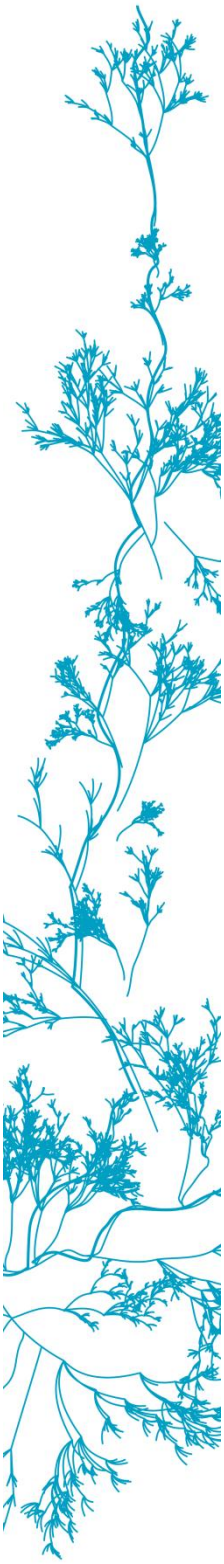

EVALUATING THE EFFECTIVENESS OF THE KERNVISIE METHOD IN SUPPORTING CHILDREN WITH SPECIAL EDUCATIONAL NEEDS

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Abstract

This study aimed at examining the effectiveness of the Kernvisie Method (KVM) that was developed to help students with special educational needs. The intervention assumes that these children think in a different way and that this thinking style needs to be addressed by a different kind of instruction, namely through visualizations of the learning content. We predicted that KVM children would show a significantly higher achievement gain in spelling ability than average students. In addition, we compared the achievement growth in the second half of the school year for children starting with the KVM in the first and in the second term. Besides, we examined gender differences in the effectiveness of the intervention. Furthermore, we expected children preferring to think visually to benefit higher than those preferring to think kinesthetically, and dyslexic children to gain more than non-dyslexics. Existing CITO spelling test scores of nineteen elementary school children (six second graders, six fourth graders, and seven fifth graders) were used to analyze the development of spelling skills during the intervention. T-tests revealed that second grade participants showed a significantly higher growth in spelling ability than average students, while we found no effects for fourth and fifth grade students. Analyses of Variance (ANOVAs) did not reveal differential effects of the method based on KVM starting point, gender, preferred thinking style, and dyslexia diagnosis. Directions for future research as well as limitations of the study and the intervention are discussed.

Keywords: special educational needs, intervention, dyslexia, spelling ability, individual coaching

Evaluating the Effectiveness of the Kernvisie Method in Supporting Children with Special Educational Needs

In the following section the topics dyslexia, literacy instruction in elementary school, as well as available intervention methods for children with literacy problems will be discussed successively. Afterwards, the reasoning behind the intervention to be examined is explained before an overview about this research study is presented.

Defining dyslexia and its consequences

The diagnosis dyslexia is common as never before and represents the most frequent and best conceptualized learning difficulty (Shaywitz, Fletcher, & Shaywitz, 1995). Dyslexia can be defined as a learning disorder characterized by deficits in both reading and spelling ability. Perie, Grigg, and Donahue (2005) report that as many as 36 % of all fourth grade elementary school students fail to reach satisfactory reading levels. Furthermore, prior research has shown that there are significantly more boys than girls that are affected by dyslexia (Miles, Haslum, & Wheeler, 1998). In addition, dyslexic boys show higher impairments than dyslexic girls do (Berninger, Nielsen, Abbott, Wijsman, & Raskind, 2008). While the general intellectual performance is averagely distributed in dyslexics, their partial performance in the language domain shows significant weaknesses. Examples of possible problems include difficulties with accurate word decoding, poor text comprehension, slow reading rate, and diverse spelling mistakes (Lyon, Shaywitz, & Shaywitz, 2003).

What makes these circumstances so problematic is the fact that the condition persists during the whole school career and even beyond, despite intense learning support (Ferrer et al., 2015). The situation affects the entire life of the concerned individuals: besides negative consequences for the academic progress, motivational as well as self-worth problems arise (Burden, 2008; Schunk, 1989).

Literacy instruction and remedial teaching in primary school

The best approach to teaching children to read has been studied extensively in various studies over the past years (Mayer, 2008). Literature agrees with practice that the best available approach is the so-called “phonics approach”, in which the focus is set on phonological awareness as a prerequisite to reading (Rayner, Foorman, Perfetti, Pesetsky, &

Seidenberg, 2002). Phonological awareness is understood as the ability to recognize a word's component sounds, that is, practically being able to hear certain sound elements as well as generating them by oneself (Ehri, Nunes, Stahl, & Willows, 2001). The first task for pupils who are learning to read is to recognize phonemes (i.e., mastering complete phonological awareness (Mayer, 2008)). Secondly, the children acquire the skill of decoding words as they become able to read out written letters into sounds. Afterwards, the decoding ability gets more and more automated until full automation is reached and children are able to decode words and then even sentences fluently. This step is accompanied by correct intonation and rapid speed of reading out loud. After the mastery of decoding fluency, enough cognitive capacity is left in order to be able to access the sense of words by retrieving it from one's long-term memory. With understanding what is read, the process of obtaining the reading skill is completed.

Likewise, it has been investigated how handwriting and spelling are taught in primary school. Before a word can be spelled correctly, it needs to be written down at first and consequently, learning to handwrite precedes the acquisition of spelling skills. The handwriting instruction follows the same sequence as reading instruction does, as firstly letters are taught individually and are later combined to form words, which build sentences in the next step (Vander Hart, Fitzpatrick, & Cortesa, 2010). In order to ensure accurate spelling of what is written down, teachers support their pupils in applying spelling rules and encourage them to make use of spelling strategies for unknown words. These often arise from relying on sounds (phonemes) and writing words down in accordance. Graham et al. (2008) describe that most teachers report teaching spelling rules, phonological awareness, phonics for spelling, and spelling strategies for novel words. Furthermore, a vast majority of elementary school teachers expects their students to master a list of specifically selected spelling words on a weekly basis.

This kind of instruction does an effective job for most of the learners, as they learn to understand the connection between letters and the corresponding phonemes and in turn, reading and spelling skills are acquired and improved (Ball & Blachman, 1991; Rayner et al., 2002). However, if problems occur while trying to learn to read, write, or spell, the specific pupil appears to be stuck somewhere in the process and consequently, is not able to master one or more component steps. It is essential to identify these children in order to use the chance of early intervention, which is aimed at diminishing the gap between strong and weak readers and spellers (Torgesen, 2004). Difficulties in reading and spelling, as well as in other school subjects, are typically addressed in the same manner for all pupils, namely by the

widely employed teaching strategy repetition (Saville, 2011). Often, children that have problems with the learning content in class are separated and put into a small group of pupils, being further educated in remedial classes. The most prominent teaching strategy includes recapitulating the tasks and questions over and over again, until the learning goals are fulfilled. This approach of repeated, intense phonics training seems to work for most children, as it has been established successfully over the past years and has been shown to effectively improve reading and spelling ability (Bradley & Bryant, 1983; Oakland, Black, Stanford, Nussbaum, & Balise, 1998).

Still, there is a group of children for which this tactic does not bear fruit (Mulligan & Peterson, 2013; Rüsseler, Probst, Johannes, & Münte, 2003). These children are instructed in the same manner as their fellow students are. However, they are not able to profit and translate this into improved achievement. In this case, parents possibly long for clarity and want their children to be tested for and potentially diagnosed with dyslexia, in order to adapt the given instruction. If all the effort invested in supporting the concerned child by the school does not yield any progress, the parents start searching for complementary intervention methods for dyslexic students. Diverse kinds of treatment approaches are available that differ with regard to the frequency and intensity of the method, the setting in which it is applied, the "therapist" (professional or parent), as well as the focus on different learning goals.

Complementary methods for dyslexic children

Phonics training. Many of the existing therapies are based on the Orton-Gillingham (OG) approach and aim at enhancing the children's literacy skills by working on their phonological awareness, through making use of multiple senses (Alexander & Slinger-Constant, 2004). In this way, visual, kinesthetic, and auditory senses are combined, so that for example weak visual memory skills can be compensated by remembering the according sound of a letter (Gillingham & Stillman, 1997). Ritchey and Goeke (2006) reviewed the research literature and found evidence for the effectiveness of OG and OG-adaptations for various aspects of literacy (word reading, word attack skill, reading comprehension, and spelling). The described intervention technique can be seen to follow the phonics approach, as the different component steps to enhance children's phonological awareness are stressed as well.

Alternative methods. Contrary to the findings by Ritchey and Goeke (2006), a meta-analysis evaluating the outcomes of intervention programs has shown that traditional special

educational treatment approaches, like the OG method, fail to reach the desired effect (Swanson, 1999). For this reason, several alternative methods have been developed that set their focus on different aspects apart from working on phonological awareness. These unconventional approaches aim at enhancing reading and spelling skills indirectly. Flaugnacco et al. (2015) showed that music therapy leads to enhanced literacy skills by improving temporal processing and rhythm in dyslexics. The so-called Sunflower Therapy makes use of applied kinesiology, homeopathy, massage, osteopathy, herbal preparations, and neuro-linguistic programming (NLP) (Bull, 2007). While the intervention did not have effects on literacy skills, emotional factors like self-esteem and academic self-concept could be improved. As a third option, neurofeedback training addresses dysfunctional neural activities in specific brain areas and has been shown to improve spelling skills, while the reading skills of the concerned children could not be enhanced (Breteler, Arns, Peters, Giepmans, & Verhoeven, 2010). These alternative approaches to treating dyslexic children all stem from different backgrounds and might be useful complements to the educational interventions that focus on phonics training. Treatment methods are implemented in schools as part of remedial teaching or externally in the manner of coaching groups of students or individual children. In these settings and especially in the school context, parents are often not part of their children's education, despite the clear benefits depicted by research literature (Hornby & Lafaele, 2011).

Seeing dyslexia in a new light

The approaches described earlier all aim at supporting dyslexic children. As these do not benefit from the traditional phonics instruction in school, their deficits are addressed in order to improve their skills. In the past however, many researchers called for a paradigm-shift with regard to dyslexia. This new perspective aims at underlining the potential and resources in order to use these in helping people mastering their academic career. According to Bouman (2014), children dealing with learning difficulties cannot learn in the way the school offers them to, as the way information is presented is incompatible with the way this information is worked on. Consequently, the teaching method should be adapted and the concerned children should not be entitled as "problem children" or be allocated a special status. Eide and Eide (2006) argue in the same vein: they criticize the system of diagnosing and treating children's behaviors as well as the educational system that does not adjust its instruction to children's special educational needs. Prior research has shown that labeling individuals can have detrimental effects (Link, 1987): when being assigned a diagnosis,

negative social and psychological consequences as for example self-depreciation, feeling discriminated against and abandoned, as well as income reduction, and unemployment may emerge.

Instead of focusing on deficits and problems encountered by dyslexic persons, Eide and Eide (2011) describe how the topic should be seen in a new light and how the learning style of those concerned differs from the one of non-dyslexics. Prior research has related dyslexia to right hemisphere dominant thinking (Vlachos, Andreou, & Delliou, 2013). The Nobel Prize winner Roger W. Sperry (1975) claimed that the educational system fails to adequately address the "minor hemisphere", talking about the less logical, more creative thinking right brain half that is preferred by dyslexic people. Sperry criticizes that schools attend mostly to left-thinkers who excel in thinking straight and drawing correct conclusions. However, those who come to solutions in a different and innovative, some might say chaotic, way fall behind. Supporting this standpoint, Edwards (1979) warns against failing to value and challenge the right brain's power.

Left-brain dominant and right-brain dominant thinking

This line of research suggests that the specific, right brain dominant learning style might profit from alternative instruction that is different from the phonics approach. Each individual differs in the extent to which either the left or the right hemisphere is preferred; a phenomenon called hemisphericity (Bogen, 1969). Although both hemispheres are involved during each activity that is executed, the left brain half excels in logic, language, and arithmetic, while the right brain half dominates concerning emotions, music, imagery, and creativity (Adolphs, Damasio, & Tranel, 2002; Narumoto, Okada, Sadato, Fukui, & Yonekura, 2001). Another difference between learners that are left-focused and right-focused is the general learning technique, which can be described as linear, logical, stepwise, and from-parts-to-the-whole for left-oriented individuals and as nonlinear, impulsive, and from-the-whole-to-its-components for right-oriented individuals (Iaccino, 1993; Pink, 2006; Springer & Deutsch, 1985). In consequence, right-oriented learners try to find a solution to a problem right away (simultaneous) and have a hard time analyzing parts of a problem first, in order to work out a stepwise solution procedure. Relating this reasoning to learning languages in school, it seems logical that some children stumble when being instructed to use spelling rules to find out how to write a certain word.

The dual channels principle (Baddeley, 1999) gives a further indication on the different ways information is worked on in left and right-oriented thinkers. It describes that learners process information via two different channels: the verbal one and the visual one. In the verbal system, oral material such as spoken language is worked on, while in the visual system, pictorial information such as written words is processed. The link between dyslexia and visual spatial talents has been established in various studies (for example, Everatt, Steffert, & Smythe, 1999; Steffert, 1999; von Károlyi, 2001). In consequence, it might be easier for dyslexics to encode and remember information that was processed via the visual channel. Adapted to the school context, one helpful suggestion appears to be that instruction as well as learning content is offered to the students not only as verbal information, but also as written or pictorial representations.

Since the phonics approach focuses on the logical combination of component letters and sounds, and at a later stage the synthesis into bigger words and sentences, it works effectively for left brain thinkers. However, children that mostly use their right brain half are not addressed by the phonics approach because they "jump" to the whole word or sentence right away, are confused by this mass of information and thoughts and consequently cannot work successfully with this kind of instruction. In addition, repetition of the same manner of instruction seems to be a reasonable approach for left oriented learners, while it does not reach the desired effect for right oriented learners because their mass of thoughts and associations disrupts this automation process. Furthermore, if instruction is provided verbally only (as in a lecture format), it represents a disadvantage for right-oriented children because they focus more on images and less on language. In turn, misunderstandings emerge because this type of learners does not understand the verbal instruction correctly since it is not adapted to his educational needs.

The Kernvisie Method (KVM)

Based on these considerations, the Kernvisie Method (KVM) was developed by Wim Bouman (2014) in order to help children with special educational needs achieve the school's learning goals. One core characteristic of the KVM is the focus on visualization and imagery, to make information plain to the students with a right brain preference and a left brain weakness. The KVM argues that, within the preference to think with the right hemisphere, it can be further differentiated whether the child favors to think with a visual thinking system or with a kinesthetic thinking system. Individuals that favor the visual system think in terms of

images. In their language use, they often express themselves in visual terms. Consequently, these children can sometimes be hard to understand and might appear chaotic and initiative. In contrast, individuals that prefer the kinesthetic system act according to their feelings. The atmosphere and the teachers' attitude during learning situations are very important, which is why these persons can be described as rather sensitive and reactive than initiative. While learning something, they need time and room to think everything over.

In the subject domain of language, children working with the KVM learn to write and spell words correctly by eliminating inaccurate word pictures and imagining the right word picture in their heads. Being stored by the learner, the word picture can be retrieved every time it is needed, in order to present the correct spelling. The approach to memorizing whole words can be categorized as following the sight-word learning route. This procedure represents the second core element of the intervention. However, the inaccurate word pictures were encoded by students and have been stored alike for years. In this way, they hinder correct and rapid reading as well as accurate spelling. As this problem is not addressed by the phonics approach, it persists continually and consequently, improvements are inhibited. Through elimination of the inaccurate representations and memorization of the correct spelling, words in texts are recognized faster and in turn, the reading speed increases. Furthermore, the correct spelling that is imagined serves as a template that enables transferring the accurate spelling onto paper.

The KVM kind of learning is easier for the targeted students, because persons that prefer thinking and learning with their right hemisphere focus on images, encode information as pictures, and recall knowledge through imagery. By targeting right-oriented thinkers, the KVM aims at addressing their preferred learning style and providing an alternative to the regular instruction that is suited for left brain thinkers. The intervention advocates the idea that the awareness of the students preferring to think with their right brain enables to provide information to the pupils in a way that fits their learning style better. In turn, misunderstandings can be avoided and the learning achievement of right-oriented pupils can be enhanced. In the subject domain of language, it might be better to offer the concerned pupils the whole word picture right away and let them store this visualization that is tuned to their way of learning (learner-centered approach). In this way, the school system would realize and appreciate different learning styles and do more children justice by leading them by their own qualities. Connor and Morrison (2016) recently showed that individualizing instruction to students' needs can lead to higher academic achievement and enhanced literacy skills. Although the division into different learning styles as well as according instruction has

been criticized in past research (Kirschner & van Merriënboer, 2013), it is important to develop and scientifically evaluate innovative methods that originate from years of practical experience.

What differentiates the KVM from some other intervention programs designed for dyslexic children is the fact that the parents are part of a three-way commitment between coach, child, and parents. Thus, they are present during the whole process and support their child continually. The involvement of parents has been shown to be beneficial for both the motivation and achievement outcomes of children in diverse studies (Gonzalez-DeHass, Willems, & Holbein, 2005; Hoover-Dempsey et al., 2001; Jeynes, 2003). Furthermore, the developers of the KVM aim at reaching schools and want to implement their method in this setting as well. This step represents a strong practical advantage over intervention methods that have been developed scientifically and never managed to leave the world of science. Besides, students of families with low financial means are not rejected the intervention method in this way.

The present research

The main objective of this study is to investigate whether children's spelling skills improve more when being instructed by the KVM, compared to skills development that can be expected based on benchmark data. The KVM is used as an individual coaching approach and can therefore be seen as an additional instructional technique for students that do not benefit sufficiently from the normal instruction in school. We hypothesize that (a) the spelling skills of children who are coached with the KVM improve significantly more, compared to the spelling skill development that can be expected based on benchmark data. This hypothesis draws on the reasoning that the special educational needs of weak language learners are addressed more effectively via the KVM because it can be seen as an added individualized value to instruction in schools. In order to investigate this prediction, existing CITO spelling test scores of primary school students in grades two, four, and five are analyzed. The development of spelling test scores during the KVM instruction is compared to the spelling test score development of the benchmark for each grade.

Further, we want to examine (b) whether children with different KVM starting points (i.e., either in the first half or in the second half of the school year) show differential gains in spelling ability in their second term in school. Exploratory analyses will be conducted to study this comparison.

Additionally, we aim at investigating whether the KVM is more effective for different kinds of subgroups. We will examine (c) whether the KVM is more effective for girls or for boys. These analyses are of exploratory nature.

Further, we predict that (d) the intervention is more effective for children that prefer to use their visual thinking system than for children that prefer to use their kinesthetic thinking system. The intervention's focus on imagery is maximally suited to visual-dominant children's preferences and consequently, they are expected to profit more from the KVM.

Finally, we predict that (e) the KVM is more effective for children that are diagnosed with dyslexia than for children that are not diagnosed with dyslexia. Since dyslexics have been shown to be talented regarding visualizations and imagery, the dyslexic students in our sample are expected to benefit more from the intervention than non-dyslexics.

Method

In this section we describe the children taking part in this study, the approach and implementation of the Kernvisie Method (KVM), the data used, the data collection, and finally the way the data were analyzed.

Participants

Table 1

Descriptive Statistics for the Participants' Gender, Age, and Coaches – by Grade

	Grades			Total
	Two (n = 6)	Four (n = 6)	Five (n = 7)	
Gender (n)				
female	3	2	5	10
male	3	4	2	9
Age				
M (SD)	7.20 (.45)	9.50 (.84)	10.14 (.69)	9.00 (1.45)
Coaches (n)	5	2	2	7

There were nineteen participants in this study who attended grades two, four, and five at the start of their individual KVM coaching. Table 1 presents the number of participants per grade and per gender. Furthermore, it gives the means and standard deviations for their age and the number of different coaches, at grade level and in total. In the table, the number of coaches per grade does not add up to the total number of coaches, since some work with children of more than one grade. All the children received regular instruction in their schools. However, this kind of teaching did not yield the desired effects as problems in specific subject areas arose. This is why the parents of the children participating in this study decided to let them receive additional support through the alternative instruction of the KVM, in order to improve their school achievement.

Kernvisie Method (KVM)

The individual coaches that instruct their clients with the KVM were all trained by Wim Bouman and thus certified Kernvisie-Coaches. The method can be seen as additional training that is given to children for which the regular instruction in schools is insufficient. It aims at supporting children with special educational needs in the Netherlands. This study focuses on pupils' development in the language domain spelling.

During all the coaching sessions the children's parents are present, while being advised to note down how they can support their child at home, not to interrupt the dialogue between the coach and their child, not to correct the child, and to ask the coach only, if questions appear. The content of each coaching session is structured consistently for all children. For each grade, different components are selected, based on grade level. All the sessions last one hour and specific learning material that was designed according to the KVM is used. Three weeks always pass between two subsequent sessions. Following the coaching sessions, homework is assigned aligned to the content treated during the session. As the parents support their child during the assigned tasks, their commitment is stressed in this way as well.

Children of all grades start their initial session with establishing a relation to the coach and getting to know the basic techniques of the KVM. The coaches aim at clarifying that the child is no less intelligent than other children and that their way of thinking is very creative. Further, it is tested which thinking system the child prefers (as explained later). The student is asked to draw a picture of his head that visualizes the moment he struggles in the thinking process. Afterwards, the coach explains that the mind is capable to imagine much more than is possible in reality.

In the next step, the child is asked to write down the alphabet without any help. The alphabet represents the starting point to the actual KVM coaching. While the student writes it down on his own, the coach is able to observe how well the letters are automated, whether the child gets stuck somewhere, whether some letters are inaccurately ordered, or missing completely. The results of this task already point to first problems that need to be addressed. After this task, the alphabet is visually presented to the child in clusters, which follow the alphabetic order, to facilitate encoding it correctly into the child's memory. The clusters are used because learning content has been shown to be easier to learn when arranged into chunks, rather than a line of all letters would be (Mayer, 2008). The coach instructs the child to look at each chunk, then cover it up, and visualize it in its head. In this way, all the clusters

are encoded into the child's memory. In order to transfer this learning content, the parents are asked to put a print-out of the clustered alphabet to the wall at three different spots in the family's home for three days. Every time the child sees it on the wall, it is instructed to check whether the picture of the alphabet in their brain fits the alphabet on the wall.

Finally, incorrectly spelled words are eliminated in the long-term memory of the children. For this purpose, the coaches make use of a word list, which is specifically tuned to their client's grade-level, and dictate these words to the child. Afterwards, wrongly spelled words are identified and erased from the child's long-term memory. A meaningful metaphor is chosen to make this step as personally significant as possible. One example for such a symbol might be kicking the wrong word away if the concerned child plays soccer. In this context, it is important to use the child's input and work together as this enhances the child's motivation. In turn, the correctly spelled word is written down and thus serves as a picture that the child needs to put in its head by "seeing it in its brain" in order to encode it into its long-term memory. This corrected word picture can be accessed every time the student needs to write the word down. Furthermore, it helps to rapidly read a word because the child recognizes it right away through the corrected picture in their brain. The parents are asked to let their child write down the words again in the next three days.

Table 2 gives an overview of the selected subsequent coaching sessions for the individual grades, including content and total amount of sessions per grade. The sessions two to five address the subject language, including spelling, reading, and grammar. Session six deals with mixed topics before the subsequent three sessions focus on mathematics topics. The course of language as well as math sessions is conceptualized in increasing complexity. Finally, the emotional factors accompanying learning difficulties are addressed and complete the coaching.

Table 2

Overview of the Course of Coaching Sessions

Grade	1	2	3	4	5	6
Initial contact: presentation of the KVM approach	√	√	√	√	√	√
Two symbol sounds (au, ou, ei, ie, ij, eu, ui, g/cht, f/v, s/z)	√	√	√			
Spelling rule: short and long sounds	√	√	√			
Present and past tense				√	√	√
Past participle (and reading)				√	√	√
Reading	√	√	√			
Mind map (concentration) and topography				√	√	√
Calculation 1-20	√	√	√	√	√	√
Count tables		√	√	√	√	√
Applying computational techniques (addition and subtraction, multiplication and division)	√	√	√	√	√	√
Relaxation techniques, self-confidence, clockwatching	√	√	√	√	√	√
Amount of coaching sessions	7	8	8	8	8	8

Data

Thinking style preference. Before starting to work with a specific child, the KV-Coaches test whether it prefers to think in a visual or in a kinesthetic way. This is done by asking the child what it ate the day before yesterday. In turn, the child's eye movement is observed while it is thinking and the coach can deduce the thinking system accordingly. If the

child moves its eyes upwards, the visual system is used. If the child moves its eyes diagonally downwards, the kinesthetic system is used. This information is recorded by the coaches in order to adapt their language use to the child.

Demographic information. The demographic information of the participants is collected during the initial contact session, by means of an intake form that is filled out by the parents. Variables that were included in this study are age, gender, and presence or absence of a dyslexia diagnosis.

Spelling ability. In order to compare the spelling ability growth of the participants during KVM instruction to expected spelling ability growth of average students based on benchmark data, existing CITO spelling test results were used. These were retrieved from the student monitoring system of the schools and collected from the parents of the participating students. Children in the Netherlands are regularly administered the standardized test battery CITO that explores amongst other subject domains spelling. The CITO subtest that was taken into account is the Spelling 2012 test series. In this test, words as well as sentences are dictated to the children in order to examine their level of spelling ability. The raw scores of each child (number of correct answers) are transformed into ability scores, which serve as measures for the participants' spelling ability in this study. Within this test series, there is one continuous ability scale across grades (Cito, 2009).

Data collection

The CITO administration takes place regularly in the middle and end of each school year in the schools of all participants. Children's scores are stored in the schools' student monitoring systems and handed out to the parents. As the children enter the individual coaching any time during the year, the participants started working with the KVM on diverse points in the school year, either in the first or the second half. The parents of KVM students were contacted by the KVM administration and informed about the purpose of the study. With providing their children's CITO test results, they gave their informed consent to use their children's data.

Data analysis

To test the hypothesis that KVM students show a significantly higher achievement growth in spelling than can be expected based on benchmark data, we will compute the growth in spelling ability for the grades two, four, and five separately. For the second grade students, the achievement gain is computed from the test moment end of grade one (E1) to the test moment end of grade two (E2). For the fourth grade students, the spelling ability growth is computed from the test moment end of grade three (E3) to the test moment end of grade four (E4). For the fifth grade students, the achievement gain is computed from the test moment end of grade four (E4) to the test moment end of grade five (E5). Furthermore, the average growth for these academic career moments will be computed from benchmark data and subtracted from the growth of KVM students, for each grade separately. Grade-wise t-tests will be conducted with these difference scores in order to determine whether or not the progress of KVM students is significantly higher than the one of average students.

In order to examine differences in spelling ability growth during the second term for children with different KVM starting points (first or second term), we will compute the spelling ability growth during this term for each grade separately. The half-year growth for second graders is computed from the test moment middle of grade two (M2) to the test moment end of grade two (E2). The half-year growth for fourth graders is computed from the test moment middle of grade four (M4) to the test moment end of grade four (E4). The half-year growth for fifth grade students is computed from the test moment middle of grade five (M5) to the test moment end of grade five (E5). Grade-wise one-way Analyses of Variance (ANOVAs) will compare this growth of first term and second term KVM students.

To examine the predictions regarding differential effects based on gender, preferred thinking style, and dyslexia diagnosis, grade-wise one-way ANOVAs will be performed on the achievement gain in spelling of the KVM students. In this way, the spelling growths of the different subgroups will be compared.

Results

Comparison of KVM students' spelling ability growth to the benchmark

Table 3

Means and Standard Deviations of Spelling Ability Scores for the Study's Participants and the Average Student based on Benchmark Data, at the End and Middle Grade Test Moments

	Sample *M* (SD)	BM *M*
E1	103.33 (11.02)	115.00
M2	114.33 (13.22)	121.00
E2	117.33 (14.14)	122.00
Growth Grade 2	14.00 (6.60)	7.00
E3	121.33 (3.33)	130.00
M4	128.33 (4.03)	133.00
E4	134.67 (7.01)	137.00
Growth Grade 4	13.33 (6.09)	7.00
E4	131.14 (6.64)	137.00
M5	133.29 (5.22)	139.00
E5	135.00 (4.76)	141.00
Growth Grade 5	3.86 (3.02)	4.00

Note: BM: Benchmark

Table 3 provides means and standard deviations of the spelling ability scores on the three career moments end of first school year (E1), middle of second school year (M2), and end of second school year (E2) for second grade students; end of third school year (E3), middle of fourth school year (M4), and end of fourth school year (E4) for fourth grade students; and end of fourth school year (E4), middle of fifth school year (M5), and end of fifth school year (E5) for fifth grade students. Furthermore the gain in scores during the second, fourth, and fifth grade is included for both KVM and average students.

The spelling ability of students in all grades is measured on a common scale and students are expected to improve in ability between test moments. Based on benchmark data, the average growth in spelling ability for the test series 2012 from test moment E1 to E2 is seven points, from test moment E3 to E4 seven points, and from test moment E4 to E5 four points on the ability scale (Cito, 2009). There was a statistically significant difference between spelling ability growth in grade two for KVM students and average students, t (5) = 2.60, p = .048. This means that the growth of KVM students was significantly higher than the average growth that can be expected based on benchmark data. This result is presented in Figure 1. The further t-tests revealed that there was no statistically significant difference in spelling ability growth in grade four for KVM and average students , t (5) = 2.55, p = .051, as well as in grade five, t (6) = -.13, p = .91. These results are presented in Figure 2 and Figure 3, respectively. This means that these KVM children's and the average students' development in spelling ability did not show a difference in increase. Because of the small sample size these results cannot be used to draw thorough conclusions on.

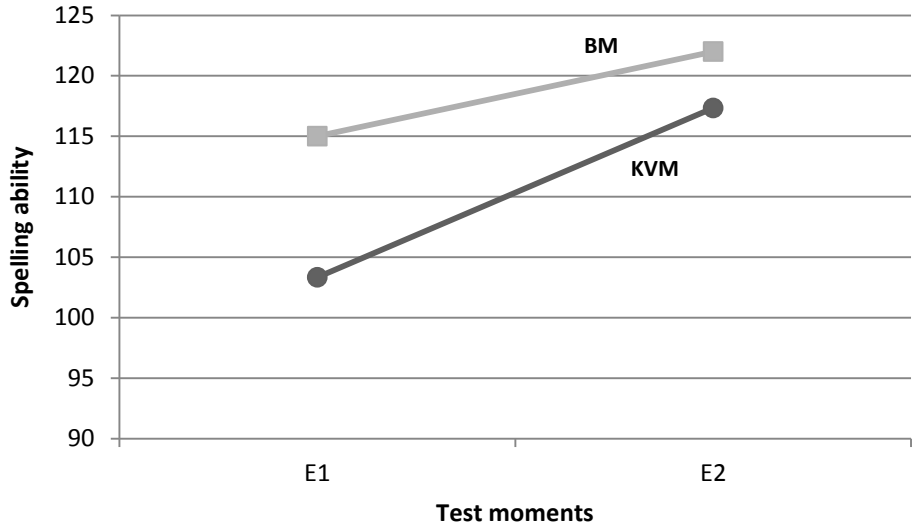

Figure 1

Spelling Ability Growth for KVM and Average Second Grade Students from Test Moments E1 to E2

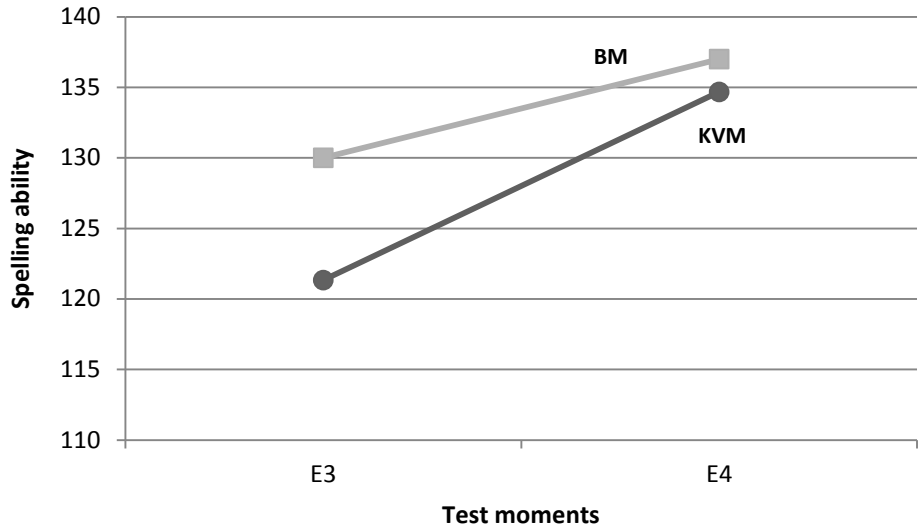

Figure 2

Spelling Ability Growth for KVM and Average Fourth Grade Students from Test Moments E3 to E4

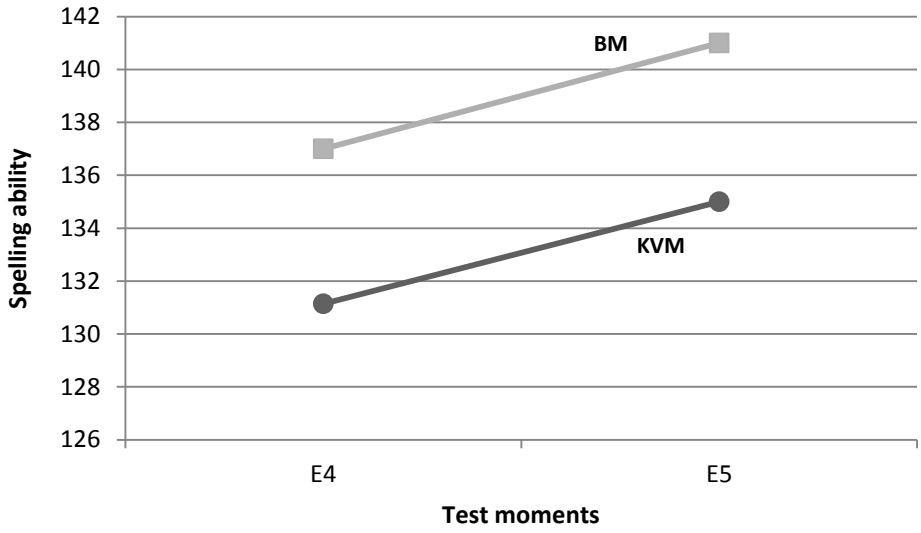

Figure 3

Spelling Ability Growth for KVM and Average Fifth Grade Students from Test Moments E4 to E5

Half-year growth for KVM students with different starting points

Table 4

Means and Standard Deviations of Half-Year Spelling Ability Growth for First and Second Term Students – by Grade

	M (SD)
Grade 2	
first term (n = 3)	0.00 (7.21)
second term (n = 3)	6.00 (8.72)
Grade 4	
first term (n = 2)	7.00 (4.24)
second term (n = 4)	6.00 (6.00)
Grade 5	
first term (n = 2)	-1.00 (0.00)
second term (n = 5)	2.80 (2.05)

The means and standard deviations of the half-year growth in spelling ability for first and second term KVM students are presented in Table 4. To compare the second term growth in spelling ability of children starting in the first term and students starting in the second term, grade-wise one-way Analyses of Variance (ANOVAs) were conducted. The analyses revealed that there were no statistically significant differences in second term spelling ability growth for first and second term KVM students; grade two: F (1, 4) = .84, p = .41; grade four: F (1, 4) = .04, p = .85; grade five: F (1, 5) = 6.14, p = .056. This means that we could not find significant differences in half-year spelling ability growth for first and second term KVM students.

Gender difference in spelling ability growth

Table 5

Means and Standard Deviations of Spelling Ability Growth, per Gender, Preferred Thinking Style, and Dyslexia Diagnosis – by Grade

	Grade 2 (n = 6)		Grade 4 (n = 6)		Grade 5 (n = 7)	
	M (SD)	n	*M* (SD)	n	*M* (SD)	n
Gender						
female	17.00 (6.25)	3	12.67 (5.51)	2	3.60 (3.51)	5
male	11.00 (6.56)	3	14.00 (7.81)	4	4.50 (2.12)	2
Thinking style preference						
visual	18.00 (8.49)	2	14.00 (7.81)	3	5.33 (2.08)	3
kinesthetic	12.67 (6.81)	3	12.67 (5.51)	3	1.67 (3.22)	3
Dyslexia diagnosis						
yes	n/a		n/a		4.75 (1.50)	4
no	n/a		n/a		2.67 (4.51)	3

Table 5 gives the means and standard deviations of spelling ability growth for the different subgroups, per grade. To test whether the method was more effective for girls or for boys, grade-wise one-way Analyses of Variance (ANOVAs) compared the mean growth in spelling ability for female and male KVM students. Analyses revealed that there were no statistically significant differences between these mean improvement scores for girls and for boys; grade two: F (1, 4) = 1.32, p = .32; grade four: F (1, 4) = .06, p = .82; grade five: F (1, 5) = .11, p = .76. Said differently, we could not find a difference in effectiveness for either sex.

Spelling ability growth for visually and kinesthetically thinking students

In order to investigate whether KVM students that preferred to think visually showed a significantly higher mean growth in spelling ability than KVM students that preferred to think kinesthetically, ANOVAs compared the mean growth in spelling ability for these two groups of children. In grades two and five respectively, the preferred thinking system of one student is not known. Therefore only five students are included in the analysis for grade two and only six students are included in the analysis for grade five. The mean spelling ability growth for visual-dominant thinkers was higher than the one for kinesthetic-dominant thinkers in all grades. However, ANOVAs revealed that there were no statistically significant differences in mean growth in spelling ability for KVM students with a visual thinking preference and for those with a kinesthetic thinking preference; grade two: F (1, 3) = .62, p = .49; grade four: F (1, 4) = .06, p = .82; grade five: F (1, 4) = 2.75, p = .17. This means that those KVM students that preferred to think visually did not have a significantly higher ability growth than those KVM students that preferred to think kinesthetically and vice versa. In other words, the KVM was not more effective for one thinking style preference.

Spelling ability growth for students with and without a dyslexia diagnosis

To investigate the prediction that KVM students with a dyslexia diagnosis show a significantly higher growth in spelling ability than KVM students without a dyslexia diagnosis, ANOVA compared the spelling ability growth for these two groups of students. As there were enough students to examine this differential effect in grade five only, the analysis is limited to the fifth grade students of our sample. Although the dyslexic children showed a higher growth than non-dyslexics, ANOVA revealed that there was no statistically significant difference between these two groups of students, F (1, 5) = .79, p = .42. Said differently, we could not find differences in effectiveness of the intervention for either dyslexic or non-dyslexic students.

Discussion

Student achievement

The aim of this study was to investigate the effectiveness of the Kernvisie Method (KVM) that was developed to support students that require alternative instruction. We predicted that KVM students' growth in spelling ability was significantly higher than average growth that can be expected based on benchmark data. This hypothesis could only be supported for the second grade students in our sample. Said differently, the second grade children receiving the KVM intervention caught up to the standard, because they raised their ability level from below average towards the average development in spelling ability. The fourth and fifth grade KVM children did not show a higher growth than average students do. A possible explanation for these findings would be that the second grade is a quite early point in children's school career. Therefore, the chance of early intervention is used and it might be possible to achieve more positive outcomes than if the method is implemented at a later stage. In the case of fourth and fifth grade students, the children's problems might have become severer and spread to diverse subject domains (Torgesen, 2004).

Another benefit of the KVM over regular instruction in schools is its focus on visualizations of the learning content. As the children receiving the individual coaching continue going to school, the alternative KVM instruction is added to the phonics instruction taught in their daily educational context. As discussed earlier, former research has shown that interventions that aim at improving children's phonological awareness do yield significant effects (Hurford et al., 1994). Using the phonics training as a basis, the KVM serves as additional approach that helps children to look at the learning content from a different perspective. This combination appeared to be fruitful for the second grade children suffering from learning difficulties in our sample. Through the KVM, incorrectly spelled words are eliminated in the children's memory and are substituted by accurate word pictures. In turn, these corrected representations help in reading faster and spelling correctly, also in the school context. Furthermore, the correct representations of words and word segments might help in profiting from the traditional phonics approach in school. The second grade children do not have as much inaccurate word pictures, compared to older children in grade four or five. This might be a reason why they are able to benefit from the alternative instruction and show a significantly higher spelling ability growth than average students. Regarding the fourth and fifth graders in our sample, it is possible that they need more time to adjust themselves to the

novel approach and reach improvements. They worked differently in school for years and consequently, their collection of incorrect word pictures has not been erased by this traditional instruction.

Another possible factor explaining the intervention effect for the second graders is the involvement of children's parents in each coaching session as well as in homework activities. In line with the findings of this study, the parental encouragement might be especially important for younger children. One possible reason might be that this early point in children's academic career is the stage at which they acquire completely new skills, while later (in grade four and five) these skills are expanded and refined. The additional support of parents might not be experienced by the concerned children if they participate in remedial teaching in schools only. Thus, it can be seen as a strong advantage of the KVM compared to sole remedial teaching in schools. Prior research has shown that parents' encouragement and interest in children's academic activities leads to higher intrinsic motivation in the children (Ginsburg & Bronstein, 1993). Furthermore, Dweck (1986) found out that motivation is an essential determinant for the acquisition of new skills as well as the transfer of obtained skills in novel contexts. Consequently, motivation might serve as a mediator between the involvement of parents and student's ability to acquire new knowledge and skills.

Differential effects

In this study, we compared the second term growth in spelling ability of KVM students starting with the intervention in the first half and KVM students starting with the intervention in the second half of the school year. The two groups of KVM students did not differ in how much they raised their spelling ability during the second term. Probably, the ability gain becomes apparent right after starting with the method, and first term students were able to conserve this increase into the second term. In addition, we examined whether girls or boys benefitted more from the KVM. We did not find gender differences in the effectiveness of the method. Although in general, girls show a better spelling achievement than boys (Allred, 1990), this does not mean that they display a higher gain between two school career moments.

Furthermore, we expected students with a visual-dominant thinking style as well as dyslexic children to profit more from the method than students with a kinesthetic-dominant thinking style and non-dyslexics, respectively. Although these predictions could not be supported by the conducted analyses, the mean improvements in spelling ability generally

point in the hypothesized direction for the different subgroups. It might be the case that students need more time to profit from the intervention and that subgroup effects become apparent after a longer time. Besides, the approach to visualize the learning material to the concerned students suits those children more that prefer to think and learn with their visual system. Furthermore, the visual gift of children with dyslexia is addressed by the instructional approach of the KVM. Additional studies with a larger sample size, which enables to draw thorough conclusions, might yield significant effects.

Limitations of this study

Besides the advantages of the KVM that have been described earlier, there is a need to recognize several limitations of both this research study and the KVM. Because of the limited sample size, no reliable conclusions can be reached with this examination. In consequence, the validity of our results is restricted as well. Since no control group was available to compare the achievement growth of the KVM students to, this contrast was established to average growth that can be expected based on benchmark data. It might be more useful to assign waiting list control subjects to a control group. These would probably represent a more realistic reference value, because average students might differ from KVM students in certain confounding variables that affect their ability growth (such as for example, motivation and self-esteem). Consequently, it might be wiser to test participants with regard to these emotional aspects in advance and assign matched subjects to an experimental and a control group. Like this, causal inferences could be established that would elaborate the effectiveness of the method more thoroughly.

Kernvisie Method (KVM)

Structure of the intervention. The intervention method might profit from scientific techniques. Unfortunately, the Kernvisie-Coaches do not make use of any standardized tests to measure their students' achievement progress or motivation level, and to ensure the quality of their work accordingly. From a scientific standpoint, this aspect should be changed urgently in order to adapt the KVM instruction to the children's needs, to guarantee the quality of the approach, and to keep improving this intervention program. In addition, the criteria to include children in the coaching as well as to reject coaching are not clearly defined, as for example no dyslexia diagnosis has to be assigned in advance. Since no

imaging techniques are applied to investigate children's brain activities, it cannot be legitimately concluded that all the clients prefer to think and learn with their right brain half and that the KVM instruction is suitable in consequence. Furthermore, one can depict a logical inconsistency in the content of the KVM: it is claimed that rules, as used in standard school instruction, are ineffective for KVM students as these prefer to think in a more creative way and not as stepwise as "left-thinkers". However, one coaching session is incorporated that focuses on a spelling rule for the Dutch language. Following the reasoning of the Kernvisie approach, the instruction in this session should not help to improve the spelling ability that is addressed by this rule.

Furthermore, the KVM always includes the domains literacy, math, topography, and general emotional aspects as self-confidence. Although parents are asked for suggestions on what subject domains to work on with their child, the same sequence of sessions is adhered to with every student. This procedure might be questionable for some children and parents who want to address problems in one subject area only. Because factors as self-esteem are present in all learning difficulties, they are definitely worth to include for all clients. However, the benefit of working on math if the child does a good job in this subject at school is to be examined.

Visual and kinesthetic thinking styles. Another aspect that one might argue about is the differentiation between the dominance in visual thinking versus kinesthetic thinking, which is elaborated on in Wim Bouman's book. As described in this study, the KV-Coach determines which system is preferred by the individual child before the coaching sessions start. However, the way to test the children's thinking style preference is not backed up scientifically. It is possible that children's eye movements are determined by other factors than their thinking style, such as shyness. Furthermore in the next step, this discrimination is not applied to the material the children work with or the instructional techniques used, as these focus on visualizing the learning content. The specific learning system solely dictates the coaches' language use. If this differentiation is thought to be helpful by the developers, they might perhaps consider implementing distinct instructions that present the learning content according to the pre-specified learning systems. According to their line of reasoning, this might help to reach higher effects in the children's achievement as well as their motivation.

However in general, it is questionable to what extent it is useful to discriminate and separate these two sense systems. Schick (2004) describes how all the senses are involved

during the reading and spelling process: as one reads a word or writes a word down, the visual sense is used to see the letter combination. The auditory sense is activated as one hears a word and as the pronunciation is imagined or the word is spelled out aloud. If the spelling of a word is already automated, the student experiences a good feeling, as he or she can be sure that the word is spelled correctly or can be read fluently. If the spelling is not fully automated or the student encounters a novel word though, the student might be insecure about the correct spelling or pronunciation and less positive feelings occur. Consequently, the kinesthetic sense is involved in the process as well and therefore, it appears useful to use all these systems in instruction also, as for example the multisensory Orton-Gillingham intervention described earlier does.

Phonological awareness. Another aspect of the KVM that might raise doubts is the fact that word pictures of words that are already known are used; however these might not help the children in knowing how to spell novel, unknown words. This case might be better addressed by spelling rules and strategies as taught in school. In support of this reasoning, McArthur et al. (2015) found out that a combination of sight word training with phonics training resulted in higher achievement gains than both did on their own. As it has been shown that dyslexic children suffer from deficits in phonological awareness that persist into adulthood (Bruck, 1992), it appears useful to address this weakness in intervention programs. The finding that phonological awareness training successfully raises reading as well as spelling skills supports this approach (Ball & Blachman, 1991). This is why it might be useful to teach children remedially with a combination of the KVM (as sight-word approach) and traditional phonics instruction.

Innovation. A last point that can be criticized is that, contrary to the claim of innovation and novelty, Browder and Lalli (1991) already reviewed research on sight word training twenty-five years ago. This stresses the fact that this kind of instruction is well-known in education. In consequence, each concerned individual needs to decide whether or not the Kernvisie approach is of added value for him or her, especially regarding the costs of individual coaching that parents have to pay completely by themselves. This aspect is attended to though, as the KVM developers further widen their team of coaches to teachers in schools. Consequently, the approach might be helpful for a larger population than it would be with individual coaching only. In this way, it is also accessible for children with special educational needs that might not afford the costs of individual coaching.

Directions for future research

In order to adapt the schools' instruction to students' special educational needs, it seems important to implement alternative teaching methods, such as the KVM, in the school context. This provides an option for pupils, who do not profit from the regular instruction that they received so far. As already described, the KVM starts being integrated into the school context by training teachers through the exclusively developed trajectory "Leerkrachtig Onderwijs". Future research should examine whether the method provides a good alternative for children that do not profit from class instruction. If implemented into the school context, the KVM needs to be adapted in order to realize the integration into this environment. Possibly, children profit more from the intertwined instruction that they receive from one educator only. It would be interesting to study differences in effectiveness between both trajectories in which the KVM is implemented (individual versus school). Furthermore, the aspect of parental involvement should be studied further, in both settings. As described earlier, it might be an important factor for the young children, which contributes to the success of the method. It might not be possible to involve the parents in the school context as much as is possible in the individual coaching. Additionally, the motivation levels of children in both trajectories might differ and this variable might affect academic achievement. Future research should examine these effects.

In each educational situation, the students' motivation is a major factor that might determine whether or not the provided instruction will be effective. As the KV-Coaches report observing immediate results regarding self-esteem and enthusiasm in their clients, another interesting aspect for further studies would be the effect of the intervention on students' motivation. Since dyslexics' self-esteem has been found to be one of the main concerns for parents (Riddick, 2010), this aspect should not fall behind in scientific investigations. In order to test these observations systematically and be able to draw meaningful conclusions, quantitative tests should be conducted prior, during, and after the intervention. Like this, the possible mediating relation between parental involvement, students' motivation, and their academic achievement, which was mentioned earlier, could be investigated.

Since both spelling and reading skills are concerned in dyslexics, the effectiveness of the intervention on children's reading ability should be investigated in future research studies. As explained earlier, the elimination of inaccurate word pictures and the substitution with corrected representations should facilitate the reading process and increase the reading speed. In addition, the children's reading comprehension might benefit as well. Furthermore, the

method also treats mathematical topics. Consequently, improvements of KVM students in this topic should also be examined.

When reasoning about the effectiveness of a certain intervention method, it is always interesting whether or not the achieved results can be conserved after terminating the treatment. For this reason, it might be useful to inspect long-term effects of the KVM on both motivation and academic achievement. With such an investigation, it might be possible to provide a prediction regarding post-intervention progress of the treated children.

Concluding remarks

In conclusion, the findings of this research study suggest that the second grade KVM students in our sample illustrated a significantly higher growth in spelling ability than the average student does. Since this effect was not found for the rest of the sample, the results are inconclusive across grades. The method could not be shown to be more effective for another subgroup of students. Aiming at improving the validity of this effectiveness investigation, future research should include a larger sample size as well as a control group to enable reliable and causal inferences. In addition, future studies should make use of standardized tests that measure both literacy skills as well as motivation, since the emotional factors influencing the effectiveness of an intervention should be taken into account in any case.

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