: A Conceptual Overview. In: Tunmer W.E., Pratt C., Herriman M.L. (eds) Metalinguistic Awareness in Children. *Springer Series in Language and Communication*, vol 15. Springer, Berlin, Heidelberg.

Tyler, A., & Nagy, W. (1989). The acquisition of English derivational morphology. *Journal of Memory and Language*, 28(6), 649–667.

Urquart, S., & Weir, C. (Eds) (1998). *Reading in a foreign language: process, product and practice*, Harlow: Longman.

Van Eck, R. (2006). Digital Game-Based Learning: It's Not Just the Digital Natives Who Are Restless. *Educause Review*, *41*(2), 1–16.

Váradi, T. (2002). *The Hungarian National Corpus*. In: Proceedings of the 3rd LREC Conference, Las Palmas, Spanyolország, 2002, 385-389. http://hnc.nytud.hu

Varga, T. Sz. (2019). *Individual Differences in the Visual Comprehension of a Morphological Test on the Basis of Eye Tracking Examinations* in Abstracts of Presentations: 4th Hungarian Eye-Tracking Conference. 31th May 2019, Budapest. Pécs, HU : University of Pécs (2019) , 13 p.

Varga, S., & Steklács, J. (2019). A morfológiai tudatosság és összefüggése a szövegértő olvasás képességével második osztályos korban: egy próbamérés tanulságai [The relationship between morphological awareness and reading comprehension skills in grade 2: analysis of a pilot study] *In: Bóna, Judit; Horváth, Viktória (szerk.) Az anyanyelv-elsajátítás folyamata hároméves kor után.* ELTE Eötvös Kiadó, Budapest. (2019c) pp. 107-127.

Varga, S., Pásztor, A., & Steklács, J. (2019). A szövegértés és a morfológiai tudatosság számítógép-alapú fejlesztése alsó tagozaton [Computer-enhanced development of reading comprehension and morphological awareness skills]. *Iskolakultúra,* 29(8), 94-106.

Varga, S. (2020). *A morfológiai tudatosság és a szövegértési képességek összefüggései*.[The relationships between morphological awareness and reading comprehension] In VIII. Neveléstudományi és Szakmódszertani Konferencia = Vzdelávacia, výskumná a metodická konferencia (p. 69).

Varga, S., Pásztor, A., & Steklács, J. (2020). An online instrument assessing the relationship between morphological structure awareness and reading comprehension in Hungarian 2-4 graders. *Ilkogretim Online - Elementary Education Online*, 2020; 19 (4): pp. 2322-2334. http://ilkogretim-online.org.trdoi:10.17051/ilkonline.2020.764232

Verhoeven, L., & Perfetti, C. (2008). Advances in Text Comprehension: Model, Process and Development. *Applied Cognitive Psychology* 22. pp.293-301.

Verhoeven, U., & Perfetti C. A. (2011). Introduction to this Special Issue: Vocabulary Growth and Reading Skill, *Scientific Studies of Reading, 15*(1), 1-7. Vol. 28, pp. 239–269, http://dx.doi.org/10.1007/s11145-014-9523-2

Verhoeven, L., & Perfetti, C. (2017). Introduction: Operating principals in learning to read. In L. Verhoeven & C. Perfetti (Eds.), *Learning to Read across Languages and Writing Systems* (pp. 1-31). Cambridge: Cambridge University Press.

Vygotsky, L. S. (1962). *Thought and language*. Cambridge, MA: MIT Press.

Wagner, R. K., Torgesen, J. K., Rashotte, C. A., Hecht, S. A., Barker, T. A., Burgess, S. R., Donahue, J., & Garon, T. (1997). Changing relations between phonological processing abilities and word-level reading as children develop from beginning to skilled readers: A 5-year longitudinal study. *Developmental Psychology*. 1997; 33:468–479.

Westera, W. (2015). Games are motivating, aren´t they? Disputing the arguments for digital gamebased learning. International Journal of Serious Games 2(2), Online publication. http://journal.seriousgamessociety.org/index.php?journal=IJSG&page=article&op=view&path%5B%5 D=58&path%5B%5D=pdf_17.

Wigfield, A., & Guthrie, J.T. (1997)."Relations of children's motivation for reading to the amount and breadth of their reading," *Journal of Educational Psychology*, 89, 1997, pp. 420–432.

Wolter, J. A., & Green, L. (2013). Morphological awareness intervention and school-age language and literacy deficits: A case study, *Topics in Language Disorders*, 1, 27–41.

Xiaoying et al. (2009). Morphological Awareness and Chinese Children's Literacy Development: An Intervention Study. *Scientific Studies of Reading.* 13. 26-52.

Zhang, D., & Koda, K. (2012). Contribution of morphological awareness and lexical inferencing ability to L2 vocabulary knowledge and reading comprehension among advanced EFL learners: Testing direct and indirect effects. *Reading and Writing*, 25(5), 1195-1216.

Ziegler J., & Goswami, U. (2005). Reading Acquisition, Developmental Dyslexia, and Skilled Reading Across Languages: A Psycholinguistic Grain Size Theory, *Psychological Bulletin Copyright* 2005 by the American Psychological Association. 2005, Vol. 131, No. 1, 3–290033-2909/05/$12.00 DOI: 10.1037/0033-2909.131.1.

Ziegler, J. C., Bertrand, D., Tóth, D., Csépe, V., Reis, A., Faísca, L., Saine, N., Lyytinen, H., Vaessen, A., & Blomert, L. (2010). Orthographic depth and its impact on universal predictors of reading: A cross-language investigation. *Psychological Science*, 21(4), 551-559.

Zorzi, M., Houghton, G., & Butterworth, B. (1998). Two routes or one in reading aloud? A connectionist dual-process model in *Journal of Experimental Psychology: human Perception and Performance*, 24, pp. 1131-1161.

Zughoul, O., Jani, H., Shuib, A., & Almasri, O.A. (2013). Privacy and Security in Online Examination Systems. *IOSR Journal of Computer Engineering*, 10, 63-70.

LIST OF FIGURES

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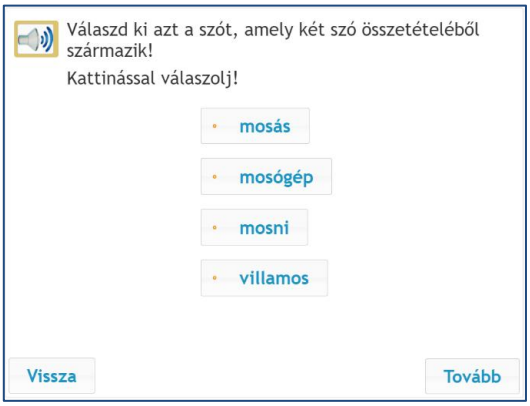
Appendix A. Sample Items from the Instrument

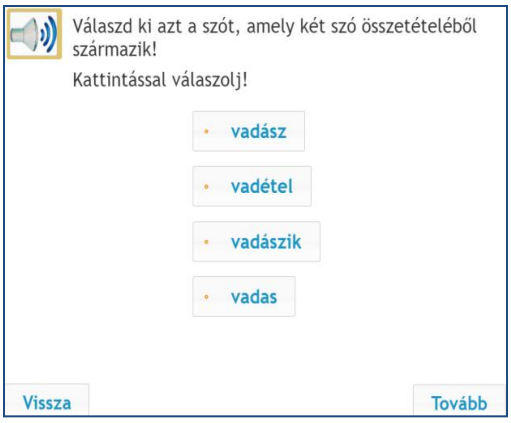
Sample items from the Compounds Words Subtest (Pilot test)



Item md_1
Choose the word which is formed by combining two words. Answer by clicking.

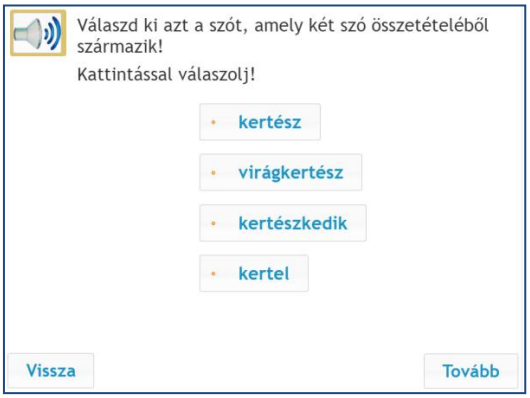
Item md_2
Choose the word which is formed by combining two words. Answer by clicking.

Item md_3
Choose the word which is formed by combining two words. Answer by clicking.



Item md_4
Choose the word which is formed by combining two words. Answer by clicking.

Item md_5
Choose the word which is formed by combining two words. Answer by clicking.



Item md_6
Choose the word which is formed by combining two words. Answer by clicking.

Item md_7

Choose the word which is formed by combining two words. Answer by clicking.

Item md_8

Choose the word which is formed by combining two words. Answer by clicking.

Item md_9

Choose the word which is formed by combining two words. Answer by clicking.

Item md_10

Choose the word which is formed by combining two words. Answer by clicking.

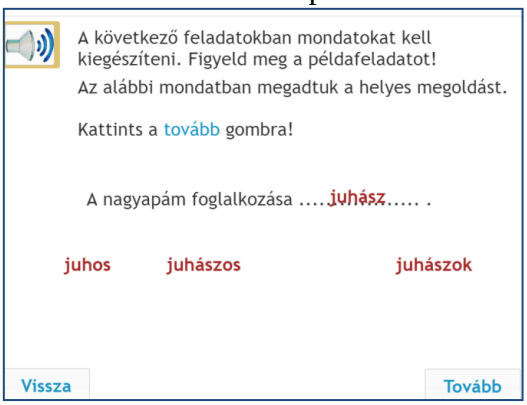
Item md_11

Choose the word which is formed by combining two words. Answer by clicking.

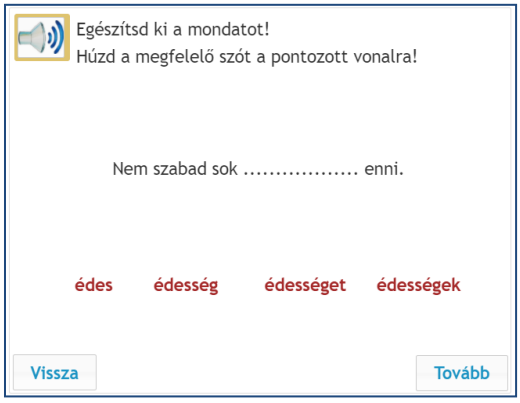
Item md_12

Choose the word which is formed by combining two words. Answer by clicking.

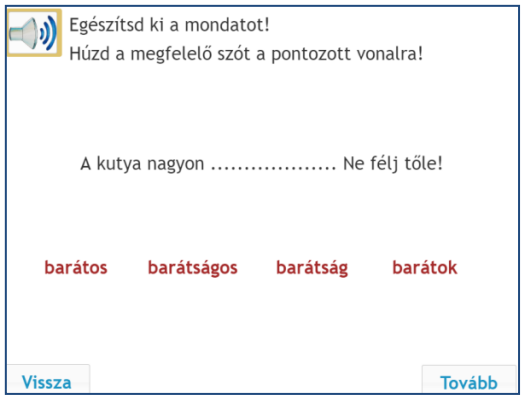
Sample items from the Derivation Subtest



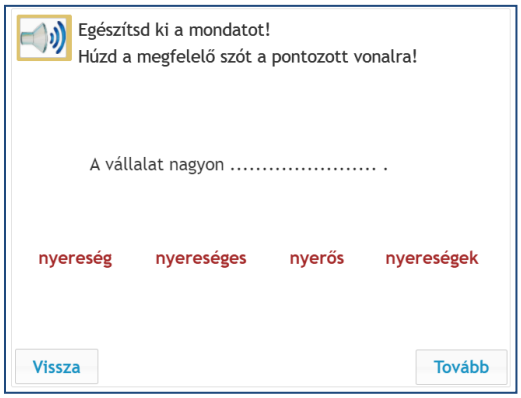
Item oa_00 Example
In the following tasks you should complete sentences. Read the following example carefully. We indicated the correct solution.



Item oa_2
Complete the following sentences. Drag the correct word onto the dotted line.

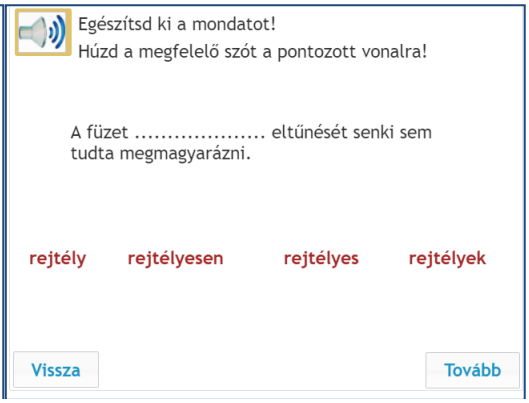


Item oa_3
Complete the following sentences. Drag the correct word onto the dotted line.

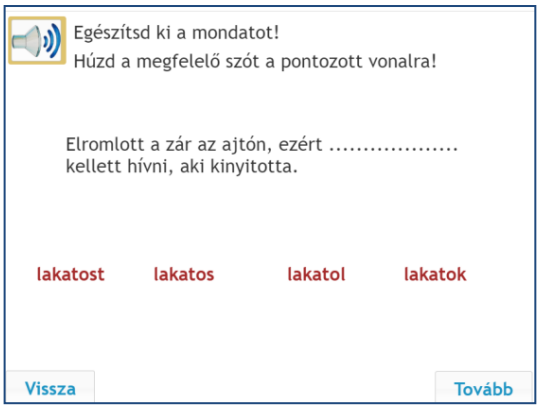


Item oa_4
Complete the following sentences. Drag the correct word onto the dotted line.

Item oa_6
Complete the following sentences. Drag the correct word onto the dotted line.

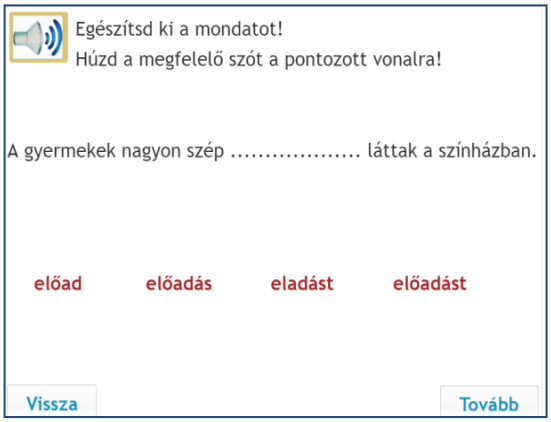


Item oa_7
Complete the following sentences. Drag the correct word onto the dotted line.

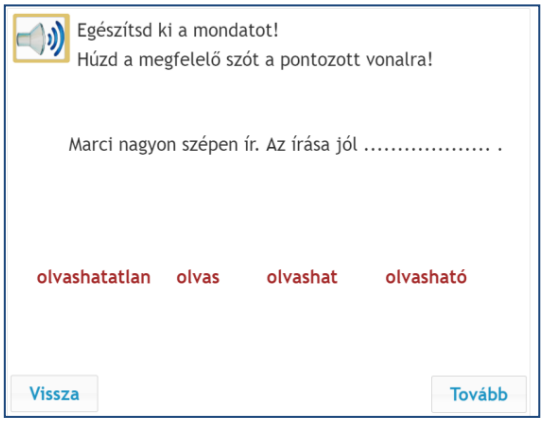


Item oa_8
Complete the following sentences. Drag the correct word onto the dotted line.

Item oa_9
Complete the following sentences. Drag the correct word onto the dotted line.

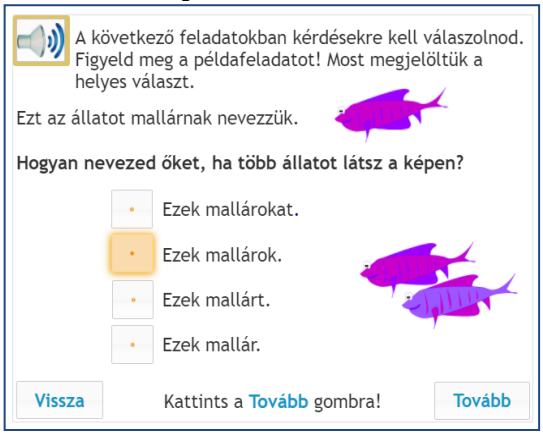


.Item oa_10
Complete the following sentences. Drag the correct word onto the dotted line.



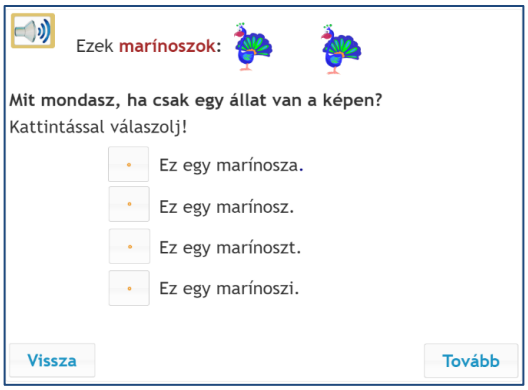
Item oa_11
Complete the following sentences. Drag the correct word onto the dotted line.

Sample items from the Affix Identification/Nonwords Subtest



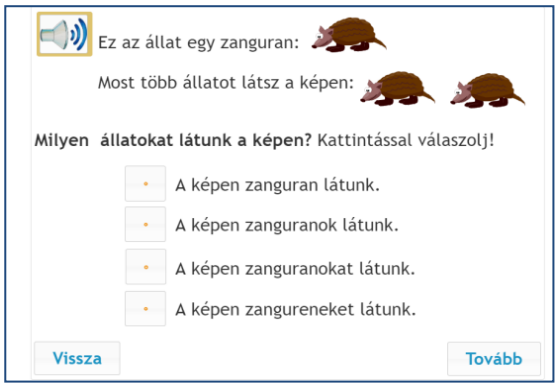
Item oa_00 (example)
In the following task you should answer questions. Read the example carefully. We indicated the correct answer.

Item oa_11
This animal is called tat. What would you call them if you saw many of them? Answer by clicking.

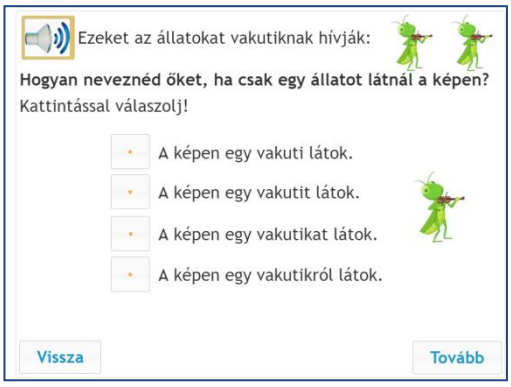


Item og_2
These are marinoszes.
What do you say if there is only one animal in the picture?

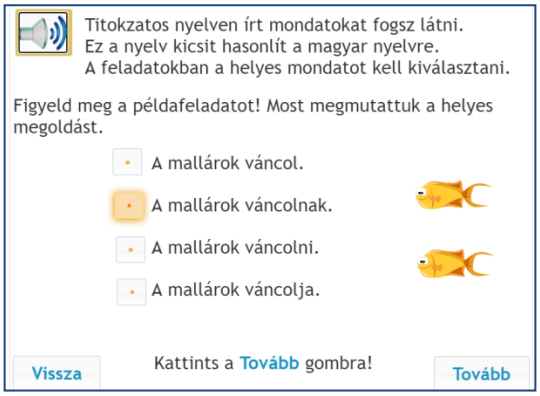
Item og_3
This bird is a roffa. Now, you see many of them. What kind of animals are they? Answer by clicking.



Item og_4
This animal is a zanguran.
Now, you see many of them.
What kind of animals can you see in the picture? Answer by clicking.



Item og_5
These animals are called vakuties. What would you call them if you saw only one animal? Answer by clicking.



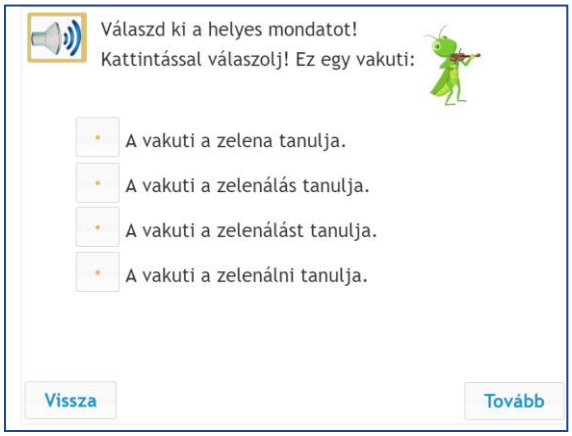
Item og_4
This animal is a zanguran.
Now, you see many of them.
What kind of animals can you see in the picture? Answer by clicking.

Item og_5
These animals are called vakuties. What would you call them if you saw only one animal?
Answer by clicking.

Item og_9
Choose the correct sentence.
Answer by clicking.

Item og_10
Choose the correct sentence.
Answer by clicking.

Item og_11
Choose the correct sentence.
Answer by clicking.



Item og_13
Choose the correct sentence. This is a vakuti. Answer by clicking.

Samples from the Morpheme Segmentation Subtest

mg_1_10_példa
In the following task you should choose the number which indicates how many parts the words consists of. Read the example carefully. We have shown the correct answer. Click on the next bottom

mg_1_6 items
How many parts do the following words consist of? Answer by clicking.

Sample items from the Morpheme segmentation

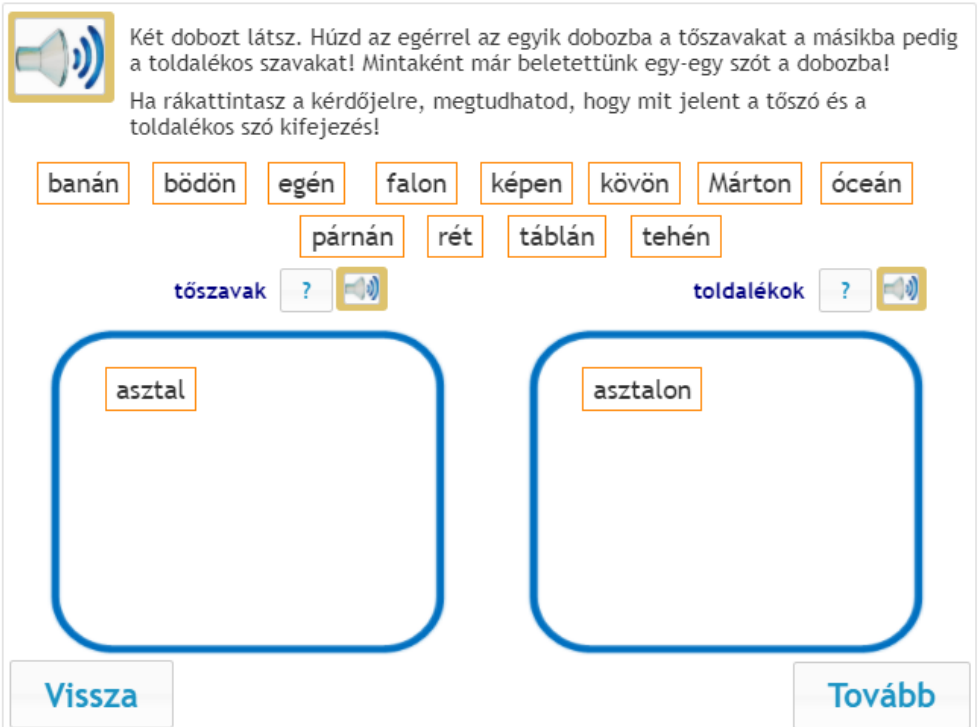
mg_2_10_példa

In the following task you should decide the first word comes from the second word Read the example carefully. We have shown the correct answer. Click on the next button.

mg_2_6 items

Examine the following words carefully. Decide whether we form the first word from the second word? Answer by clicking.

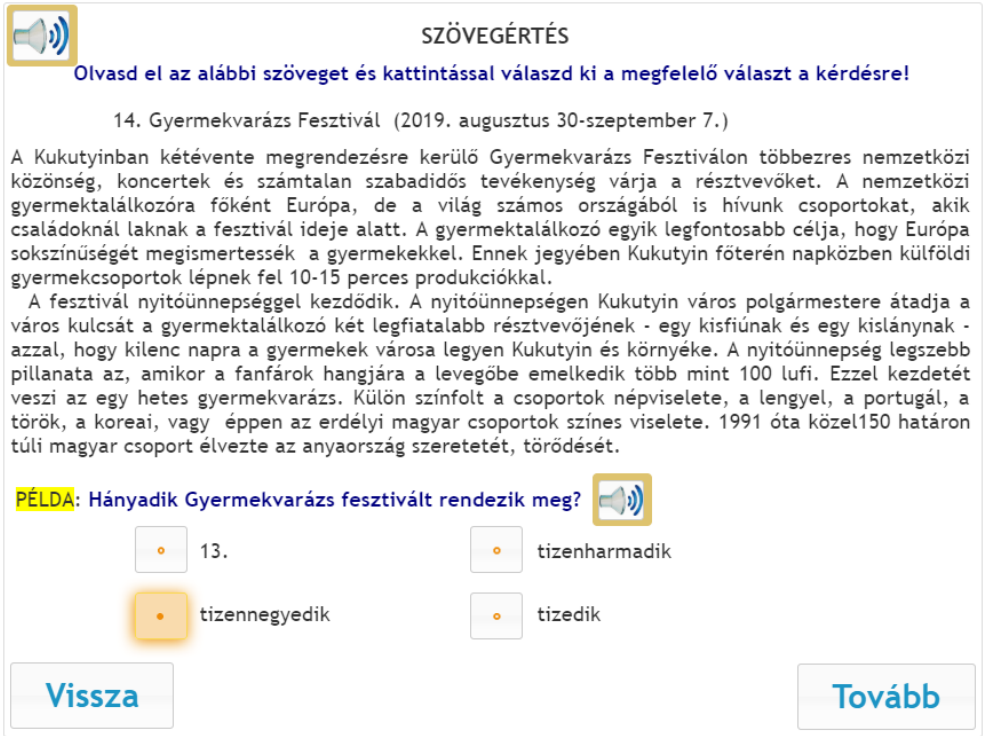
Sample Items from the Affix Identification for Real words Subtest



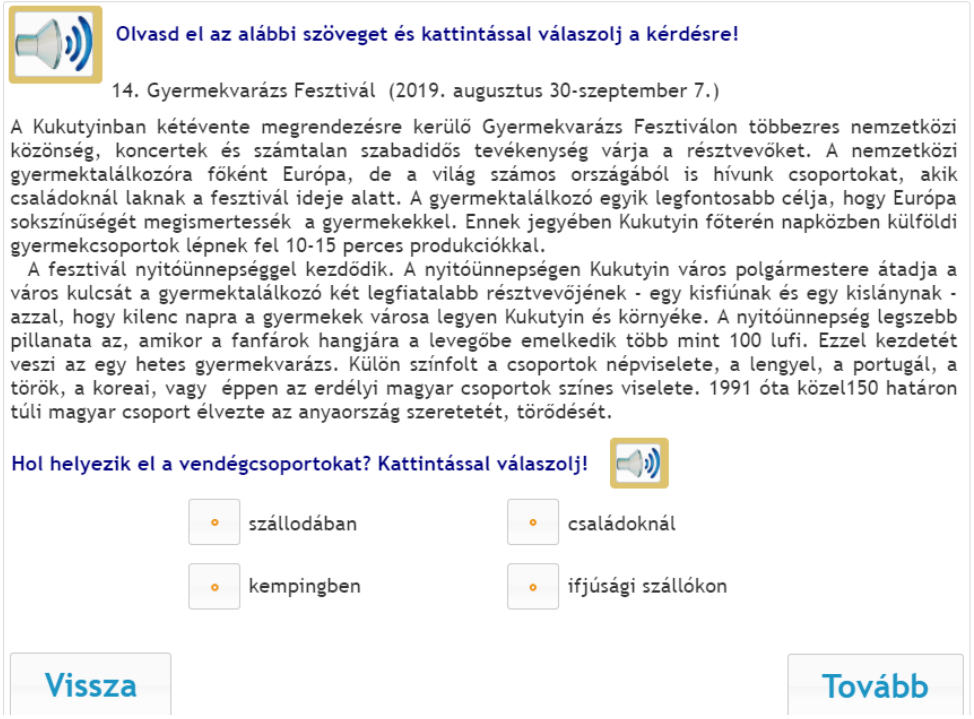
Item MA_1-10_new.

You can see two boxes on the screen. Drag the base words from the menu into the base word box and inflected words into the affixed word box. We have already put one word into each box as an example. If you click on the question mark, you can learn what base word means and what affixed word means.

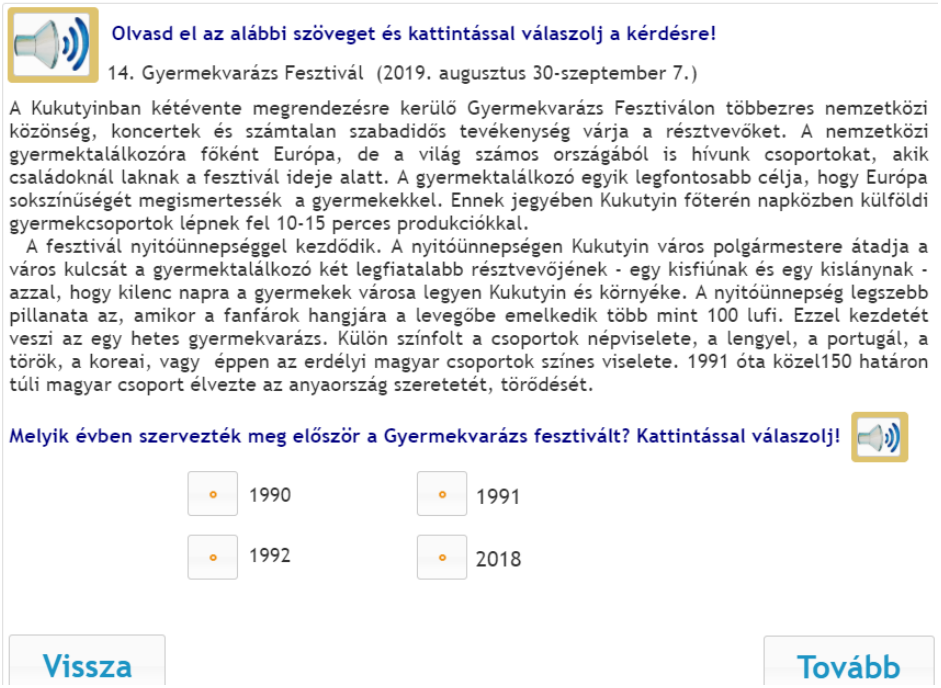
Sample items from Reading Comprehension Subtest



od_00_példa_Read the following text and click on the correct answer.

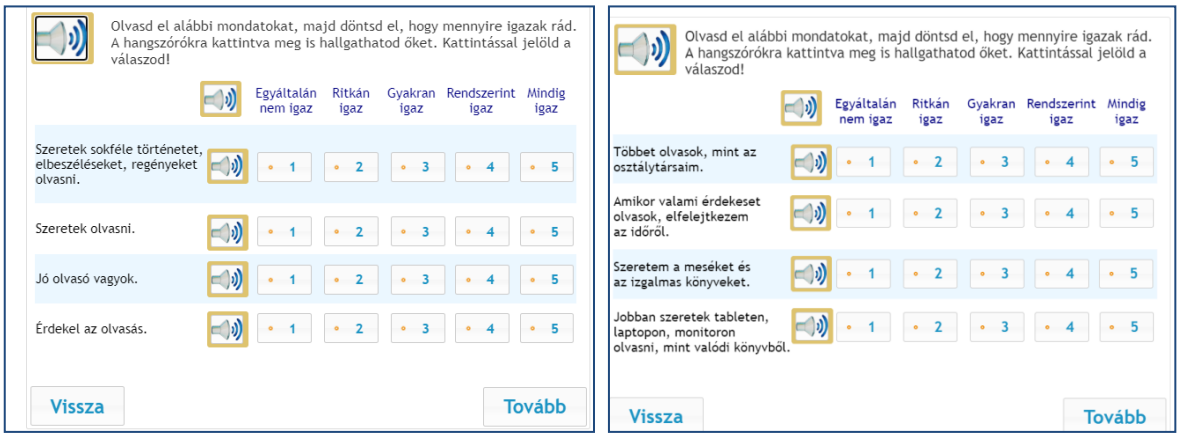


og_03_ Read the following text and click on the correct answer.



og_09_ Read the following text and click on the correct answer

Sample items from the reading motivation questionnaire



Read the following statements and decide how much they are true of you. If you click on the speakers, you can listen to the statements. Answer by clicking.

Appendix B. Guideline about the Morphological Awareness Test

Morfológiai tudatosság és szövegértés online mérése – tájékoztató

A morfológiai tudatosság abban segíti a tanulókat, hogy felismerjék a szavakat alkotó morfémákat, a szavak elemeit, a nyelv szerkezetét. A 2-4. osztályos tanulók számára készített morfológiai teszt segíthet a pedagógusoknak feltárni, hogy a gyermekek megértési képességei mennyire fejlettek, képesek-e összekapcsolni a hallott, szavakban és képekben megjelenített információt, valamint, hogy felismerik-e az egyes nyelvtani szerkezetek közötti különbséget. A pedagógusok információt kaphatnak arra vonatkozóan, hogy a gyermekeknek milyen nyelvi elemek okoznak nehézséget.

A morfológiai teszt elvégzése során a gyermekeknek a morfémák felismerésével kapcsolatos feladatokat kell megoldani (lásd a példafeladatokat). Az eszköz a „felismerés szintjén" méri a nyelvi elemek megértését, ezért előzetes gyakorlásra nincs szükség. A gyermekeknek klikkeléssel kell kiválasztani a megfelelő mondatot vagy szót, illetve vonszolással kell a megfelelő szót a mondatba illeszteni. A mérőeszköz a szavak és a mondatok szintjén vizsgálja a megértést egyszerű, a gyermekek számára érthető szókincs és játékos, a helyes ragozás, szóképzés, illetve az összetett szavak felismerésére vonatkozó, feladatok segítségével. A feladatok megoldása egyúttal gyakorlási lehetőséget is ad a gyermekek számára.

A feladatsor az alábbi résztesztterületekről ad információt:

Álszavak
A tanulóknak a helyes mondatot kell kiválasztani négy lehetőség közül. A feladatban álszavakhoz illesztettünk valódi képzőket és ragokat. A feladat azt méri, hogy a tanulók mennyire tudnak műveleteket végezni a morfémákkal abban az esetben, ha nem tudnak a szó jelentésére támaszkodni. Az álszavas feladat méri leginkább a morfológiai tudatosságot, illetve a nyelvtani szerkezetekre vonatkozó tudatosságot.

Szóképzés
A feladat során a tanulók mondatokat egészítenek ki. Négy szó közül kell kiválasztani a kontextusnak megfelelő képzett szót. A feladat azt méri, hogy a tanuló mennyire tudja azonosítani a megfelelő képzett alakot gyakoribb és kevésbé gyakori szavak esetében.

Szóelemzés
A szóelemzés feladat azt méri, hogy a tanulók egy megadott szólistából ki tudják-e választani a tőszavakat és a toldalékos szavakat. A gyermekek két dobozt látnak a képernyőn. Az egyik dobozba a tőszavakat a másikba pedig a toldalékos szavakat kell belehelyezni az egér segítségével. Ha a tanuló rákattint a tőszó és a toldalékos szó után lévő kérdőjelre, elolvashatja a két fogalom meghatározását.

Összetett szavak
A tanulónak négy szó közül kell kiválasztani azt a szót, amelyik két szó összetételéből származik. A feladat azt méri, hogy mennyire tudják a gyermekek megkülönböztetni az összetett szavakat az álösszetett szavaktól (pl.: villamos) és a képzett vagy ragozott egyszerű szavaktól.

Morféma szegmentálás
A morféma szegmentálás feladattípus azt méri, hogy a tanuló el tudja-e különíteni a szavak különböző morfémáit. Az első feladatban álszavakhoz illesztettük valódi ragokat, képzőket. A tanulóknak meg kell állapítani, hogy hány része van a szónak. A második feladatban a gyermekeknek el kell dönteni, hogy az első megadott szót az utána következő szóból képezzük-e vagy nem.

EFOP-3.2.15-VEKOP-17-2017-00001
A köznevelés keretrendszeréhez kapcsolódó mérési-értékelési és digitális fejlesztések, innovatív oktatásszervezési eljárások kialakítása, megújítása

Appendix C. Email Informing the Schools about the Survey

Kedves Kapcsolattartó!

Köszönjük, hogy az Önök iskolája is alkalmazza az eDia-rendszert pedagógiai munkájában. A jelenleg is elérhető olvasás, matematika és természettudományos feladatsorok mellett szeretnénk felkínálni a morfológiai tudatosság mérésének lehetőségét is.

A morfológiai tudatosság abban segíti a tanulókat, hogy felismerjék a szavakat alkotó morfémákat, a szavak elemeit, a nyelv szerkezetét. A 2-4. osztályos tanulók számára készített teszt segíthet a pedagógusoknak feltárni, hogy a gyermekek megértési képességei mennyire fejlettek, képesek-e összekapcsolni a hallott, szavakban és képekben megjelenített információt, valamint, hogy felismerik-e az egyes nyelvtani szerkezetek közötti különbséget. A feladatsor az alábbi résztesztterületekről ad információt: álszavak, szóképzés, szóelemzés, összetett szavak, morféma szegmentálás, valamint tartalmaz egy rövid szövegértés tesztet is (részletesebb leírást és példafeladatokat talál a mellékelt leírásban: Morf_tud_leiras_eDia.pdf).

A tesztek megoldását követően az eredmények százalékos formában jelennek meg a tanulóknak, valamint százalékos formában tölthetők le az eDia rendszer belső felületéről is. A részterületeket is tartalmazó táblázat mellett a tanulók mérési azonosítóira kattintva letölthetik az egyéni, szöveges értékeléseket is (mellékelten küldünk egy mintát: morf_tud_egyeni_visszajelzes_MINTA.pdf).

Amennyiben felkeltettük érdeklődésüket, és iskolájuk már elküldte a 2-4. osztályos tanulók mérési azonosítóit a jelenleg is zajló főterületi mérésünkhöz, akkor a diákok ezekkel az azonosítókkal be tudnak lépni a tesztbe (mellékelten küldjük az útmutatót).

Ha a 2-4. osztályos tanulókkal nem regisztrált a főterületi mérésekbe, úgy kérjük, töltse fel számunkra a mérési azonosítókat a szokásos módon az edia.edu.u-szeged.hu rendszerben a ’00_Partneriskolai hálózat’ adatbázist választva.

A feladatsor 2-4. osztályos tanulóknak készült, ezért a feladatok utasításai meghallgatók, ezért kérjük, biztosítsanak **fülhallgatót** a diákok számára. A mérés megkezdése előtt ellenőrizze a fülhallgatókat, hogy megfelelően működnek-e.

Amennyiben a kutatással vagy az adatfelvétellel kapcsolatban bármilyen kérdés, probléma merülne fel, forduljanak bizalommal a kutatásszervező csoport munkatársaihoz a 62/544-628 illetve a 62/343-487-es telefonszámokon!

Köszönjük, hogy munkájukkal támogatják a kutatásunk és az eDia-rendszer felépítésének megvalósítását!

Üdvözlettel:

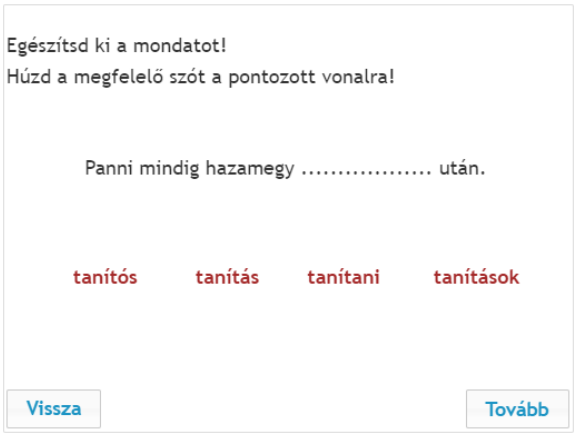
az SZTE OK Kutatásszervező
Munkacsoport és az MTA-SZTE
Képességfejlődés Kutatócsoport munkatársai

Appendix D. Parents' Consent Form

Tisztelt Szülő!

A Szegedi Tudományegyetem Oktatáselméleti Kutatócsoport és az MTA-SZTE Képességfejlődés Kutatócsoport egy online feladatsort dolgozott ki, amely az általános iskolás tanulók morfológiai tudatosság és olvasás- szövegértési képességeinek értékelését teszi lehetővé. A morfológiai tudatosság abban segíti a tanulókat, hogy felismerjék a szavakat alkotó morfémákat, a szavak elemeit, a nyelv szerkezetét. A feladatok megoldása egyúttal gyakorlási lehetőséget is ad a gyermekek számára (lásd az alábbi példafeladatot).

Az adatfelvétel a diákoknak teljes anonimitást biztosító eDia-rendszer felületén keresztül történik (edia.hu). A gyerekek a rendszert a törvényi előírásoknak megfelelő mérési azonosítóval használják, amely mérési azonosító minden más, a gyermekeket egyértelműen azonosító adat nélkül kerül feltöltésre az eDia-rendszerbe.



Az online feladatokat az Önök iskolájába is ki szeretnék közvetíteni, melyhez kérjük az Ön hozzájárulását is. Kérjük, az alábbi nyilatkozat kitöltésével jelezze, hogy hozzájárul-e gyermeke részvételéhez! A részvételtől bármikor elállhat.

Amennyiben az adatfelvétellel kapcsolatban bármilyen kérdése merülne fel, forduljon hozzánk bizalommal a varga.szilvia@gamf.uni-neumann.hu és az iskola@edu.u-szeged.hu e-mail címeken vagy a +36-30-511-32-43-es telefonszámon!

Tisztelettel:

Tánczikné Varga Szilvia
tanársegéd,
Neumann János Egyetem, Idegennyelvi és Továbbképzési Tanszék

Pásztor Attila
tudományos munkatárs,
MTA-SZTE Képességfejlődés Kutatócsoport

— —

Alulírott ……..……...…… (szülő/gondviselő neve), a(z) ……..……...…… iskola …… osztályában tanuló ……..…….. (gyermek neve) szülője/gondviselője kijelentem, hogy az SZTE Oktatáselméleti Kutatócsoport és az MTA-SZTE Képességfejlődés Kutatócsoport által fejlesztett online elérhető morfológiai tudatosság és szövegértés feladatsorról kielégítő tájékoztatást kaptam. Tájékoztattak arról, hogy az eDia-rendszer használata teljes anonimitást biztosít a gyermekem részére. A gyermekem a rendszert a törvényi előírásoknak megfelelő mérési azonosítóval használja, amely mérési azonosító minden más, a gyermeket egyértelműen azonosító adat nélkül kerül feltöltésre az eDia-rendszerbe. Hozzájárulok ahhoz, hogy a vizsgálat során felvett, a gyermekem azonosítására nem alkalmas adatok kutatási célból elemzésre kerüljenek.

_____, 2019. _____

_____

szülő/gondviselő aláírása

Appendix E. Guidelines about the Testing Procedure

MÉRÉSI ÚTMUTATÓ

MORFOLÓGIAI TUDATOSSÁG TESZT
felvételéhez

Kedves Kolléga!

Köszönjük, hogy az Önök iskolája is alkalmazza az eDia-rendszert pedagógiai munkájában. A jelenleg is elérhető olvasás, matematika és természettudományos feladatsorok mellett szeretnénk felkínálni a morfológiai tudatosság mérésének lehetőségét is.

A morfológiai tudatosság abban segíti a tanulókat, hogy felismerjék a szavakat alkotó morfémákat, a szavak elemeit, a nyelv szerkezetét. A 2-4. osztályos tanulók számára készített teszt segíthet a pedagógusoknak feltárni, hogy a gyermekek megértési képességei mennyire fejlettek, képesek-e összekapcsolni a hallott, szavakban és képekben megjelenített információt, valamint, hogy felismerik-e az egyes nyelvtani szerkezetek közötti különbséget. A feladatsor az alábbi résztesterületekről ad információt: álszavak, szóképzés, szóelemzés, összetett szavak, morféma szegmentálás, valamint tartalmaz egy rövid szövegértés tesztet is (részletesebb leírást és példafeladatokat talál a mellékelt leírásban: Morf_tud_leiras_eDia.pdf).

A tesztek megoldását követően az eredmények százalékos formában jelennek meg a tanulóknak, valamint százalékos formában tölthetők le az eDia rendszer belső felületéről is. A részterületeket is tartalmazó táblázat mellett a tanulók mérési azonosítóira kattintva letölthetik az egyéni, szöveges értékeléseket is (mellékelten küldünk egy mintát: morf_tud_egyeni_visszajelzes_MINTA.pdf).

A teszt a következő webcímen érhető el: edia.hu/mt

A teszt kitöltésének időszaka: 2019. november 14. – 2020. január 31.

A munka megkezdése előtt kérjük, hogy…

- a termet **készítse elő,** a gépeket kapcsolja be, minden gépen indítson el egy internetes böngészőt (Mozilla Firefox vagy Google Chrome – más böngésző nem használható). Fontos**,** hogy a gépeken a **böngésző programok legfrissebb változatai legyenek** (pl.: Firefox -> Súgó -> A Firefox névjegye; Google Chrome esetén is hasonló az eljárás). A böngészők frissítése elengedhetetlen a tesztek, a feladatok zavartalan működéséhez és futásához!
- **amennyiben az iskola internet sávszélessége nagyon kicsi vagy túlterhelt, lehetőség van a tesztek proxy szerveren** keresztüli kitöltésére, melynek beállítása a teszt kitöltése előtt szükséges. Az erre vonatkozó információk a teszt linkjének nyitóoldalán elérhetőek, valamint egy **útmutatót is mellékelünk a proxy szerver használatához** (proxy_reszletes_hu.pdf). Nagyon fontos, hogy a proxy szerver alkalmazása esetén mindenképp jussanak el a proxy szerverként szolgáló számítógépen a nyitó oldalig, ahol a diákoknak a mérési azonosítót kell beírni.
- minden gépen töltse be és **indítsa el a feladatsort!**
- A feladatsor 2-4. osztályos tanulóknak készült, ezért a feladatok utasításai meghallgathatók, ezért kérjük, biztosítsanak **fülhallgatót** a diákok számára. A mérés

megkezdése előtt ellenőrizze a fülhallgatókat, hogy megfelelően működnek-e
- A hiányzó tanulók mérési azonosítóját **más nem használhatja.**

Kérjük, a mérés során tett észrevételeinek, javaslatainak lejegyzésével segítse további munkánkat! Figyelje meg, hogy…

- milyen kérdéseket tesznek fel a tanulók a feladatokkal, a megoldás módjával kapcsolatban!
- milyen egyéb észrevételeket, javaslatokat tud megfogalmazni a feladatokra és az adatfelvételre nézve?

Amennyiben a kutatással vagy az adatfelvétellel kapcsolatban bármilyen kérdés, probléma merülne fel, forduljanak bizalommal a kutatásszervező csoport munkatársaihoz a 62/544-628, 62/343-063 illetve a 62/343-487-es telefonszámokon!

Köszönjük, hogy munkájukkal támogatják a kutatásunk és az eDia-rendszer felépítésének megvalósítását!

Üdvözlettel:

az SZTE OK Kutatásszervező Munkacsoport és az MTA-SZTE Képességfejlődés Kutatócsoport munkatársai

Appendix F. Individual Feedback Sample

Morfológiai tudatosság és szövegértés

Azonosító: **A000-B000** Időszak: **2019 tavasz**

A teljesítményeket mutató táblázatban minden teszt után az 'évf.' feliratú oszlopban a mérésben részt vett, az adott évfolyam/korosztály átlagos eredménye jelenik meg. Az 'Oszt.' feliratú oszlop az osztály/csoport átlagos teljesítményét mutatja, a 'Pont' feliratú oszlop, a táblázat utolsó oszlopa, a gyermek saját százalékos teljesítményét tartalmazza. A táblázat első sora a teljes teszten elért átlagos eredményt mutatja. A táblázat alatt lévő pókhálóábra vizuálisan is szemlélteti az erősségeket, és azokat a területeket, ahol esetleg fejlesztés szükséges. A világoskék vonalak az osztálytársak/csoporttársak különböző teszteken nyújtott átlagos teljesítményeit mutatják, a zöld vonalak a mérésben részt vevő összes gyermek átlagos teljesítményét szemléltetik, míg a piros vonalak az adott gyermek teljesítményét emelik ki. Ha a piros vonal a zöld vonalon kívül helyezkedik el, akkor a teljesítmény azonos, vagy magasabb szintű, mint a mérésben részt vevő gyerekek átlaga, attól függően, milyen közel van a piros vonal a zöldhöz. Ha a zöld alakzaton belül helyezkednek el a teljesítményt mutató piros vonalak, akkor az eredmény a vizsgált területeken átlagos érték alatti. Ha a piros vonal átmetszi a zöld vonalakat, akkor előfordulhat, hogy van olyan terület, ahol a minta átlaga feletti és van olyan, ahol minta átlaga alatti a teljesítmény. A pókhálóábra sugaraira írt számok magyarázata a pókhálóábra felett lévő táblázatban találhatók meg (pl.: 1: Összesített eredmény, azaz az összes teszten nyújtott átlagos teljesítmény). Az összefoglaló táblázat és a pókhálóábra alatt szöveges értékelést is megfogalmaztunk, annak függvényében, hogy az adott gyermek a teljesítménye alapján milyen eredményt ért el. Az egyes szintek meghatározása az eddigi mérésekben részt vevő gyerekek eredményei, valamint a feladatok helyes megoldásához szükséges tudás alapján történt. Ahol releváns, további táblázatokban és pókhálóábrákon szemléltetjük az egyes résztesztekben elért teljesítményeket is a korábbiaknak megfelelő logika szerint.

A tesztek leírása

Teljes teszt eredménye (%)

Szóelemzés (%)

A szóelemzés feladat azt méri, hogy a tanulók egy megadott szólistából ki tudják-e választani a tőszavakat és a toldalékos szavakat. A gyermekek két dobozt látnak a képernyőn. Az egyik dobozba a tőszavakat a másikba pedig a toldalékos szavakat kell belehelyezni az egér segítségével. Ha a tanuló rákattint a tőszó és a toldalékos szó után lévő kérdőjelre, elolvashatja a két fogalom meghatározását.

Összetett szavak (%)

A tanulónak négy szó közül kell kiválasztani azt a szót, amelyik két szó összetételéből származik. A feladat azt méri, hogy mennyire tudják a gyermekek megkülönböztetni az összetett szavakat az álösszetett szavaktól (pl.: villamos) és a képzett vagy ragozott egyszerű szavaktól.

Álszavak (%)

A tanulóknak a helyes mondatot kell kiválasztani négy lehetőség közül. A feladatban álszavakhoz illesztettünk valódi képzőket és ragokat. A feladat azt méri, hogy a tanulók mennyire tudnak műveleteket végezni a morfémákkal abban az esetben, ha nem tudnak a szó jelentésére támaszkodni. Az álszavas feladat méri leginkább a morfológiai tudatosságot, illetve a nyelvtani szerkezetekre vonatkozó tudatosságot.

Szóképzés (%)

A feladat során a tanulók mondatokat egészítenek ki. Négy szó közül kell kiválasztani a kontextusnak megfelelő képzett szót. A feladat azt méri, hogy a tanuló mennyire tudja azonosítani a megfelelő képzett alakot gyakoribb és kevésbé gyakori szavak esetében.

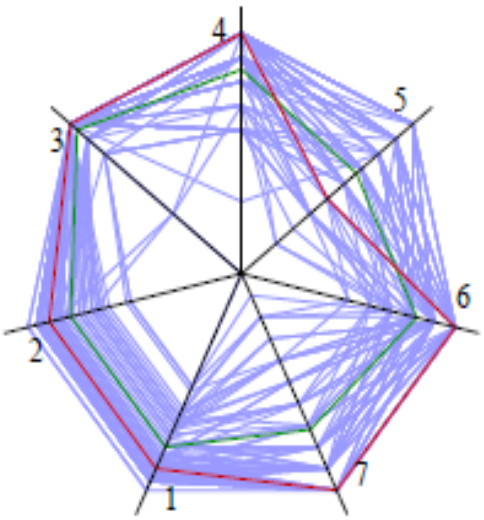
Szövegértés (%)

A szövegértés feladatban a tanulóknak egy tövid egyszerű szöveget kell elolvasni, és tíz feleletválasztós kérdésre válaszolni. A kérdések a szöveg egyes részeire illetve egészére irányulnak, és információ visszakeresést igényelnek.

A teszten/teszteken nyújtott teljesítmények

Kategória	3. évf.	Oszt.	Pont
1.	80	83	90
2. 01	80	83	90
3. 02	96	96	100
4. 03	85	87	100
5. 04	67	71	50
6. 05	82	85	100
7. 06	72	74	100

: Teljes teszt eredménye (%)
01: Teljes teszt eredménye (%)
02: Szóelemzés (%)
03: Összetett szavak (%)
04: Állszavak (%)
05: Szóképzés (%)
06: Szövegértés (%)



A tanuló teljesítményének szöveges értékelése

3. Szóelemzés (%) kategória értékelése:

A tanuló teljes biztonsággal azonosítani tudja a szótövet és a toldalékokat egyszerű toldalékos szavak esetében. Ez azt mutatja, hogy a tanuló felismerés szintjén tisztában van a tőmorféma és a toldalék fogalmával.

4. Összetett szavak (%) kategória értékelése:

A tanuló teljes biztonsággal azonosítani tudja az összetett szavakat. Meg tudja különböztetni az összetett szavakat az álösszetett szavaktól (pl.: villamos) és a képzett vagy ragozott egyszerű szavaktól. A tanuló felismerés szintjén tisztában van az egyszerű és összetett szavak fogalmával.

5. Álszavak (%) kategória értékelése:

Az álszavas feladatban elért eredmény azt mutatja, hogy a tanuló gyakran téveszt a képzők és ragok azonosításában, abban az esetben, ha nem tud a szó jelentésére támaszkodni. Sokszor nem tudja kiválasztani a kontextusnak megfelelő képzett vagy ragozott alakot. Ez azt jelzi, hogy a tanuló a felismerés szintjén bizonytalan a képzők és ragok fogalmával. A morféma azonosítás fogalmát gyakorolni kell.

6. Szóképzés (%) kategória értékelése:

A tanuló teljes biztonsággal tudja azonosítani kontextusnak megfelelő képzett alakot gyakoribb és kevésbé gyakori szavak esetében is. Ez azt mutatja, hogy a tanuló felismerés szintjén tisztában van a képzők és ragok fogalmával.

7. Szövegértés (%) kategória értékelése:

A tanuló kiválóan érti a rövid egyszerű szövegeket. Könnyedén értelmez információ visszakeresést igénylő kérdéseket, amelyek a szöveg egyes részeire illetve egészére irányulnak. Szövegértési képességei a korosztálynak megfelelnek.

PUBLICATIONS RELEVANT TO THE RESEARCH

Tánczikné-Varga, Sz. (2017b). Factors affecting reading comprehension. *Gradus* 4: 2. pp. 41-47.

Tánczikné-Varga, Sz. (2017a). Reading models in L1 and L2. *Gradus* 4: 1 pp. 144-156.

Tánczikné-Varga, Sz., Steklács, J. (2018). *The relationship between morphological awareness and reading comprehension, a pilot study.* In: Vidákovich, T.; Fűz, N. (szerk.) PÉK 2018 [CEA 2018] XVI. Pedagógiai Értékelési Konferencia [16th Conference on Educational Assessment]: Program és összefoglalók [Programme and abstracts], Szeged: SZTE Neveléstudományi Doktori Iskola, (2018) pp. 97.

Tánczikné-Varga, S. Steklács, J. (2019). *Morfológiai tudatosságot vizsgáló feladatok megoldási stratégiáinak vizsgálata szemmozgáskövető módszerrel* [Examination of the problem solving strategies of morphological awareness tasks with eyetracking examinations]. In: Varga, A., Andl, H., Molnár-Kovács, Z. (szerk.) Neveléstudomány – Horizontok és dialógusok. Absztraktkötet. XIX. Országos Neveléstudományi Konferencia. Pécs, 2019. november 7-9. p. Pécs: Pécsi Tudományegyetem (2019) p.289.

Tánczikné-Varga, Sz. (2019). *Developing an instrument for assessing the relationship between morphological awereness and reading comprehension: a second pilot study.* TALC3, The 3rd Conference on Theoretical and Applied Linguistics: Language in Use - Linguistic and Pedagogical PerspectivesBiaŁystok, Poland, 5 th -6th December, 2019.

Varga, Sz. & Steklács, J. (2019). A morfológiai tudatosság és összefüggése a szövegértő olvasás képességével második osztályos korban: egy próbamérés tanulságai [The relationship between morphological awareness and reading comprehension skills in grade 2: analysis of a pilot study] *In: Bóna, Judit; Horváth, Viktória (szerk.) Az anyanyelv-elsajátítás folyamata hároméves kor után.* ELTE Budapest: Eötvös Kiadó (2019) pp. 107-127.

Varga, Sz., Pásztor, A., & Steklács, J. (2019). A szövegértés és a morfológiai tudatosság számítógép-alapú fejlesztése alsó tagozaton [Computer-enhanced development of reading comprehension and morphological awareness skills]. *Iskolakultúra,* 29 (8), 94-106.

Varga, S. (2020). *A morfológiai tudatosság és a szövegértési képességek összefüggései*. [The realtionships between morphological awareness and reading comprehension] In VIII. Neveléstudományi és Szakmódszertani Konferencia = Vzdelávacia, výskumná a metodická konferencia (p. 69).

Varga, Sz., Pásztor, A. & Steklács, J. (2020). An online instrument assessing the relationship between morphological structure awareness and reading comprehension in Hungarian 2-4 graders. *Ilkogretim Online - Elementary Education Online,* 2020; 19 (4): pp. 2322-2334. http://ilkogretim-online.org.trdoi:10.17051/ilkonline.2020.764232.

Varga, Sz. (2021, August). *Online assessment of morphological awareness and its development in grades 2-4.* Paper accepted at the 19th Biennial EARLI 2021-Online. Gothenburg, Belgium, August 23 - September 3, 2021.

AUTHOR'S DECLARATION

I, the undersigned Szilvia Varga hereby declare that this submission is entirely my own work, in my own words, and that all sources used in research are fully acknowledged and all quotations are properly identified.This thesis contains no material which has been accepted as part of the requirements of any other academic degree or non-degree program, in English or in any other language.
This is a true copy of the thesis, including final revisions.

26th May, 2021.

Szilvia Varga