The Effect of Modelling Metacognitive Strategies Using Explicit Direct Instruction on Fourth Grade Students' Metacognitive Awareness and Reading Comprehension Achievement.

Master thesis
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Keywords: metacognition, reading comprehension, modelling, Explicit Direct Instruction (EDI)

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Abstract

This study aimed to investigate the relationship between metacognitive awareness and reading comprehension achievement and whether teaching metacognitive strategies would enhance improvement in metacognitive awareness and performance in reading comprehension. An experimental mixed methods design was conducted at two primary schools in the province of Groningen, investigating a sample of 60 fourth grade students with different levels in reading comprehension and reading fluency. A metacognitive questionnaire (MSQ) and a reading comprehension test were used. A sample of 54 students was then studied to gain a deeper understanding of the strategies they used while working on reading comprehension tasks by means of individual interviews. In contrast to the expectations, results showed no significant correlation between metacognitive awareness and reading comprehension achievement and there was no evidence to conclude that teaching metacognitive strategies improved students' metacognitive awareness and reading comprehension achievement. The interviews suggested that students were unable to reflect on their used strategies during reading. This study expands to existing research by demonstrating that metacognitive awareness is not by default an underlying success factor of performance in reading comprehension among fourth grade students, and that improving reading comprehension among students is a challenge. When metacognition is applied in the daily practice of reading comprehension in the classroom, it does not easily lead to improvement in reading comprehension achievement.

Keywords: metacognition, reading comprehension, modelling, Explicit Direct Instruction (EDI)

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1. Introduction

In the modern world where information is available anytime and anywhere, being able to understand written materials is more important than ever. Written materials are involved throughout students' entire school careers, which makes that their educational successes rely to a large extent on their reading and comprehending skills (Logan et al., 2011). Good reading comprehension requires deep reading, which is "reading as an intellectual and aesthetic activity" (Nikolajeva, 2014, as cited in Bland, 2015, p. 26). This means that deep reading requires a deeper cognitive process from readers, because it connects metacognitive skills with readers' abilities to apply, analyse, and reflect on the text (Staudinger, 2017). Deep reading is closely connected to metacognition as "deep reading captures the metacognitive nature of reading, where students reflect on their own process and reason about connections" (Sperling et al., 2004, as cited in Staudinger, 2017, p. 3). Metacognitive strategies are important in the process of deep reading because they allow for awareness, control, improvement, and evaluation of understanding (Zhang & Seepho, 2013). However, the Progress in International Reading Literacy Study (PIRLS), an international study that measures the reading achievement of students in their fourth year of formal schooling, reports that students from multiple European countries have difficulty with two of the four processes that are tested in PIRLS. Those two processes are "interpret and integrate ideas and information" and "evaluate and critique content and textual elements" (Mullis et al., 2017). These countries involve Austria, Belgium (French), Czech Republic, Denmark, England, Finland, France, Germany, the Netherlands, Norway, and Sweden. As deep reading involves interpreting, integrating, and evaluating written materials, it is likely that students from these countries have difficulty with deep reading.

Modelling metacognitive strategies during the teaching of reading comprehension could be beneficial for students' metacognitive awareness and reading comprehension achievement, as this is found to enhance students' abilities in reading comprehension (Baumann et al., 1993). Modelling is defined as "verbalizing strategic thinking" (Hollingsworth & Ybarra, 2018, p. 132) and is included in the Explicit Direct Instruction (EDI) teaching model. EDI is referred to as metacognitive teaching, in which teachers know what, when, and why to model strategies during teaching (Hollingsworth & Ybarra, 2018). Metacognitive awareness is about a reader's knowledge and awareness of that knowledge that determines their level of understanding, performance, and achievement in reading (Guterman, 2003). Additionally, frequent and systematic teaching strategies are conducive to performance in reading comprehension (Okkinga et al., 2018a).

Although previous studies examined the effect of metacognition on reading comprehension and their relation (Donker et al., 2014; Guterman, 2003; Zhang & Seepho, 2013), this is not yet studied in combination with individual interviews. This means that a more in-depth understanding

about whether and which metacognitive strategies are used by fourth grade students while answering reading comprehension questions remains largely unknown. Conducting individual interviews with the students could lead to a more in-depth understanding into metacognition in reading comprehension, especially regarding deep reading comprehension (see e.g., Staudinger, 2017).

Therefore, the current study aimed to investigate the relationship between metacognitive awareness and reading comprehension achievement among Dutch fourth grade students and whether modelling strategies using EDI during the teaching of reading comprehension will improve fourth grade students' metacognitive awareness and reading comprehension achievement. This study additionally examines whether and which metacognitive strategies are used by fourth grade students while answering reading comprehension questions belonging to the reading processes of "interpret and integrate ideas and information" and "evaluate and critique content and textual elements". Regarding societal relevance, this study could contribute to the daily practice of teaching reading comprehension by teachers and to the creation of reading comprehension materials by instructional designers in primary education. If modelling metacognitive strategies does indeed improve students' metacognitive awareness and reading comprehension achievement, this is an adequate argument to include this in daily practice, in reading comprehension, and in other subjects that include understanding written materials. This could lead to an improvement in the quality of the Dutch reading comprehension education.

2. Theoretical Framework

2.1 Reading Comprehension

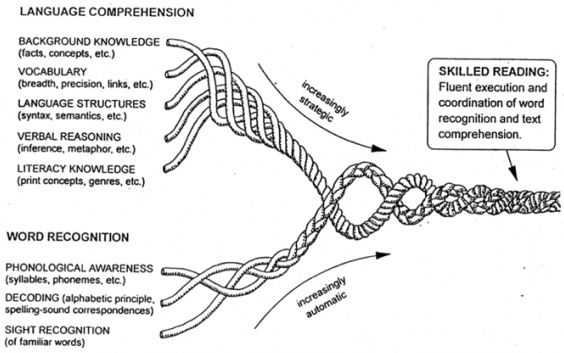
Reading comprehension is a complex skill that has been studied for years and for which there are a number of definitions. It can be defined as a process in which readers engage with the text and build a mental representation of it (Kintsch, 1998). Meneghetti et al. (2006) builds upon this definition by adding that it is the integration of the text with prior knowledge, that results in a mental representation of the text (see also McLaughlin, 2012). Supplementary to making connections between prior knowledge and textual information, research by Ahmadi et al. (2013) indicated that reading comprehension is also about understanding the main theme of a text even when this is not explicitly stated. Additionally, McNamara et al. (2011) specified these definitions by adding that reading comprehension involves coordination and integration of underlying processes as "integrate individual word meanings into a coherent sentence level representation and to integrate sentences to create a global understanding" (p. 230).

In line with these theoretical views, Mullis and Martin (2015) elaborate on four reading comprehension processes for the PIRLS-assessments. The first process is “focus on and retrieve explicitly stated information”, which allows for locating and understanding information that is explicitly stated in the text. The next process is “make straightforward inferences”, which means that students can go beyond the text and can make inferences about information that is not explicitly mentioned in the text. The third process is “interpret and integrate ideas and information”, in which students can construct understanding by integrating the text with their knowledge. The last process is “evaluate and critique content and textual elements”, and allows for evaluating language use, ideas, feelings, and information.

Factors found to be influencing the success in reading comprehension have been explored in several studies. Research carried out by Hoover and Gough (1990) indicated that there are two elements critical for reading success, which are decoding and linguistic comprehension. This is also known as the Simple View of Reading (SVR). This view on reading involves decoding as a readers’ ability of word recognition out of context and linguistic comprehension as a readers’ ability in understanding words, sentences, and the text as a whole based on lexical information. Scarborough (2001) created an illustration of ‘skilled reading’ which aligns with the Simple View of Reading as it likewise relies on the two critical elements (see Figure 1). Those elements are language comprehension and word recognition, which are identical to the SVR elements of linguistic comprehension and decoding. This view demonstrates that multiple elements underly a readers’ success in reading comprehension and argues that a reader is a ‘skilled’ reader when there is fluency in the execution and coordination of word recognition and text comprehension.

Figure 1

Skilled Reading

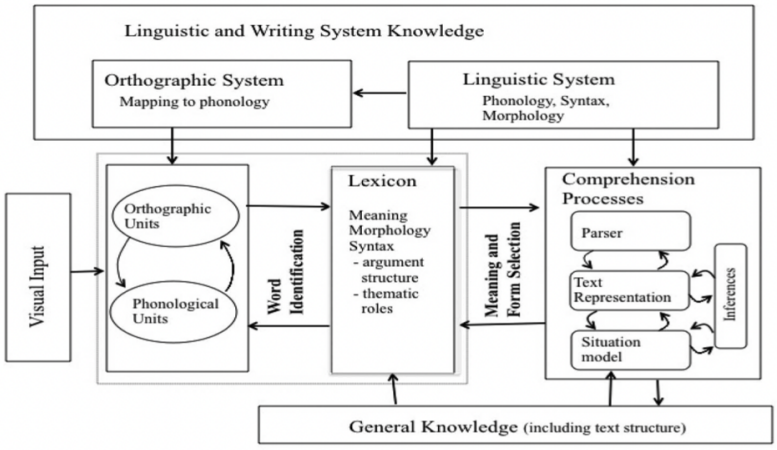


Note. From ‘’Connecting early language and literacy to later reading (dis)abilities: Evidence, theory, and practice,’’ by H. S. Scarborough, 2001, *Handbook of Early Literacy Research, 1,* pp. 97-110. Copyright 2001 by Guilford Press.

Perfetti and Stafura (2014) acknowledge the importance of language comprehension and word recognition, as can be seen in the Reading Systems Framework (RSF) in Figure 2. This framework is more specific about the processes of reading comprehension from visual input to comprehending the read text. Different components such as the orthographic- and linguistic system, and lexicon underlie this reading comprehension processes. The Reading Systems Framework is based on three basic principles. The first principle assumes three classes of knowledge that a reader uses while reading. This includes linguistic-, orthographic-, and general knowledge. Linguistic knowledge refers to phonology, syntax, and morphology. Orthographic knowledge involves mapping to phonology and general knowledge refers to prior knowledge which also includes knowledge about text structures. The second principle states that the three knowledge classes are used within the processes of reading in a constrained and interactive way. The processes of reading include decoding, word identification, constructing meaning, sentence parsing, inferencing, and monitoring comprehension. The third basic principle assumes that the processes of reading take place in the readers' cognitive system and considers both short- and long-term memory, as well as limited processing resources. The four processes of reading comprehension by Mullis and Martin (2015), align with the Reading Systems Framework as it includes decoding, word identification, constructing meaning, sentence parsing, inferencing, and monitoring comprehension.

Figure 2

The Reading Systems Framework



Note. From ''Word knowledge in a theory of reading comprehension,'' by C. Perfetti, and J. Stafura, 2014, *Scientific Studies of Reading, 18*(1), p. 24 (https://doi.org/10.1080/10888438.2013.827687). Copyright 2014 by Routledge.

In short, reading comprehension is a complex skill. For which multiple models have been published to illustrate its complexity. Many factors underly a readers' success in reading comprehension, such as their ability in decoding, word recognition, construct meaning, inferencing, and monitoring comprehension. But also, the use of prior knowledge is an important factor of reading comprehension. Because it is such a complex skill, it does not come naturally to readers and that is the main reason why students should be taught and trained in reading comprehension.

2.2 Metacognition and Reading Comprehension

Metacognition and reading comprehension are strongly connected. Metacognition involves metacognitive awareness, which is a major component of metacognition. Metacognitive strategies can be used during lessons to teach students how to become metacognitively aware. These strategies are widely used in reading comprehension before, during, and after reading (Okkinga et al., 2018b; Pressley & Gaskins, 2006). According to Zhang and Seepho (2013) a reader organizes and plans the reading task before reading, determines what reading strategy to use and if this strategy will lead to successfully completing a reading task. During reading, the reader monitors his understanding of the text and monitors whether reading strategies can be used for comprehension problems during reading. And after reading, readers evaluate whether they successfully succeeded the reading goal and whether they understood the written materials.

Metacognition is a skill that can be trained, particularly metacognitive awareness in problem-solving domains (Batha & Carroll, 2007). A recent meta-analysis examined the effects of strategy instruction on academic performance in writing, science, mathematics, and reading comprehension. This meta-analysis involved studies that included metacognition in school contexts, that aimed at academic performance, and included control groups. It was found that instruction on metacognitive knowledge, which is a part of metacognition, was valuable for reading comprehension and therefore beneficial for student achievement (Donker et al., 2014). Only one study in this meta-analysis focused on fourth grade students, who had received few years of reading instruction and was performed by Guterman (2003). This study examined the effect of using the MetaCognitive Awareness Guidance (MCAG) on reading comprehension. During this study, three groups of students were created. Students in the control group received no intervention or instruction and students in the placebo group only received content instructions. The students in the so-called intervention group received the MCAG on paper before performing the reading tasks. Students could request the reading tasks when they felt that the MCAG adequately prepared them in terms of prior knowledge and topic knowledge of that reading task. It was found that the students that were part of the intervention group, who had received the MCAG, attained a significantly higher score on the given

reading tasks as compared to the control group and placebo group. A study by Cubukcu (2008) examined the use of metacognitive strategies in reading comprehension among college students. Students in the experimental group received the intervention, in which 10 metacognitive strategies were at heart. These strategies were about using strengths, inferring meaning, using background information, evaluating, searching according to the goals, reading goals, distinguishing, deciding on the difficulty, revising, and guessing the later topics. Each lesson focused on two different strategies which students learned to apply. It was found that the instruction was effective, and students yielded better reading comprehension outcomes.

In short, previous studies suggest that metacognition is beneficial for enhancing student performance in reading comprehension. Metacognition is a skill that can be trained and involves planning, monitoring, and evaluating while reading or working on a reading task. Especially when it comes to the higher order thinking levels (e.g., problem solving), metacognition was found to be highly effective for reading comprehension achievement. However, it remains unclear from research whether this positive relationship also applies to fourth grade students in primary education, in terms of whether and which metacognitive strategies are used by fourth grade students while answering reading comprehension questions.

2.3 EDI in Teaching Reading Comprehension

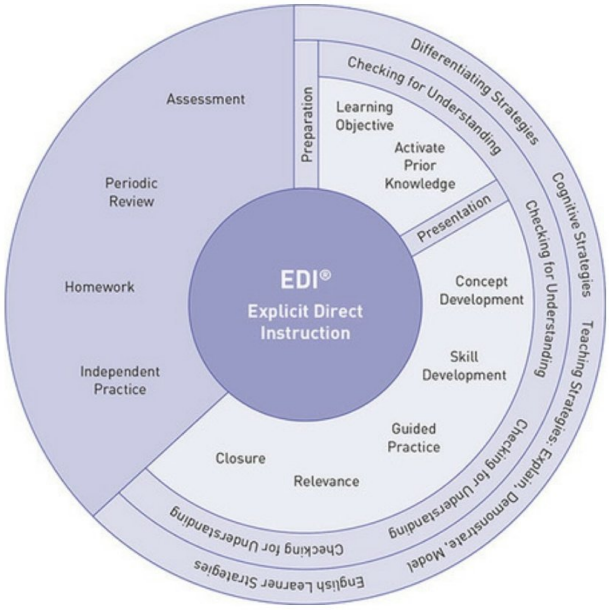
Existing research recognizes the critical role played by metacognition and instruction in students' achievement in reading comprehension. Especially modelling metacognitive strategies is proven effective as a teaching method to improve students' achievement in reading comprehension (Baumann et al., 1993). This is in line with research from Pressley and Gaskins (2006) on the metacognitive processes that metacognitive competent readers use. This research shows that explicit strategy instruction fosters the metacognitive processes before, during, and after reading. Pressley and Gaskins (2006) emphasize that reading comprehension performance improves with the use of multiple strategies, direct explanation and teaching of those strategies and underlines the importance of teaching students how to self-direct and monitor their comprehension. By doing that, students can practice the strategies that are necessary for their individual understanding of the text. However, it should be noted that it takes adequate time and practice for students to develop these skills.

Direct explanation and teaching of strategies in general means that teachers put modelling to use by demonstrating their strategic thinking out loud when solving a problem during teaching, which can be in any domain. Therefore, it is essential that teachers have knowledge about what, when, and why to model during teaching (Hollingsworth & Ybarra, 2018). Pressley (2004)

acknowledges this by stating that a metacognitively sophisticated teacher is aware of the fact that comprehension skills are not developed by students on their own, but that they need explicit explanations, modelling, and scaffolding from their teacher to develop this complex skill. A study carried out by Hubers (2022), indeed found that explicit instruction was effective in teaching higher order thinking skills. The teaching model 'Explicit Direct Instruction' (EDI), see Figure 3, is a successfully proven instructional model to teach effectively to all students (Hollingsworth & Ybarra, 2018).

Figure 3

The Explicit Direct Instruction Teaching Model



Note. From "Explicit direct instruction. The power of well-crafted, well-taught lesson," by J. R. Hollingsworth and S. E. Ybarra, 2018, pp. 15. Copyright by Dataworks.

The EDI model is based on the Direct Instruction (DI) model by Engelmann et al. (1988) and research into effects of interventions on student outcomes by Hattie (2009). Both the DI model and the EDI model assume that direct instruction should be teacher-led, structured in a logic sequence, and should involve clear learning goals that all students can achieve. A main difference between both models is that the DI model prescribes scripted lessons that should be followed exactly, whereas the EDI model presents didactic principles that strength each other while teaching (Hermans & Smit, 2018). A meta-analysis has been conducted by Stockard et al. (2018) that examined the effectiveness

of direct instruction, over 50 years of research. This meta-analysis studied the effect of direct instruction on reading achievement among other teaching areas and included 226 studies in reading. Results showed significant positive effects for reading, with an effect size of .51. This is seen as a moderate effect, according to Cohen et al. (2018). Research by Hattie (2009) compiled many tens of thousands of educational studies into meta-analyses and determined effect sizes of various interventions on student outcomes. Regarding providing direct instruction, an overall effect size of .59 was found. Both meta-analyses provide evidence to conclude that providing direct instruction is beneficial for student outcomes in any domain.

According to the EDI model (Hollingsworth & Ybarra, 2018), four techniques are important while teaching. The first technique is to involve and activate, where students are constantly challenged to participate actively during the lesson. The second technique is about checking understanding, where the teacher checks in every stage of the lesson whether all students understand the taught material. The third technique is giving feedback, because it is believed that students can learn from mistakes. The last technique is repeat, which means that taught content will be repeated in order to make sure that students will not forget. All techniques take place during seven different teaching phases, which are (1) activating prior knowledge, (2) sharing lesson objective, (3) instruction of content and skills, (4) guided practice, (5) extended instruction, (6) independent processing, and (7) lesson conclusion.

Four steps are used within the different phases, to prepare students gradually for the independent processing. The four steps are (1) the teacher demonstrates, (2) the teacher and all students work together during the guided practice, (3) the students work in pairs, and (4) the students work individually.

In short, teaching reading comprehension requires teachers to model during teaching reading comprehension, explicitly demonstrating the steps they take in deciphering a text. In addition, teachers must also demonstrate how students can monitor their own comprehension to ensure that students become self-directed readers.

2.4 The Current Study

Reading comprehension is a complex skill, in which students should be taught and trained. The use of metacognition and direct instruction during the teaching of reading comprehension has been proven effective. However, it remains unclear from research whether this effectiveness also applies to fourth grade students in primary education in terms of whether and which metacognitive strategies are used by fourth grade students while answering reading comprehension questions.

The current study had three main goals. First, to investigate the relationship between metacognitive awareness and reading comprehension achievement. Second, to investigate whether modelling metacognitive strategies using EDI during the teaching of reading comprehension improved fourth grade students' metacognitive awareness and reading comprehension achievement. And last, to investigate whether and which metacognitive strategies fourth grade students use while answering reading comprehension questions of the processes of "interpret and integrate ideas and information", and "evaluate and critique content and textual elements". The following research questions and hypotheses were formulated:

I. What is the relationship between metacognitive awareness and reading comprehension achievement among Dutch fourth grade students?

In line with different studies that indicate that metacognition is beneficial for enhancing student performance in reading comprehension (Cubukcu, 2008; Donker et al., 2014; Guterman, 2003), it was expected that metacognitive awareness and reading comprehension achievement are positively related.

II. To what extent does modelling metacognitive strategies using EDI during the teaching of reading comprehension improve Dutch fourth grade students' metacognitive awareness and reading comprehension achievement on the two higher order thinking levels of "interpret and integrate ideas and information", and "evaluate and critique content and textual elements"?

Based on the theory that explicit strategy instruction fosters metacognitive processes before, during, and after reading (Pressley & Gaskins, 2006), it was predicted that modelling metacognitive strategies using EDI would indeed improve students' metacognitive awareness and reading comprehension achievement.

III. To what extent do Dutch fourth grade students use metacognitive strategies during answering reading comprehension questions belonging to the processes of "interpret and integrate ideas and information", and "evaluate and critique content and textual elements"?

Consistent with the theory that metacognition is a skill that can be trained, especially metacognitive awareness in problem-solving domains (Batha & Carroll, 2007), it was expected that after the six-weeks intervention program, the students were able to use the metacognitive strategies that they learned during the sessions in the intervention program.

3. Method

3.1 Research Design

To examine the relationship between metacognition and reading comprehension, the effect of teaching metacognitive strategies using explicit direct instruction (EDI), and whether and which metacognitive strategies were used by fourth grade students, an experimental mixed-methods design was used (see Table 1). The quantitative part entailed a true experimental design, in which metacognitive awareness and reading comprehension were the dependent variables and teaching metacognitive strategies the independent variable.

Table 1

Research Design

	Pre-test	Intervention	Post-test
Experimental group	RO^1	*X*	O^2
Control group	RO^3		O^4

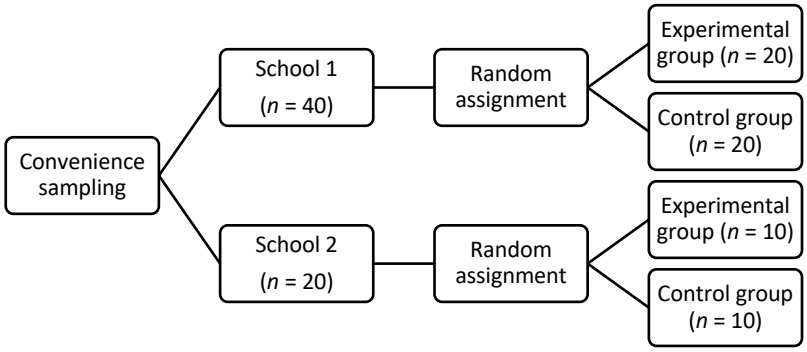
Note. The random assignment of respondents is indicated with *R*. The measures are indicated with *O*, and the intervention with *X*. From ''Research methods in education,'' by L. Cohen, L. Manion, and K. Morrison, 2018, p. 403. Copyright 2018 by Routledge.

3.2 Participants

The sample included 60 fourth grade students from two primary schools in the province of Groningen (the Netherlands). The sampling procedure can be found in Figure 4. The two participating schools were chosen based on convenience sampling and therefore it must be taken into account that the current sample does not necessarily reflect the Dutch population of fourth grade students (Babbie, 2013). Within the two schools, students were randomly assigned to either the experimental group or control group to address threats to external validity (Boudah, 2020). They ranged in age from eight to 10 years (M = 8.82, SD = 0.43) and included 29 boys and 31 girls.

Figure 4

Sampling Procedure



Both schools use the same student monitoring system of Cito and monitor the students throughout their primary school years. The most recent test of reading comprehension of this research group was at the end of the 3rd grade, where a distinction was made between five levels (see Table 2). In addition to the reading comprehension test, students participated in a reading fluency test (AVI) where students read a short story in time. Specific standards for each text determined whether the student has met the appropriate reading level. The results of the current research group are shown in Table 3. Students that scored above E5 have a reading fluency level above the level appropriate to the number of years of reading instruction. Students that scored below E5 have a reading fluency level beneath the level appropriate to the number of years of reading instruction. It should be noted that the current sample of fourth grade students, is for both reading comprehension and reading fluency a relatively weak group.

Table 2

Percentage of Students per Score on Reading Comprehension

	A-score	B-score	C-score	D-score	E-score
Experimental group	3.3%	6.7%	26.7%	36.7%	26.7%
Control group	10.7%	17.9%	21.4%	39.3%	10.7%

Note. n = 58 (two students did not participate in this reading comprehension test due to their low technical reading level). A-score = 25% highest scoring students compared to national average; B-score = 25% above national average scoring students; C-score = 25% slightly to well under the national average scoring students; D-score = 15% well under national average scoring students; E-score = 10% lowest scoring students compared to national average.

Table 3

Percentage of Students per AVI-Score

	Plus	E7	M7	E6	M6	E5[a]	M5	E4	M3
Experimental group	3.2%		12.9%	19.3%	12.9%	22.6%	16.1%	6.5%	6.5%
Control group	10.3%	3.4%	13.8%	13.8%	13.8%	17.3%	17.3%	6.9%	3.4%

Note. n = 60. Plus = highest reading fluency level in primary education; E7/E6/E5/E4 = the E represents the reading fluency level appropriate at the end of grade 5/4/3/2 respectively; M7/M6/ M5/M3 = the M represents the reading fluency level appropriate halfway grade 5/4/3/1 respectively.
[a] The reading fluency level appropriate to the time of the test and number of years of reading instruction would be E5.

A Chi-Square Independence Test was performed twice to test whether the distribution of the results in reading comprehension and reading fluency for both the experimental group and the control group were equally distributed over the levels of CITO as showed in Table 2 and Table 3 respectively. The null hypotheses assumed that there would be no statistically significant difference in the distribution between the experimental group and the control group in reading comprehension and in reading fluency, whereas the alternative hypotheses assumed that there would be a statistically significant difference. Results showed no significant differences in distribution between the experimental group and the control group for reading comprehension ($X^2(4) = 4.78$, $p = .311$) and reading fluency ($X^2(8) = 3.00$, $p = .934$). This means that for both reading comprehension and reading fluency, both the experimental group and the control group are equally distributed of the levels of CITO and therefore it is statistically plausible to state that the groups are equivalent. However, it is worth mentioning that the current research group does involve relatively low-ability readers.

The descriptive statistics about the participants' demographic information, is shown in Table 4. The majority of this sample reported that they have about 26 to 100 books at home, whereas the minority reported to have zero to 10 and 201 books or more (46.7%, 6.7%, and 6.7% respectively). All participants additionally responded to a background questionnaire with questions about reading motivation and reading fun. The mean scores and standard deviations can be found in Table 5.

Table 4

Respondents Demographic Table (n=60)

Measure	Item	Frequency	Percentage
Gender	Male	29	48.3%
	Female	31	51.7%
School	School 1	40	66.7%
	School 2	20	33.3%
Number of books	0 – 10 books	4	6.7%
	11 – 25 books	14	23.3%
	26 – 100 books	28	46.7%
	101 – 200 books	10	16.7%
	201 books or more	4	6.7%

Table 5

Descriptive Statistics for Background Questionnaire

Measure	Item	*M*	*SD*
Reading Motivation	At school I read silently on my own.	4.20	0.94
	At school I read things that I can choose myself.	4.58	0.89
	At home I read for fun.	3.53	1.27
	At home I read to learn new things.	3.12	1.25
Reading Fun	I like reading.	3.78	1.08
	I think reading is boring.	2.07	1.19
	I wish I had more time to read.	3.35	1.45
	I like to talk with others about what I have read.	3.08	1.41
	I learn a lot by reading.	3.82	1.17

Note. n = 60.

3.3 Instrumentation

3.3.1 Background Questionnaire

The background questionnaire included 12 items and was partly adopted from Mullis and Martin (2015) and translated into Dutch language prior to using it. Several background characteristics were collected, such as age, gender, reading motivation, and reading fun. These background characteristics were used to describe the research group. Reading motivation was assessed with 4 items, for example, “At school I read silently on my own”. Reading fun was assessed with 5 items, for example, “I like reading”. For each item, participants rated to what extent they agreed with the statement,

ranging from strongly disagree (1) to strongly agree (5). Cronbach's Alpha was .22 for reading motivation, and .10 for reading fun. This means that the reliability of these constructs was unacceptably low (Cohen et al., 2018). The background questionnaire is not included in the appendix because it is a pre-existing instrument that was not adjusted or updated for this study.

3.3.2 Metacognitive Strategy Questionnaire (MSQ)

Metacognitive awareness within reading comprehension among Dutch fourth grade students was measured with a Metacognitive Strategy Questionnaire (MSQ) on an ordinal level with 11 items. This instrument was used in the pre-tests (see Appendix A) and post-tests (see Appendix B). The items were partly adopted from the MSQ by Zhang and Seepho (2013). This MSQ was used among English major students. And to the best of my knowledge, it was never used with fourth grade students. Since this study was interested in the reading comprehension processes of "interpret and integrate ideas and information", and "evaluate and critique content and textual elements", the items belonging to these processes were used along with general items. This questionnaire was based on a 5-point Likert scale (1 = *never to almost never* to 5 = *always or almost always*). The items were translated into Dutch language and adjusted to ensure it would be understandable for fourth grade students. Initially, the MSQ was pilot tested and due to practical constraints only among an additional group of 10-year-old students, (n = 4). Its reliability was calculated with Cronbach's Alpha, which yielded a reliability estimate of .80. The used MSQ in the pre-test yielded a reliability estimate of .84, whereas the MSQ in the post-test yielded a reliability estimate of .76.

3.3.3 Reading Comprehension Test

Reading comprehension achievement among fourth grade students was measured with adopted items from a standardized reading comprehension test (PIRLS-2016) on a nominal level and was used in the pre-test and post-test. Two versions were created in close cooperation with Expertisecentrum Nederlands, version A for the pre-test with 10 items and version B for the post-test with 13 items. Both version A and version B contained items based on the processes of "interpret and integrate ideas and information", and "evaluate and critique content and textual elements". Originally, this is a standardized test conducted by the International Association for the Evaluation of Educational Achievement (IEA). The reliability of the original instrument was calculated with Cronbach's Alpha and the outcome showed an international high reliability estimate of .83 (Martin et al., 2017). The used reading comprehension test in the pre-test yielded a reliability estimate of .49, whereas the reading comprehension test in the post-test yielded a reliability estimate of .64. The reading

comprehension tests are not included in the appendix because they are both pre-existing instruments that were not adapted or updated for this study.

3.3.4 Interview Protocol

An interview protocol was self-developed and served as basis for the semi-structured interviews. These interviews were used to gain an in-depth understanding of whether and which metacognitive strategies are used by fourth grade students while answering questions involving the reading comprehension processes of ‘’interpret and integrate ideas and information’’ and ‘’evaluate and critique content and textual elements’’. The first question of this interview protocol served as a basis for the interview. The remaining questions were based on the metacognitive strategies during the interventions and metacognitive strategy questionnaire. These strategies were converted into interview questions as is shown in Table 6. The questions were translated into Dutch language, prior to using it. The interviews were voice recorded with LifeGoods Digital Voice Recorder and transcribed.

Table 6

Interview Protocol

1	Can you explain how you arrived at this answer to this question?
2	By organizing the reading question, did you determine the reading goal belonging to this question?
3	Did you activated your background knowledge before answering this question?
4	Did you think of strategies that you could use in answering this question?
5	Did you read the text before you read the task, or the other way around?
6	Did you search for specific locations in the text to answer this question?

3.3.5 Coding Scheme

To examine whether and which metacognitive strategies were used by the fourth grade students, the voice recordings were coded using a self-developed coding scheme (see Table 7). This coding scheme was based on the metacognitive strategies questionnaire, and common responses of students during the interviews. The main category of this coding scheme is “strategies for answering questions” to allow for coding for the specific strategies that the students used.

Table 7

Overview of Coding Scheme

Categories	Description	Example
Strategies for answering questions		
Making a plan	Participants indicated that they made a plan before starting the reading task.	I made a plan before I start a reading task because I think that is helpful.
Identifying purpose	Participants indicated that they thought of the purpose of the assigned task.	I first identified the purpose of the assigned task.
Thinking of helpful strategies	Participants indicated that they thought of strategies that they could use.	I thought of strategies that I could use for this specific question.
Re-reading the text	Participants indicated that they re-read the text in order to find the answers.	I went through the pages again and then read the text again.
Searching for the answer	Participants indicated that they searched the text at specific locations to find the answer.	Well, I searched back in the text. And I have looked what I could use for this question, but sometimes I could not find it that well.
Scanning the text	Participants indicated that they have scanned the text to find the answer.	Well, I sort of scanned the text and then I found out.
Remembering the text	Participants indicated that they remembered the text and therefore could answer the question immediately.	Well, I thought this is the time to think about what I had read. And then I immediately knew it and I could write the answer down.
Thinking deeply about the text	Participants indicated that they only thought deeply about the text, in order to answer the question.	Thinking about what I should write down and I have puzzled a bit.
Unable to share what strategies were used	Participants indicated that they did not know what strategies they used to arrive at the given answer.	I don't know, just thinking I guess.

Note. The examples given by making a plan, identifying purpose, and thinking of helpful strategies were general examples. The examples for the other categories are English translations of actual answers that were given by Dutch students.

3.4 Intervention Program

During the intervention program, the students in the experimental group received 12 lessons in reading comprehension in which 11 metacognitive strategies, see Table 8, were modelled using the four steps of EDI. These steps were (1) the teacher demonstrates, (2) the teacher and all students work together during the guided practice, (3) the students work in pairs, and (4) the students work individually. The intervention program alternated weekly between informative texts and narrative texts and each intervention lasted 45 minutes. The intervention program started with reading comprehension lessons based on two informative texts, covering one text in each intervention. Lessons based on informative texts were repeated in week three and week five, lessons based on narrative texts took place in week two, four, and six.

The interventions included the three phases in which metacognition can be taught and which are widely used in reading comprehension (Okkinga et al., 2018b; Pressley & Gaskins, 2006). These phases were before, during, and after reading.

Table 8

Metacognitive Strategies Before, During, and After Reading

Before reading	
1	Before reading the text, I think about what I already know about the topic.
2	Before reading the text, I think about what might happen in the text.
During reading	
3	During reading, I underline or highlight difficult words and sentences and try to understand them.
4	During reading, I keep reading and keep checking whether I still understand the text.
After reading	
5	After reading and before answering questions, I make a plan about how to answer this question because I think that is helpful.
6	After reading and before answering questions, I think about the reading purpose of this reading task.
7	After reading and before answering questions, I think about strategies that I can use.
8	After reading, I check whether it was correct what I thought what would happen in the text.
9	After reading, I spent time to reflect on my reading performance.
10	After reading, I recall and summarise the read text in my mind.
11	After reading, I refer to the reading goal to evaluate if I achieved.

Before reading, the reading goal, lesson plan, and expectations were shared with the students. After that, the students recalled their prior knowledge regarding the subject the text was about and thought about what could happen in the text. For this, students wrote on a small

whiteboards and shared their knowledge by raising their whiteboard. In the next phase, which was during reading, the corresponding metacognitive strategies and the entire texts were modelled by the author of this thesis. Much attention was paid to the texts' vocabulary and overall meaning, as these are important factors of reading comprehension according to the Simple View of Reading and the Reading Systems Framework. The last phase of every intervention was after reading, in which the metacognitive strategies five, six, and seven of Table 8 were modelled. In addition, small reading assignments were completed by students who either worked individually or in pairs. To conclude, every intervention ended with reflection and evaluation in which the metacognitive strategies eight, nine, 10 and 11 of Table 8 were covered.

3.5 Procedure

Permission was obtained from the Ethical Committee of the University of Twente before primary schools were approached and before any data was collected. Before collecting the data with the participating schools, the MSQ was pilot tested with a small group of ten-year-old students that did not participate in this study. Because this study involved underage students, permission was asked from their parents. This was done by a written consent form. The data collection took place within the regular school hours of the participating primary schools.

Before the intervention period started, reading comprehension materials were asked from Dutch reading comprehension publisher Nieuwsbegrip. They responded positively, and a trial subscription was provided to access their reading materials online. The materials were printed before usage in the intervention. Additionally, the first participated school provided narrative reading materials for the entire intervention program.

During the first week of data collection, the study was introduced to the students and the consent forms were distributed. At the end of this week, the returned consent forms were collected. Both the experimental group and the control group were administered to the pre-tests, which were the background questionnaire, the MSQ, and the reading comprehension test version A.

During this same week, the intervention program started with the experimental group. During the program, the collected informative and narrative reading comprehension materials were used. Modelling metacognitive strategies before, during, and after reading the materials were the centre of the intervention (see previous paragraph). The metacognitive strategies that were at hand, were displayed on the board (see Table 8). The intervention was weekly repeated with the experimental group, twice a week.

At the end of the intervention program, the post-tests were administered with the experimental group and the control group. This was the reading comprehension test version B and

the Metacognitive Strategy Questionnaire, which both took place during mornings at different days. In addition, individual interviews were held with students from both the experimental group and the control group (*n* = 54), based on the interview protocol. The interviews were held in the afternoons, after students finished their post-tests.

4. Results

4.1 Descriptive Statistics

Metacognitive awareness and reading comprehension achievement were the main variables of this research. Metacognitive awareness was measured with a metacognitive strategy questionnaire (MSQ) in the pre-test and post-test. The pre-test was completed by 57 fourth grade students, while the post-test was completed by 59 students. This difference was due to the lack of absence of two students in the pre-test that were part of the control group. It was chosen not to have them take the MSQ when they were back at school, due to practical constraints within one of the particular participating schools. Reading comprehension achievement was measured with a reading comprehension test with PIRLS texts. Both the pre-test and the post-test were completed by 58 students. Table 9 shows the descriptive statistics for metacognitive awareness and reading comprehension achievement, in which both the experimental group and the control group did not differ significantly on any of the measures.

Table 9

Descriptive Statistics of the Main Variables

	Experimental group		Control group			
	n	*M (SD)*	*n*	*M (SD)*	*t*	*d*
Metacognitive awareness						
Time 1 (pre-test)	29	36.90 (8.52)	28	34.29 (9.10)	-1.12	-0.30
Time 2 (post-test)	29	34.00 (7.39)	30	37.67 (7.94)	1.83	0.48
Reading comprehension achievement						
Time 1 (pre-test)	29	29.53 (15.21)	29	23.92 (12.05)	-1.56	-0.41
Time 2 (post-test)	29	25.59 (15.90)	29	23.59 (15.26)	-0.49	-0.13

4.2 Relationship Between Metacognitive Awareness and Reading Comprehension Achievement

To answer the first research question, the relation between metacognitive awareness and reading comprehension achievement was calculated by means of Spearman's Rho. Results for both the pre-test (ρ = .12, p = .370) and the post-test (ρ = -.15, p = .276) showed no significant correlation between these variables.

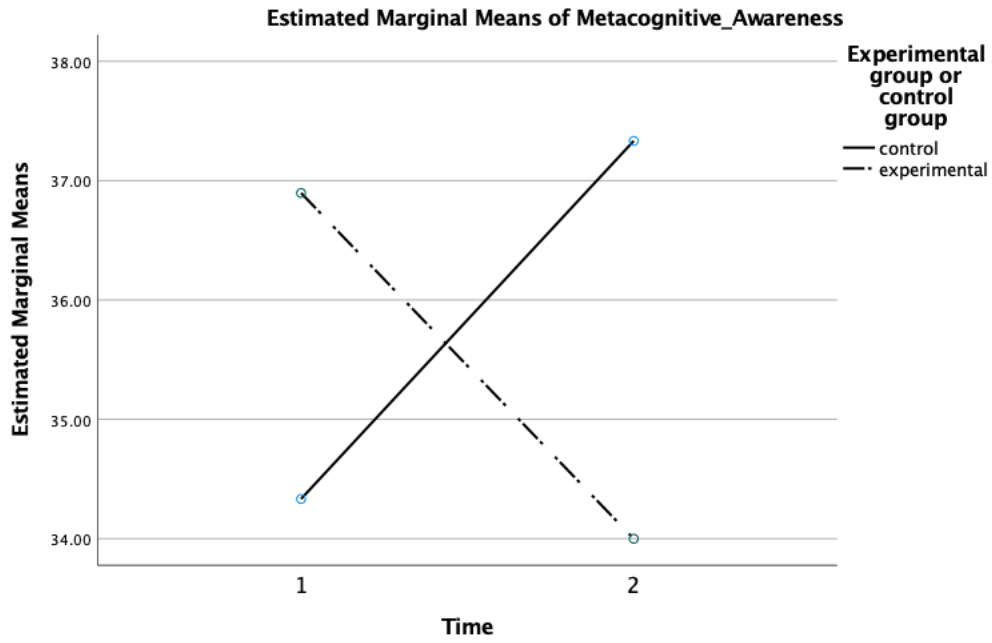
4.3 The Effect of Teaching Strategies Using EDI During a Six-week Intervention

The second research question focused on the effect of teaching metacognitive strategies on metacognitive awareness and reading comprehension achievement. To examine this effect, a General Linear Model Test was used for both variables, taking the repeated measures approach. Before the GLM Repeated Measures Tests were carried out for metacognitive awareness and reading comprehension achievement, the assumptions of independence, normality, and sphericity were checked. All three conditions were met. For both metacognitive awareness and reading comprehension achievement, the GLM Repeated Measures was carried out with time (pre-test and post-test) as within-subject factor and with group (experimental group and control group) as between-subject factor.

For metacognitive awareness, no main effects of time (F(1,54) = 0.002, p = .966,η^2 = < .001) and group (F(1,54) = 0.04, p = .837, η^2 = .001) were found. However, an interaction effect was found between Time*Group, F(1,54) = 6.07, p = .017, η^2 = .101 (see Figure 5). The interaction indicates that the control group increases more over time while the experimental group decreases. To further understand this interaction, Table 9 shows that the mean score for metacognitive awareness in the pre-test and post-test between the experimental group and the control group differ from each other. An independent samples t-test showed that this difference in the pre-test was not significant (t(55) = -1.12, p = .268). Regarding the post-test, this difference was also not significant (t(57) = 1.83, p = .072), but approaching significance.

Figure 5

Metacognitive Awareness Results per Condition



Regarding reading comprehension achievement, no main effects of time ($F(1,55) = 0.72$, $p = .400$, $\eta^2 = .013$) and group ($F(1,55) = 1.84$, $p = .180$, $\eta^2 = .032$) were found. There was also no significant interaction effect between Time*Group ($F(1,55) = 6.32$, $p = .430$, $\eta^2 = .011$). This indicates that both the experimental group and the control group did not improve significantly over time.

4.4 Analysis of Intervention Program and Content Coding

The third and last research question aimed to investigate in more detail to what extent Dutch fourth grade students used the metacognitive strategies that were taught in the six-week intervention program.

During the intervention program, it was noticed that students seemed to have difficulty in applying the metacognitive strategies while working individually. This was reflected in the interviews, in which students seemed to have difficulty articulating what they had done during the reading comprehension post-test and named strategies that were not part of the intervention program (see Table 10). There were great differences between students in the two schools that participated. The students at school 1 seemed to have more difficulty in applying the strategies, even when working in pairs or in groups. While walking around, it was observed that the taught strategies were not applied. This differed from school 2, where the students working in pairs or in groups did apply the strategies.

It was noticed that at school 2, each pair or group included at least one student who directed the group into application of the strategies. After students showed this for several interventions, the choice was made to let the students work individually. After that, while walking around the classroom, it was observed that none of the students applied the taught strategies. More specifically, it seemed that without the presence of a teacher or fellow student, the students were not able to apply the strategies themselves.

Table 10

Frequencies and Percentages of Indicated Used Strategies by Fourth Grade Students

	Experimental group (*n* = 28)		Control group (*n* = 26)	
	Frequency	Percentage	Frequency	Percentage
Making a plan			1	3.8
Re-reading the text	7	25.0	4	15.4
Searching back in the text for the answer	11	39.3	4	15.4
Scanning the text	1	3.6	1	3.8
Remembering the text	3	10.7	3	11.5
Thinking about the text	3	10.7	3	11.5
Unable to share strategies	3	10.7	7	26.9
Other[a]			3	11.5

Note. *n* =54.

[a] Not all answers could be classified under the coding categories as displayed in Table 7. Those answers were classified as *other*.

Only one student, who was part of the control group (*n* = 30) did indicate to have used one the metacognitive strategies that were taught to students in the experimental group: “I made a plan in my mind, and I remembered”. He was then asked how that plan looked like and he answered with: “I thought about what happened and what the text was about.” This was exactly what the strategy was about, and it is worth mentioning again that this concerns a student of the control group.

The scores of seven students that were part of the experimental group (*n* = 30) were remarkable because they either showed a great relative improvement between the pre-test and post-test or showed a relative decline in their progress between the pre-test and the post-test. Student 41, who showed a relative increase of 25 between the pre-test and post-test, explained which strategy was used: “I read it in the text. I looked at the pictures and read the text again to which the picture belonged to the question and then I wrote that down.” Student 32, who showed a

relative increase of 57.89 indicated to have used the same strategy: “I read a little piece again and then I found it”. Next to students from the experimental group who showed an improvement between the reading comprehension pre-test and the post-test, there were also students that showed a decline. Student 19, with a relative decline of 31.25 indicated the following: “I thought a lot about it, read it again, that is it.” Student 53, with a relative decline of 33.22 seems to agree with that statement: “I found it in the text that she wanted to help and with that she was being nice.” These statements support the implication that could be drawn from Table 8, which is that the answers could be literally found in the text. Although the listed students all indicated that they found the answer in the text, they did not all improve in reading comprehension performance. The majority of the experimental group indicated during the interviews that they found their given answers in the text.

Overall, there was no indication during the interviews that students were able to apply the taught metacognitive strategies while working individually on the post-test. It emerged that they were able to apply it when they could rely on a teacher or fellow student that offered guidance. In addition, there was no indication that students thought about the purpose of the assigned task, neither about strategies that could be helpful. Instead, most students re-read the text or searched back in the text in order to find the answers on the questions. This was unexpected, because the fact that students indicated that they re-read and searched the text, implied that the answers could be literally found in the text. Which is not the case because the asked questions were solely focused on the two higher order thinking levels; interpreting and evaluating.

4.5 Exploratory Follow-up

For both metacognitive awareness and reading comprehension achievement, an overall effect was not found. However, as there seemed to be differences between the two schools that took part in the current study (as described in the previous paragraph), it was decided to further explore the data and compare the two participating schools. Again, this was performed with a General Linear Model Test, taking the repeated measures approach. Before this was carried out, the assumptions of independence, normality, and sphericity were checked and were met. For both metacognitive awareness and reading comprehension achievement, the GLM Repeated Measures was carried out with time (pre-test and post-test) as within-subject factor and with school (school 1 and school 2) and group (experimental group and control group) as between-subject factors.

For metacognitive awareness, no main effects of time ($F(1,52) = 0.86$, $p = .358$, $\eta^2 = .016$) and group ($F(1,52) = 0.20$, $p = .657$, $\eta^2 = .004$) were found. However, a main effect of school ($F(1,52) =$

5.59, p = .022, η^2 = .097) was found, indicating that school 2 overall scored higher than school 1 (see Table 11).

Table 11

Descriptive Statistics of Main Variables per School

	School 1		School 2			
	n	*M (SD)*	*n*	*M (SD)*	*t*	*d*
Metacognitive awareness						
Time 1 (pre-test)	36	32.75 (9.43)	20	40.90 (4.52)	-4.44*	-1.02
Time 2 (post-test)	36	35.39 (8.03)	20	36.00 (7.38)	-0.09	-0.03
Reading comprehension achievement						
Time 1 (pre-test)	37	23.82 (14.42)	20	31.56 (11.73)	-1.97	-0.55
Time 2 (post-test)	37	20.34 (14.42)	20	32.11 (15.07)	-2.85	-0.79

Note. * p < .05

An interaction effect between Time*School (F(1,52 = 11.16, p = .002, η^2 = .177) was also found. To further understand this interaction, Table 11 shows that the mean score for metacognitive awareness in the pre-test and post-test between school 1 and school 2 differ from each other. An independent samples t-test showed that this difference in the pre-test was significant (t(55) = -4.44, p = <.001). Regarding the post-test, this difference was not significant (t(54) = -0.09, p = .925). In addition, an interaction effect was found between Time*Group, F(1,52) = 8.27, p = .006, η^2 = .137, see Figure 5. The interaction indicates that the control group increases more over time while the experimental group decreases. There were no significant interaction effects for School*Group (F(1,52) = 1.11, p = .297, η^2 = .021) and Time*School*Group (F(1,52) = 0.61, p = .438, η^2 = .012).

Regarding reading comprehension achievement, no main effects of time (F(1,53) = 0.32, p = .576, η^2 = .006) and group (F(1,53) = 2.90, p = .095, η^2 = .052) were found. However, a main effect of school (F(1,53) = 10.78, p = .002, η^2 = .169) was found, indicating that school 2 overall scored higher than school 1 (see Table 11). There were no significant interaction effects between Time*School (F(1,53) = 0.61, p = .440, η^2 = .011), Time*Group (F(1,53) = 0.25, p = .617, η^2 = .005), School*Group (F(1,53) = 0.75, p = .392, η^2 = .014), and Time*School*Group (F(1,53) = 0.66, p = .422, η^2 = .012).

5. Discussion

The main aim of this current study was to examine the effect of modelling metacognitive strategies using explicit direct instruction on fourth grade students' metacognitive awareness and reading comprehension achievement. The used intervention consisted of 12 reading comprehension lessons

which alternated weekly between informative texts and narrative texts. During these interventions, 11 metacognitive strategies were central. Students' initial level of metacognitive awareness and reading comprehension achievement was measured at the start of the interventions. Their level at the end of the interventions was compared to their level in the pre-tests. The scores of students in the experimental group were compared to the scores of students in the control group. For this study, three research questions were addressed. Results showed no significant relation between metacognitive awareness and reading comprehension achievement, and no effect of the intervention program. Although, there was an indication that the control group improved more than the experimental group on metacognition over time. Moreover, the outcomes of the individual interviews suggested that students who were part of the experimental group were not able to apply the taught metacognitive strategies.

5.1 Relationship Between Metacognitive Awareness and Reading Comprehension Achievement

The first research question addressed the relationship between metacognitive awareness and reading comprehension achievement among Dutch fourth grade students. According to a study by Guterman (2003), there was a significant positive relationship between metacognition and reading comprehension. However, this study showed no significant relations between those variables either on the pre-test and post-test.

It could be argued that the way of instruction during the interventions caused the absence of relationship between metacognitive awareness and reading comprehension. It might be the case that students need specific guidance in applying metacognitive strategies, as was the case in the study of Guterman (2003), but not in de current study. The cited study used a paper-based Metacognitive Awareness Guidance (MCAG) that students used right before the reading tasks. The current study taught the 11 metacognitive strategies during 12 interventions, after which they completed the reading comprehension test and then took the metacognitive strategy questionnaire. The nature of the metacognitive strategies that were used in the study of Guterman (2003) and the current study also differed. The cited study used metacognitive strategies that were explicit rules of thumb of how to solve a certain problem in a reading task. The current study used rather general strategies that were classified in strategies that could be used (1) before reading, (2) during reading, and (3) after reading. As noted by previous studies (Hubers, 2022; Pressley, 2004), students need explicit explanations to develop their higher-order thinking skills. So it could be argued that the strategies used in the current study might not have been specific enough to replicate the positive relation between metacognitive awareness and reading comprehension achievement.

5.2 Effect of Teaching Metacognitive Strategies Using EDI

The second research question examined the effect of modelling metacognitive strategies on fourth grade students' metacognitive awareness and reading comprehension achievement. According to Batha and Carroll (2007) metacognition is a skill that can be trained, especially in problem-solving domains as reading. Therefore it was expected that the intervention program would improve the experimental students' level in metacognitive awareness. However, results showed no effect of the intervention, although there was an indication that the control group improved more over time than the experimental group. Regulating your own learning, especially by means of evaluating, are important factors of metacognition (Zhang & Seepho, 2013). Although many students indicated on the MSQ questionnaire that they made a plan (66.7%), identified the purpose of the assigned task (70%), and thought of strategies that could be useful (78.3%), this was not evident from the interviews. The difference in outcomes suggest that these fourth grade students are not well developed in evaluating, and therefore their self-judgement as the ability to evaluate their own prior performance (Zimmerman, 2002), interfered with the correct completion of the questionnaire.

Regarding reading comprehension, according to Guterman (2003) frequent and systematic teaching strategies is beneficial for students' performance in reading comprehension. Contrary to the expectation that the intervention program would improve the experimental students' level in reading comprehension, results showed no effect of the intervention. The effect of this rather short intervention program was thus not found, as happens more often in studies focusing on improving reading comprehension as in the study of Droop et al. (2016). In this study, 1,469 students from the Netherlands were followed for two years during which they participated in an intervention program that aimed for examining the effects of strategic reading instruction on reading abilities of third and fourth grade students. Modelling played a great part within the intervention program. After one year of the intervention program, when the students were at the end of the 3rd grade, hardly any improvement in reading comprehension was found. However, after two years of the intervention program, when the students were at the end of the 4th grade, significant positive effects were found. This suggests that improving reading comprehension using strategies is difficult, complex and takes sufficient time, even when modelling is a large part of the intervention.

Moreover, it is worth noting that the current study consisted of many students with reading proficiency levels below the level appropriate to the number of years of reading instruction. Because reading itself is already a demanding cognitive process (Perfetti & Stafura, 2014), this leaves less space comprehending the text and for applying metacognitive strategies on top of that, due to students' limited processing resources (Mayer, 2021). This suggests that the lower the reading fluency level of fourth grade students, the less they will benefit from strategy instruction. As stated

by Pressley and Gaskins (2006), it takes adequate time and practice for students to develop metacognitive skills that can enhance their ability in reading comprehension.

5.3 The Extent to Which Students Used the Metacognitive Strategies

The third research question focused on to what extent the students were able to apply the metacognitive strategies that were taught in the intervention program, while answering reading comprehension questions. Contrary to the expectation that the students were able to apply the 11 metacognitive strategies after completion of the intervention program, outcomes of the individual interviews suggested otherwise.

First, the results showed that the students from the experimental group did not apply the taught strategies while working on the reading comprehension post-test. The strategies during the interventions were modelled using the EDI teaching model, which is an effectively proven teaching method (Hollingsworth & Ybarra, 2018). And although strategy use can be developed in the classroom when modelled by teachers (Zimmerman, 2002), this was not the case in the current study. Next to merely modelling strategies, students also need knowledge about the strategies and need to learn how to adapt those for applying them correctly in specific reading situations (Droop et al., 2016). The current study focused on modelling the 11 strategies, and attention about adapting strategies and how to apply them in different reading situations was not provided. This suggests that modelling metacognitive strategies, without paying attention to applying the strategies in new reading situations, leads to the lack of strategy application in new situations.

Second, it seemed that students were unable to reflect on the strategies they used while working on the reading comprehension post-test. As mentioned earlier, students' self-judgement as the ability of evaluating their own prior performance (Zimmerman, 2002), might have been underdeveloped in the current sample. This suggests that it was difficult for students not only to fill in the metacognitive strategy questionnaire correctly, but also to provide answers during the individual interviews that actual reflected their strategy use.

Although students indicated that they did not use the metacognitive strategies that were taught during the intervention program, it remains unknown whether this was actually the case or whether students were simply unable to reflect on their strategy use.

5.4 Implications

In practice, the majority of fourth grade students indicated in their interviews that they did not make use of the taught metacognitive strategies. They rather re-read the text or searched the text in order to find the answer. For teachers, it is advised to include metacognition in reading comprehension

education in daily practice. But rather to solely teach strategies during the lessons, it is recommended to additionally pay attention to the process of monitoring comprehension and teach students how to self-direct that process (Pressley & Gaskins, 2006). By doing that, students can practice the strategies until it does not cause extra cognitive load and they can individually understand written materials.

Regarding the scientific impact, the current study combined quantitative and qualitative data to investigate the effect of modelling metacognitive strategies on reading comprehension achievement and their relation. Previous research examined the effect of metacognitive awareness on reading comprehension achievement and their relation (e.g., Batha & Carroll, 2007; Guterman, 2003), but did not conduct individual interviews with participants. It thus seems that this study is the first that investigated this topic, where individual interviews were used to gain a deeper understanding about the found results.

5.5 Limitations and Future Research

The first limitation of this study is the low reliability estimates of the reading comprehension tests in both the pre-test and the post-test. Reliability estimates indicate, among others, the relationship between multiple items (Boudah, 2020). This means that when students are answering correct on a particular item, they should also answer correct on other items. When the estimates fall below .69, the estimates are low and not reliable enough (Cohen et al., 2018). The used reading comprehension test in the pre-test yielded a reliability estimate of .49, whereas the reading comprehension test in the post-test yielded a reliability estimate of .64. Thus, both reading comprehension tests were not reliable. This is an indication that the participating students were not working seriously enough on the reading comprehension tests. Although the reliability of the original PIRLS instrument yielded a high reliability estimate of .83 (Martin et al., 2017), it remains unknown what the reliability of the original instrument is on only the reading comprehension processes of “interpret and integrate ideas and information” and “evaluate and critique content and textual elements”, which was the focus of the current study.

Due to practical constraints, this study did not provide a comprehensive overview of students’ individual reading levels in combination with their performance on the reading comprehension tests of the current study. This study therefore only collected general data about students’ reading comprehension and reading fluency levels. More specifically, this study was unable to detect whether teaching metacognitive strategies could be beneficial for specific students with different levels in reading comprehension and reading fluency. For future research, it is suggested to

gather this specific data from students to draw more specific conclusions about the effect of teaching metacognitive strategies on fourth grade students' performance in reading comprehension.

The reader should bear in mind that the current study was based on so-called low-stakes tests. Meaning that students' performance in the current study did not affect students' grades in class and therefore there were no consequences for the participating students (Finn, 2015). Students' motivation could have been affected by this phenomenon, which might have led to the absence of improvement in both metacognitive awareness and performance in reading comprehension. It is suggested for future research with low-stakes testing, to additionally gather information about students' mental efforts during the tests, as this would provide insight whether or not the students were performing to the best of their abilities. In addition to this limitation, it cannot be stated with certainty that all students did read the entire texts of the reading comprehension pre- and post-tests. Gathering data on this topic was beyond the scope of this research but is worthy to mention.

6. Conclusion

The current study aimed to investigate the effect of modelling metacognitive strategies using explicit direct instruction on fourth grade students' metacognitive awareness and reading comprehension achievement. Therefore, the study tested (1) the relationship between metacognitive awareness and reading comprehension achievement among fourth graders, (2) whether explicitly teaching metacognitive strategies would improve fourth grade students' metacognitive awareness and reading comprehension achievement, and (3) whether and which strategies fourth grade students use while working on reading tasks. Results showed no significant relation between metacognitive awareness and reading comprehension achievement, no effect of the intervention program, and students of the experimental group were not able to apply the strategies that were taught in the intervention program.

It can be concluded from the present study that teaching reading comprehension is complex and difficult, even when a didactic tool as modelling is used within a proven effective teaching model like EDI. This is especially the case when the group of students have relatively low abilities in reading. In other words, improving students' reading comprehension skills is not a quick fix.

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Appendix A

Onderzoek begrijpend lezen
Metacognitieve strategieën

Code: .....
Datum: .....

Instructies:
In deze vragenlijst lees je stellingen over begrijpend lezen. Wanneer je een tekst leest of een vraag beantwoordt over een tekst, bedenk dan wat je doet voor en tijdens het lezen en het beantwoorden van een vraag. Neem de tijd om elke stelling goed te lezen en geef antwoord door een (X) in het vakje te zetten dat het best bij jou past.

Voorbeeld:
Lees de volgende stelling en kies het antwoord dat het best bij jou past door een (X) in het goede vakje te zetten.

	Stelling	**Nooit of bijna nooit** 1	**Meestal niet** 2	**Een beetje** 3	**Meestal wel** 4	**Altijd of bijna altijd** 5
	Voordat ik een vraag beantwoord, denk ik na wat ik al weet over het onderwerp.					

- Als je altijd of bijna altijd nadenkt over wat je al weet over het onderwerp voordat je de vraag beantwoordt, dan zet je een (X) in het vakje onder de 5.
- Het is belangrijk dat het antwoord dat je geeft het beste past bij wat jij doet, niet wat je denkt dat je zou moeten doen of wat andere mensen doen. Dit is geen toets, er zijn geen goede of foute antwoorden.
- Let op, de stelling gaat alleen over wat je doet tijdens het vak begrijpend lezen.

Item	Stelling	Nooit of bijna nooit 1	Meestal niet 2	Een beetje 3	Meestal wel 4	Altijd of bijna altijd 5
	Voordat ik begin met het lezen van de tekst voor begrijpend lezen…					
1	… denk ik na over wat ik al weet over het onderwerp.					
2	… denk ik na over wat er zou kunnen gebeuren in de tekst.					

Item	Stelling	Nooit of bijna nooit 1	Meestal niet 2	Een beetje 3	Meestal wel 4	Altijd of bijna altijd 5
	Tijdens het lezen van de tekst voor begrijpend lezen…					
3	… onderstreep of markeer ik moeilijke woorden en zinnen en probeer ik deze te begrijpen.					
4	… blijf ik lezen en controleer ik steeds of ik de tekst nog begrijp.					

Item	Stelling	Nooit of bijna nooit 1	Meestal niet 2	Een beetje 3	Meestal wel 4	Altijd of bijna altijd 5
	Voordat ik begin met het beantwoorden van een vraag voor begrijpend lezen…					
5	… maak ik een plan over hoe ik deze vraag ga beantwoorden omdat ik denk dat dat nuttig is.					
6	… denk ik na over wat het doel is van deze vraag.					
7	… denk ik na welke strategieën ik voor deze vraag kan gebruiken.					

Item	Stelling	Nooit of bijna nooit 1	Meestal niet 2	Een beetje 3	Meestal wel 4	Altijd of bijna altijd 5
	Na het lezen en maken van een vraag voor begrijpend lezen…					
8	… controleer ik of het klopt wat ik dacht dat er zou gebeuren in de tekst.					
9	… besteed ik tijd om te reflecteren op mijn leesprestatie.					
10	… herinner ik me waar de tekst over ging en vat ik hem in mijn hoofd samen.					
11	… gebruik ik het leesdoel van deze les om te evalueren of ik het leesdoel heb behaald.					

Appendix B

Onderzoek begrijpend lezen
Metacognitieve strategieën

Code: .....
Datum: .....

Instructies:
In deze vragenlijst lees je stellingen over begrijpend lezen. Denk bij elke stelling goed na of je dit zojuist hebt toegepast tijdens het begrijpend lezen in het PIRLS-B boekje. Neem de tijd om elke stelling goed te lezen en geef antwoord door een (X) in het vakje te zetten dat het best bij jou past.

Voorbeeld:
Lees de volgende stelling en kies het antwoord dat het best bij jou past door een (X) in het goede vakje te zetten.

	Stelling	**Nooit of bijna nooit** **1**	**Meestal niet** **2**	**Een beetje** **3**	**Meestal wel** **4**	**Altijd of bijna altijd** **5**
	Voordat ik een vraag beantwoord, denk ik na wat ik al weet over het onderwerp.					

- Als je altijd of bijna altijd hebt nagedacht over wat je al weet over het onderwerp voordat je aan de vraag begon, zet je een (X) in vakje onder de 5.
- Het is belangrijk dat het antwoord dat je geeft het beste past bij wat jij net gedaan hebt, niet wat je denkt dat je zou moeten doen of wat andere mensen doen. Dit is geen toets, er zijn geen goede of foute antwoorden.
- Let op, de stelling gaat alleen over wat je net hebt gedaan tijdens het begrijpend lezen in het PIRLS-B boekje.

Item	Stelling	Nooit of bijna nooit 1	Meestal niet 2	Een beetje 3	Meestal wel 4	Altijd of bijna altijd 5
	Voordat ik begin met het lezen van de tekst voor begrijpend lezen…					
1	… denk ik na over wat ik al weet over het onderwerp.					
2	… denk ik na over wat er zou kunnen gebeuren in de tekst.					

Item	Stelling	Nooit of bijna nooit 1	Meestal niet 2	Een beetje 3	Meestal wel 4	Altijd of bijna altijd 5
	Tijdens het lezen van de tekst voor begrijpend lezen…					
3	… onderstreep of markeer ik moeilijke woorden en zinnen en probeer ik deze te begrijpen.					
4	… blijf ik lezen en controleer ik steeds of ik de tekst nog begrijp.					

Item	Stelling	Nooit of bijna nooit 1	Meestal niet 2	Een beetje 3	Meestal wel 4	Altijd of bijna altijd 5
	Voordat ik begin met het beantwoorden van een vraag voor begrijpend lezen…					
5	… maak ik een plan over hoe ik deze vraag ga beantwoorden omdat ik denk dat dat nuttig is.					
6	… denk ik na over wat het doel is van deze vraag.					
7	… denk ik na welke strategieën ik voor deze vraag kan gebruiken.					

Item	Stelling	Nooit of bijna nooit 1	Meestal niet 2	Een beetje 3	Meestal wel 4	Altijd of bijna altijd 5
	Na het lezen en maken van een vraag voor begrijpend lezen…					
8	… controleer ik of het klopt wat ik dacht dat er zou gebeuren in de tekst.					
9	… besteed ik tijd om te reflecteren op mijn leesprestatie.					
10	… herinner ik me waar de tekst over ging en vat ik hem in mijn hoofd samen.					
11	… gebruik ik het leesdoel van deze les om te evalueren of ik het leesdoel heb behaald.					