Summary of doctoral dissertation

TESTING THE MODEL OF READING LITERACY: EXAMINING THE COGNITIVE AND NON-COGNITIVE FACTORS INFLUENCING STUDENTS' READING ACHIEVEMENT IN DIFFERENT TEXT FORMATS IN GRADE 2

Ágnes Hódi

Supervisor:
Marianne Nikolov D.Sc.

Teaching and Learning Program
Doctoral School of Education
Faculty of Arts, University of Szeged

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Introduction

Reading is an interactive process in which both text features and readers' cognitive skills play an important role. In order to provide a full coverage of the domain these variables appear in numerous national and international large-scale assessment programs that aim at measuring students' reading skills. Data show that Hungarian students, regardless of age or grade, tend to perform significantly better in retrieving information, interpreting and reflecting on the content and format of continuous texts than non-continuous ones. Gender and reading habits are most commonly associated with this disparity but the interpretation of the results falls short in finding further variables that might account for the difference in students' reading performance along text formats. The aim of the dissertation is to complement the results of previous research by examining how texts of various formats impact reading outcomes and identifying cognitive and non-cognitive factors that may hinder or facilitate reading development at the early stages of learning to read.

Theoretical background

Numerous large-scale assessment programs have aimed at measuring Hungarian students' reading literacy since the 1970's. Reading literacy is commonly defined as "an individual's capacity to understand, use and reflect on and engage with written texts, in order to achieve one's goals, to develop one's knowledge and potential and to participate in society" (OECD, 2010a, p. 14). Although the large-scale studies exhibit some methodological differences, a common feature is that the main organizational elements of the frameworks are text format, text type, cognitive processes or aspects and the situation for which the text was constructed (e.g., Mullis, Martin, & Sainsbury, 2015; OECD, 2010a). The scrutiny of the relationship between two of these components forms the scope of this study; therefore, in what follows the background will be narrowed down to text format and cognitive aspects.

As far as text format is concerned, the basic principle is that "any given text type can take many forms and combinations of forms" (Mullis, Martin, & Sainsbury, 2015, p. 14). Since "reading literacy is the ability to understand and use those written language forms required by society and/or valued by the individual" (Mullis et al., 2015, p. 12), the frameworks distinguish three types of text formats: (1) continuous, (2) mixed (3) and non-continuous. Non-continuous texts imply reading for information where the text organization is fragmented, that is, factual, quantitative, technical, or mathematical information is presented in maps, charts, graphs, time lines, tables, and diagrams, whereas continuous texts refer to traditional written forms and entail an underlying organizational and linguistic structure that may be more easily identified and comprehended. Written forms where characteristics of both continuous and non-continuous texts are integrated in a single written entity and, therefore, are characterized by "the joint presentation of verbal and pictorial information" (Rouet, Lowe, & Schnotz, 2008, p. 4) are referred to as mixed texts, multimedia texts or multimedia documents.

Understanding texts may take many forms; however, reading literacy is generally assessed in terms of how well individuals can retrieve information, interpret, evaluate and reflect on the form and content of written pieces of information. Research into the processes underlying reading comprehension has revolved around two major issues: (1) whether or not reading comprehension involves distinct skills, and (2) whether or not these readings may be ordered hierarchically. Some researchers found evidence to support the existence of separate skills in reading depending on the processes involved in answering questions (Davis, 1968; Spearritt, 1972). Others' findings did not provide evidence for the existence of multiple dimensions of reading (Carroll, 1993; Thorndike, 1973). Some researchers (Elley, 1992, 1994)

have argued for a distinction between the processes that are involved when reading different types of reading materials. Present assessment practices define cognitive aspects to reading as separate skills "requiring many of the same underlying skills" (OECD, 2004, p. 112). Alderson (2000), however, concluded that "answering a test question is likely to involve a variety of interrelated skills" (p. 49). According to him, even if separate skills are involved in the reading process, which could be identified by a rational process of analysis of one's own reading behavior, "it appears to be extremely difficult if not impossible to isolate them for the sake of testing or research" (Alderson, 2000, p. 49).

Findings on the issue of hierarchy are also controversial. For example, Kádárné Fülöp (1983) revealed that the reading aspects or processes form a hierarchical order are characterized by increasing complexity from concrete to more abstract levels. Similarly, PISA holds that from a cognitive processing perspective, the reading processes are "semi-hierarchical: it is not possible to interpret or integrate information without having first retrieved it, and it is not possible to reflect on or evaluate information without having accessed the information, and very likely made some sort of interpretation" (OECD, 2010a, p. 43). However, from a developmental perspective, they are viewed as "being in the repertoire of each reader at every developmental level" (OECD, 2004, p. 112).

Readers bring their background knowledge into the meaning making process to a different extent. Information retrieval and interpretation tasks require students to use content primarily from within the text, whereas when reflecting readers draw primarily upon outside knowledge (OECD, 2013, p. 67). All readers are expected to demonstrate some level of proficiency with each of the aspects of reading on all text formats, since all are seen as being in the repertoire of each reader at every developmental level (OECD, 2010a). A vast literature is available on the nature and functioning of these reading processes. Nevertheless, their scope has been limited to conceptualizing the reading of continuous texts. Furthermore, insufficient research has focused on the students' development in extracting and constructing meaning from the information conveyed by texts with different formats. In addition, studies examining the relationship between students' reading achievement in different text formats and cognitive aspects of reading are also scarce. Alderson (2000) recognizes this niche in research but he assumes that it is unlikely that separate skills exist for processing certain sorts of texts, even if the way in which literary texts are processed is different (p. 66).

This is somewhat surprising because it is a widely accepted theory that reading for meaning emerges from a complex dynamic interaction among the reader, the text, and the context (Smagorinsky, 2001). Readers bring to this interaction their reading processes and knowledge about the structure of texts (Pressley & Afflerbach, 1995). The results of previous research focusing on the impact of text type and text format on reading performance underpin the importance of fragmentation and typography in comprehension. Seidenberg (1989) and Williams (2005) found that understanding and recognizing text structure improves text comprehension and helps students understand global ideas or main theses. Furthermore, Dymock (2005) found that students who face difficulties comprehending informational texts cannot see the basic structure of texts implying that text format and its unique structure affect students' reading comprehension.

Assessment programs, however, seem to conceive text format as a variable that ensures the coverage of the construct rather than as a variable that influences the difficulty of a task (OECD, 2010a, 2013). Nevertheless, the frameworks acknowledge that the reading "processes and strategies are expected to vary with context and purpose as readers interact with a variety of continuous and non-continuous texts (OECD, 2013, p. 61) and different presentations of textual content can demand that readers apply different comprehension processes (Mullis, Martin, & Sainsbury, 2015, p. 17). Data show that Hungarian students' performance is poorer when it comes to understanding and making use of information conveyed by the non-continuous

and mixed texts than by their continuous counterparts (Balázsi, Ostorics, Szalay, & Szepesi, 2010; Molnár, 2006; OECD, 2010b). Attempts have been made to identify the factors underlying the differences based on some background data. Gender and reading habits are most commonly associated with this disparity (Mullis, Martin, Foy, & Drucker, 2012; OECD, 2010b). Findings also yield evidence that different text formats have a different relationship with performance measured in other cognitive domains such as school-readiness, inductive reasoning and mathematical literacy (Hódi & Tóth, 2013). The interpretation of the results falls short in finding further text-related variables that might account for the difference in students' reading performance along text formats. However, the above findings suggest that text format plays an important role in reading and may significantly affect comprehension and the underlying processes.

Aims of the empirical studies

The three empirical studies aim to complement the results of previous research on reading development by examining students' achievement in understanding various text formats and by identifying cognitive and non-cognitive factors that support or hinder further improvement.

The first study (Chapter 4) deals with the issues of construct validity, dimensionality and students' reading literacy development in their early years of learning to read, between grades 2 and 4. The structure is as follows. First, the underlying measurement model of reading literacy is examined. Second, the development along text formats and cognitive aspects is investigated. Third, the issue of the universal nature and the possible dimensionality of cognitive aspects along different text formats is discussed.

The second research was undertaken with the primary purpose of contextualizing second graders' test scores achieved in the continuous, mixed and non-continuous subtests (Chapter 5). It explores the contribution of the affective aspects of reading, attitudes and self-concept, and some technical aspects of reading such as reading diversity and the frequency of being engaged in reading texts with different formats when learning. Moreover, students' ICT use habits and the impact of students' screen viewing diet are also examined. In the component model of reading (Chiu, McBride-Chang, & Lin, 2012), these factors are classified under the psychological and ecological components.

Study three focuses on yet another aspect of the teaching and learning process: the school environment in which the large proportion of reading development takes place. The efforts started in Studies 1 (Chapter 4) and 2 (Chapter 5) to explore why students' demonstrate different achievement levels when reading texts with different formats is continued in this chapter of the dissertation. The third empirical study (Chapter 6) sets out to identify school-related factors that matter in understanding continuous, mixed and non-continuous texts in grade 2.

Structure of the dissertation

The dissertation is divided into two parts and seven chapters. The broader theoretical background to the research studies is outlined in Part 1, which entails Chapters 1 and 2. Based on the heuristic model of reading, the first chapter gives an overview of the variables that play a role in reading comprehension. In addition, the most influential theories and models of reading are also summarized. Chapter 2 gives an overview about how the current concept of reading literacy used for assessment purposes emerged and how the evolution of the definition impacted assessment practices in terms of the inclusion of versatile text formats. Chapter 2 also provides an analysis of Hungarian and international reading assessment programs and a synthesis of Hungarian students' achievement in reading and understanding texts of different formats.

Whereas Part 1 endeavors to place the key questions addressed in the dissertation into a theoretical framework, Part 2 comprises three empirical research studies conducted to seek answers to the questions addressed in Table 1. Part 2 comprises five chapters. Chapter 3 provides background to the context and to the participants of the research studies as well as outlines the research methodology employed in the three studies. Chapters 4, 5 and 6 present the three empirical studies exploring second graders' reading achievement in different text formats from different angles and perspectives. Chapter 4 comprises the first study, which involved 3,229 Hungarian second graders. The aim was to critically analyze students' reading achievement in continuous, mixed and non-continuous texts. Data were collected with the help of a reading literacy test; descriptive statistics and paired-samples t-test were employed to obtain results. Data was also used to build and to test a model of reading literacy with advanced statistical methods. The second study is presented in Chapter 5. This research study was based on the data of the very same population. The results of a main background and a short questionnaire were linked to second graders' achievement to arrive at a better understanding of why students' reading performance differs along text formats. The third study can be found in Chapter 6. Data were elicited by a background questionnaire from 189 primary school teachers of the second grader sample. The main objectives of this investigation were to characterize teachers, their pedagogical skills, practices, the conditions of teaching and learning and to explore the extent to which these factors impact second graders' reading achievement in different text formats. The results of the three empirical studies complement one another. The final part of the dissertation, Chapter 7, comprises the conclusions and suggests a path forward by discussing the theoretical and practical importance of the findings.

Research questions

The purpose of my studies was to test the model of reading literacy with a special emphasis on the relationship between text formats and cognitive aspects to reading, to characterize Hungarian second graders' reading development in terms of text formats and cognitive aspects to reading and to explore contributing factors. For an overview of the main research questions see Table 1.

Results of the empirical studies

The first study

The first study provides empirical evidence that reading texts with formats other than conventional ones belong to the construct of reading. Non-conventional text formats (i.e. mixed and non-continuous texts) including a wide-range of symbolic language and visual displays are legitimate components of reading comprehension. Top-down, bottom-up and interactive reading models (see Chapter 1) emphasize letter, sentence, paragraph and text-level processing in the meaning making process and lack elaboration on what happens when e.g., words or sentences as self-contained units or grammatical cues are not present in the reading experience. Instructional reading programs have been guided by these theories (bottom-up phonic-based instruction / top-down whole-word approach); therefore, prevailing reading methods maintain deficient thinking about reading comprehension.

Table 1 *The data sources and methods of analysis used for the main research questions*

Studies	Research questions	Data sources	Methods of analysis
Study 1 N=3,229	1) What is the underlying measurement model for reading literacy? 2) To what extent does students' reading literacy develop in continuous, mixed and non-continuous text formats between grades 2 and 4? 3) To what extent does students' reading literacy achievement differ along different text formats in grades 2 and 4? 4) How does students' reading achievement change when they read continuous, mixed and non-continuous text? 5) To what extent does students' reading literacy develop in three cognitive aspects to reading (information retrieval, interpretation and reflection) in different text formats between grades 2 and 4? 6) To what extent does students' reading literacy achievement differ in three cognitive aspects to reading (information retrieval, interpretation and reflection) in different text formats in grades 2 and 4? 7) Are cognitive aspects to reading universal in all text formats?	Reading literacy test comprising a continuous, a mixed and a non-continuous text	Descriptive statistics Paired-samples t-test Confirmatory factor analysis χ^2 difference test
Study 2 N=3,220	1) How can second graders' reading attitudes, self-concept, reading and ICT use habits be characterized? 2) How do gender differences in second graders' results mirror large-scale tendencies regarding achievement in different text formats? 3) What is the relationship between the non-cognitive factors measured by the student background questionnaire and students' reading achievements in different text formats? 4) To what extent do the non-cognitive factors measured by the student background questionnaire account for the variance in students' reading achievement in different text formats? 5) What is students' preference and background knowledge about the texts like? 6) What is students' perception about text difficulty like?	Main students' background questionnaire Short students' questionnaire Reading literacy test comprising a continuous, a mixed and a non-continuous text	Confirmatory factor analysis Descriptive statistics Independent-samples t-test Correlational analysis Regression analysis
Study 3 N=189	1) How can teachers' characteristics, pedagogical skills, practices and conditions of teaching and learning be described? 2) How do teachers' characteristics, pedagogical skills, practices and conditions of teaching and learning impact their second graders' reading achievement in different text formats?	Teachers' background questionnaire Reading literacy test comprising a continuous, a mixed and a non-continuous text	Descriptive statistics Two-sample t-test Analysis of Variance Tukey's-b and Dunnett's T3 test

This view resulted in an overrepresentation of continuous texts in teachers' syllabi, which in turn lead to an incomplete formal schema referring to knowledge that different kinds of texts and discourses are distinguished by the ways in which the topic, propositions, and other information are linked together to form a unit (An, 2013). "Lack of such kind of knowledge also contributes considerably to the problems in reading comprehension" (An, 2013, p. 130). I argue that the gap in this knowledge should be bridged in order to improve students' reading literacy performance in mixed and non-continuous text formats.

Data yielded by the first study show that second graders' reading literacy develops significantly during the period of learning to read. The development is visible in all the three text formats. I assume that students' achievements are a result of both targeted instruction and their ever-growing familiarity with different text formats in everyday life and in the home environment. On the other hand, students' test scores differ along continuous, mixed and non-continuous text formats both in grades 2 and 4. A major future task is to follow up on the progress this cohort makes in reading literacy and to examine whether the achievement gap among text formats decreases or increases over time. The results suggest that the achievement disparity may disappear in upper elementary school grades, but according to OECD PISA reading literacy measures, this achievement gap seems to remain steady (OECD, 2016).

A possible reason for this pattern of results was sought in the internal structure of reading literacy. Findings indicate that the extent to which cognitive aspects to reading literacy interact with different text formats could be a plausible explanation for the disparity in students' achievements. Data show that the cognitive aspects students use when reading a continuous text, a mixed text or a non-continuous text differ from each other. This is a promising finding: results indicate that putting the research question regarding the universal nature of reading processes into a developmental perspective can refine our knowledge accumulated in the present study. The question why and in what ways the cognitive aspects of the continuous text differ significantly from those of the mixed and non-continuous ones remains unanswered. As the non-continuous text did not include reflection on form and content items requiring knowledge outside of the text, in upper grades the subtest needs to be extended to the whole range of cognitive aspects to reading to get a full picture on the dynamics between text format and cognitive processes.

Also, drawing on the versatility of non-continuous texts, in the next phase of the program, I plan to enrich the body of non-continuous texts with graphs and charts in order to examine how the dimensionality of cognitive aspects changes if the ratio of verbal and visual elements is modified and how it impacts the level of comprehension. Briefly, the precise nature of the link between text format and cognitive aspects needs to be further elaborated. Nevertheless, I argue that it is appropriate and useful for instructional purposes to classify processes involved in reading comprehension in terms of different forms of reading materials.

An alternative future direction may explore what role the reading precursors, especially, phonological awareness, rapid automatized naming and letter-sound processing have in reading non-continuous texts. The literature has found empirical evidence on the predictive power of these cognitive skills on later reading achievement in abundance; however, the relationship has only been established in relation to decoding and reading continuous texts (see Blomert & Csépe, 2012; Török & Hódi, 2015). These findings pose new questions: if these skills are claimed to be the constituents of reading models dominantly having letters, words and sentences as main constituents of texts to be read, what importance is attributed to reading precursors in reading texts where the coherence and cohesion is not provided with traditional constituents of texts?

I believe that the results provide valuable insights for stakeholders involved in students' reading development and pave the way for further analyses on the developmental tendencies

regarding cognitive aspects (information retrieval, interpreting etc.) and text properties across genres and formats.

The second study

The second study used a student questionnaire and a short questionnaire with twofold aims. The first objective was to collect descriptive data on Hungarian second graders' attitudes toward reading in general and the test, reading self-concept, the frequency of being engaged in reading texts with different formats when learning and students' ICT use. The second aim was to contextualize second graders' reading achievement in continuous, mixed and non-continuous text formats. In short, the study focused on the reader (Chapter 5). The characterization of such a young sample and linking the background data with reading proficiency filled a niche that no other studies have done so far. The questionnaire tapped into non-cognitive factors belonging to the psychological and ecological components of reading. Data showed that the psychological factors – with self-concept having an outstandingly high value – play a key role in students' reading achievement. Evidently, ecological data is less directly related to achievement, the studied variables have only a minor contribution to students' reading proficiency. There were no substantial differences in the correlation coefficients between the examined variables across the text format subscales of reading literacy; the degree of relationship did not change markedly across text formats. Since the coefficients fell into the same range as far as the strength of correlation is concerned, I have to be cautious when interpreting the findings. Mostly minor differences were found, so I believe that involving other background variables in the study would be a more fruitful approach towards the meaningful investigation of the matter discussed in the dissertation.

Regression analysis showed that the majority of the factors account for students' achievement in different text format to various extents. However, caution is needed when interpreting the explained variance of the independent variables on students' achievement in different text formats, as the difference between the regression coefficients is not substantial. Path analyses would have been an adequate form for modeling the direct and indirect effects on reading achievement in the continuous, mixed and non-continuous format; however, despite repeated efforts towards building different models based on the literature, no model could be tested due to the small regression coefficient values. A meaningful relationship was demonstrated between the affective factors and the school-related factors but these could not be linked to students' performance either at whole test or subtest level. This outcome also confirms the necessity of the expansion of the student questionnaire with more items and to cover other domains like home environment and parent-child interaction.

The results of the mini questionnaire contribute to a better understanding of the relationship between students' attitudes towards the test and the tasks measuring the skills that have been implicated as fundamental to proficient reading. Hopefully, it helped to put to rest any lingering doubts about the usability of different text formats and topics in teaching and assessment at a young age. It certainly showed that we need a more differentiated approach to the application of mixed and non-continuous texts and to the interpretation of the results achieved in these domains. The all-or-nothing perspective is not right in this case. We cannot simply say that it is natural that students achieve lower test scores in reading "non-traditional" texts because we assume that they are not familiar with them, they rarely, if at all read such texts at school or they do not like them or find them very difficult. Data show that the picture is even more diverse.

The heuristic model designed by Snow and Sweet (2003) provides a good staring point for further research (see Chapter 1). The reader, as one of the main elements of the comprehension model, can be studied from a wide array of perspectives. These include cognitive capacities like attention, memory and inferencing and various types of knowledge

such as vocabulary, a more detailed examination of topic and domain knowledge than was carried out in this study, and linguistic and discourse knowledge. Motivation also needs further multifaceted analyses, as was suggested by the work of Szenczi (2013).

Choosing other methods for studying the main issue addressed in this dissertation is also desirable. Interviews could contribute to a better understanding of why students gave a particular response to the questions. Additionally, concurrent and retrospective think-aloud protocols (Kuusela & Paul, 2000) could be used to gather data by involving students to verbalize their actions and report on how they go about completing a task (Ericsson & Simon, 1987).

The third study

The third study addressed the key issue of the dissertation from yet another angle: the context of teaching reading. Aspects of reading instructions were mapped out and related to second graders' achievements.

The acquisition of reading skills is a basic human right and a fundamental aspect of individual and national development. Yet, for many Hungarians, the printed word has little to say. Research has provided us with ample knowledge about why students encounter difficulties in reading. The importance of cognitive and affective factors and student background is clear. International surveys have shown that school-level factors also play significant roles in reading outcomes. However, a comprehensive examination of the personal, methodological and classroom aspects of reading instruction in second grade has not been carried out in a Hungarian context. The third study aimed to fill this gap by reporting on the results of a large-scale national study aiming to identify current trends in instructional practices in reading and to study the ways in which they relate to students' achievement in subtests representing different text formats. For these purposes, data from a questionnaire administered to 189 primary school teachers and a reading comprehension test completed by 3,220 second graders were linked.

Findings suggest that teachers' age, qualification, and job satisfaction in the classroom, the instructional and evaluation methods employed, the textbooks used for instruction, the frequency of using continuous texts and ICT for teaching reading, the number of Hungarian writing and essay writing lessons, and opinions about the developmental level of students' decoding and reading comprehension may all be key contributors to students' success in reading. However, the examination of the relationship between the study variables and achievement in the continuous, mixed and non-continuous subtests revealed changing patterns across the text formats that are difficult to interpret in light of the available data. It is clear that the aspects of teaching reading impact students' development in reading texts with different formats to varying degrees. Consequently, it is imperative that we further explore the underlying mechanisms so that teachers can differentiate, supplement or modify their existing practices to enable students to reach their optimum level of reading skills. This study allows for framing new research questions and paves the way for new directions regarding students' development in different dimensions of reading literacy. I believe that future empirical studies focusing on this domain need to draw on a wide range of methods including classroom observation, analysis of teacher-student interaction, case-studies and interviews. Additionally, it is important to broaden the scope of the questionnaire and expand the reading literacy test, as was set forth regarding the future directions of the first study. For instance, the inclusion of geographical maps, floor maps or weather diagrams would be beneficial in the assessment as non-continuous texts.

Educational importance, limitations and implications for further research

This work has an important contribution to the body of knowledge that has been accumulated in the reading research literature. First and foremost, the dissertation framed an issue and more specifically, set a research objective that has not been addressed and empirically examined so far. Students' reading literacy has been in the focus of numerous large-scale assessment programs over the past decades. These studies provide feedback on students' achievement in various text formats. According to the reports, there is a significant difference between test scores achieved in the continuous and non-continuous subtests. However, analysis of this prevalent phenomenon falls short of the identification of variables related to the text, the reader and the context of instruction that may account for this achievement gap. The aim of the three studies was to complement the results of previous research by carrying out detailed analyses on how cognitive aspects function in the meaning-making process in various text formats, and how psychological and ecological factors work when reading texts of different formats. The dissertation provides a multilateral examination of the phenomenon based on the heuristic model of reading comprehension elaborated by Snow and Sweet (2003) in a relatively young sample. The results confirm and complement the previously established points elaborated by Snow (2003). Results may pave the way for a more elaborate conceptualization of theories and models of reading comprehension. They may provide valuable insights for the stakeholders involved in students' reading development.

1. Theories defining texts as a complex sign system provide a more adequate framework for conceptualizing reading literacy than generativist and structuralist theories. Generativist and structuralist theories define text as an entity constituted by sentences and consider meaning as inherent at the levels of larger units of discourse. Theories defining texts as a complex sign system hold that even though texts are constituted by components, these components derive from semiotics.

2. The reading models and theories are insufficient and defective in that they rely on the formal features of language, mainly words and structure. They do not take into consideration that comprehending texts with different structures including symbols can also be viewed as reading.

3. The main methods used in reading instruction (i.e. phonics and whole word approach) stem from defective reading models. Therefore, they do not offer an appropriate platform for the development of skills required to understand non-continuous texts.

4. Researchers, including textbook developers, and practitioners have to make sure that instruction, assessments and theoretical models provide an "adequate representation of the complexity of the target domain" (Snow, 2003, p. 193). Applying a single dimensional approach to reading literacy in terms of text format is not satisfactory.

5. A multiplicity of text formats must be integrated into the research design and the teaching and learning process, as the developmental level measured by continuous texts is not a reliable indicator of the reading developmental level in texts with other formats. Students' performance varies across text formats.

6. Text format determines how cognitive processes involved in reading comprehension work. Cognitive processes, at least in the first four years of formal reading development, are not as universal as suggested by the literature. For this reason, a differentiated approach should be taken in their assessment and development.

7. Current practices of reading instruction influence students' achievement in reading continuous, mixed and non-continuous texts to a different extent. Therefore, teachers need to modify or supplement them in order to be able to help students develop an optimum level of reading literacy in all dimensions.

The studies revealed several new and useful pieces of information but the research has at least four limitations. On the one hand, I am aware that reading as a cognitive process is a complex entity and students' reading achievement is influenced by multiple factors. Students' outcomes are affected by past school investments, family investments in the present and past, students' congenital skills and other coincidental circumstances (Kertesi, 2008). Not all of these could be integrated into the three studies. On the other hand, besides the larger picture outlined by using quantitative analyses, it is also important to look into the quality of the factors and resources. In the present dissertation, I applied a quantitative approach; thus, the findings have to be complemented and enriched by qualitative methods in order to be able to gain a more precise and deeper understanding of the relationships. Third, the reading assessments presented in the dissertation relied on closed-item formats for which reading assessment in general is frequently criticized (Sabatini & O'Reilly, 2013). I acknowledge that reading is an interactive process where meaning is arbitrarily and creatively inferred by the reader and that closed-items put a constraint on the reader and guide and limit comprehension. However, at the time of data collection the development of the electronic assessment system (eDia) was in an initial phase where the integration of open-ended items was not possible. Finally, the use of scenarios in the reading assessment would have afforded more opportunities to make the assessment more diverse, purposeful, and motivating (Sabatini, O'Reilly & Dean, 2013). However, I believe that measuring reading literacy in the traditional manner with unrelated texts was more appropriate to test the functioning of the reading processes when reading different text formats. Moreover, the execution of a test design infusing the principles of the Global Integrated Scenario-Based Assessment (Sabatini, O'Reilly & Dean, 2013) was also hampered by the then-existing limitations of the testing platform.

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