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In search of effective remediation for students with developmental dyslexia – a review of contemporary English literature

Abstract: Although developmental dyslexia is frequently diagnosed in Poland, little knowledge of effective treatment for this disorder is available in Polish society. Remedial teachers for many years have applied traditional methods aimed at correction and compensation for affected cognitive functions and academic skills. Otherwise, although western therapies are regularly advertised in the media, their effectiveness has rarely been subject to scientific investigation. Since the assumptions underlying some approaches are not consistent with current understanding of cognitive function, they may attract negative expert appraisal.

Unfortunately, it seems that fashion in dyslexia therapy is resistant to rare expressions of criticism from the scientific community. The purpose of this article is to promote awareness about effective treatment for specific reading disorders. Teachers' greater understanding in this area should help Polish dyslexic children and their parents, who may be confused by offers of misguided therapy and sharp business practise. It is hoped that this article will clarify the situation.

In this review of modern English journal articles, focus is on remedial teaching of reading, and more specifically, support for dyslexic students experiencing difficulties in decoding. Here we are concerned only with therapy in alphabetic languages in which individual speech sounds correspond to letters. Analysis of articles from the last six years leads to the conclusion that the most effective therapy for the reading disorder is training in phonological awareness and consolidation of letter-sound knowledge. However, these skills should be practised in the context of reading.

Key words: dyslexia, reading, decoding, remediation, children

Introduction

Research findings of incidence and prevalence of developmental dyslexia vary from 10 to 15% (cf. American Psychiatric Association, 2013; Bogdanowicz, 1985). Some dyslexics seek the help of remediation. Popular methods for dyslexia treatment in Poland include: classical methods used in remedial teaching, Sensory Integration Therapy, Warnke Method, Tomatis Therapy, Paul E. Dennison's Educational Kinesiology and biofeedback. Each of these forms of therapy has its supporters among dyslexic patients-customers, despite the fact that little is actually established about their effectiveness. Worse still, experts opinions about some is negative (e.g., Dennison's Educational Kinesiology), since they are founded on assumptions, inconsistent with current knowledge on the

functioning of the brain (The Committee on Neurobiology of the Polish Academy of Sciences, 2006; Korab, Borowiecka, & Petrykiewicz, 2008). Therefore, the purpose of the article is to publicise research findings on effective treatment of dyslexia. Increased awareness of psychologists, educators and teachers in this area should benefit both Polish dyslexic students and their parents. Unfortunately, they are often victims of misguided therapists and sharp business practice in the promotion pseudo-therapeutic "cures" despite the absence of acceptable evidence to confirm their effectiveness. The main objective of the article was to present contemporary methods of dyslexia treatment based on a review of English studies. However, to render achievement of this goal realistic, it was decided to restrict the article to reading, leaving spelling aside. The main interest is in decoding, not reading comprehension.

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Secondly, reference was only made to experiments assessing the efficacy of intervention on children and teenagers with diagnosed dyslexia (from elementary, middle or high school). This means that issues concerning children at risk of dyslexia or adults with specific reading disorders are beyond the scope of this article. Thirdly, only studies which concern therapy in alphabetic languages were covered, that is: those in which individual speech sounds correspond to letters. Some additional criteria further restricted choice of English language articles on reading treatment for dyslexics from peer-reviewed scientific journals which had been published in the last six years. These articles are of various types, including research reviews, systematic meta-analyses and single study scientific reports.

Developmental dyslexia – what do we already know, and what should we understand better?

The specific reading disorder known as developmental dyslexia is the subject of interdisciplinary research and contributed to by various fields, including psychology and neuropsychology, education and speech therapy. They may apply different methodological approaches, using various terminologies. This explains the persistent lack of agreement on a coherent terminology and consistent aetiology, pathology and even symptomology of the condition, which leads to its plural definition. Heterogeneous diagnostic criteria and the consequent equivocal standards in diagnosis create misunderstandings which further blur the picture of this disorder, fuelling myths popular about dyslexia. The dyslexia phenomenon is so complex that it is difficult to confine it to a single concise definition (Miles, 1995). Therefore, it is more reasonable to describe the disorder. In this light, the basic theses for this condition are presented as opposed to the quotation of a single definition. The main symptoms of dyslexia are difficulties with reading and writing (Rose, 2009; Snowling & Hulme, 2011). There is consensus that developmental dyslexia is individually diverse, displaying many and varied symptoms. It is neurologically based, from which it can be inferred that reading difficulties are accompanied by cognitive deficits, which, in particular, includes the phonological aspect (Krasowicz-Kupis, 2008; Snowling & Hulme, 2012). This deficit is usually associated with phonological processing, i.e., the processing of information as phonemes. In the literature, other related concepts such as phonological skills or phonological abilities are also mentioned. Although the scope of these terms is not always clear or the names consistently used, usually phonological processing is regarded as a superior term to phonological awareness and phonological short-term memory (Duff & Clarke, 2011; Krasowicz-Kupis, 2008). Phonological awareness is the ability to reflect on the phonological structure of words to intentionally transform their structure according to known rules. The tasks used for its assessment may involve the syllable blending or rhyme oddity task (e.g., “Which word does not rhyme: wish, dish, show?”). Phonological short-term memory is responsible for the process of remembering verbal information. The

double deficit hypothesis proposed by Wolf and Bowers (1999) assumes two independent deficits key to dyslexia – the phonological and the rapid naming deficits. The latter alludes to the rapid naming of known visual symbols. Although the history of research into the specific reading disorder is over forty years old (Snowling & Hulme, 2012), no single universal and yet effective remedial method has been found for dyslexics, for which there are at least several explanations. The first lies in the very nature of dyslexia, which, as stated earlier, is a heterogeneous syndrome of many different cognitive disorders. A second relates to the first. There is no consensual definition of dyslexia or its underlying mechanisms. As a result, there are many different approaches to treatment and their inventors invest great effort into the promotion of their efficacy. A third explanation stems from the limited randomized controlled trials for effective dyslexia treatments. This gap, in comparison with studies of various aspects of specific reading disorder, is particularly pronounced (e.g., deficits of dyslexic children). The reason for this probably lies in the time and expense incurred by longitudinal investigation of effectiveness of therapeutic methods to meet high methodological standards for the evaluation of interventions (Bishop, 2013). Brooks remarks that, “In the literature on improving the literacy of children with dyslexia-SpLD, the vast majority of reports are case studies, and most studies of groups have very small samples, making quantitatively-based generalization from them impossible at present. Accessing the many thousands of individual files in the records of specialist schools and organisations in order to uncover evidence of effectiveness would be a very worthwhile research project; an analogy is the painstaking work analysing thousands of patient records which led to the first reliable evidence that taking a low-dose aspirin daily reduces the risk of heart disease.” (2013, p. 78).

Reading in the context of developmental dyslexia

Reading, regarded as a form of language communication, is a complex psycholinguistic process that can be defined as a reception of written text (Krasowicz-Kupis, 2008). No doubt the patterns of mechanisms shaping the speech, especially the level of acquisition of language, influences the process of learning reading skills. The activity of reading requires language skills at phonological, morphological, syntactic and semantic levels, as well as, the cognitive abilities to perform mental operations involving conceptual thinking, memory, attention and visual perception (Krasowicz-Kupis, 2001, 2008). In alphabetic languages, for example Polish and English, writing is based on an alphabet of a limited number of letters. Their function is to represent speech sounds that make up words. In such languages, reading activity is in two phases: decoding (recognition of printed or handwritten letters) and translating them into speech sounds and comprehension of the material read, that is, interpretation of the content of recorded words or text. The condition for skilled decoding is in breaking the alphabetical code and understanding the relationship between letters and sounds. Decoding

is based on three cognitive foundations: knowledge of the relationship between graphic symbols in writing (e.g., letters) and their linguistic equivalents in speech (e.g., phonemes and words), phonological awareness and rapid automatic naming skills (Hulme & Snowling, 2013; Wolf & Bowers, 1999). Since learning to decode depends on the development of specific cognitive functions, the level of development of these functions can be regarded as a significant predictor for success in reading (Griffiths & Stuart, 2013; Hulme & Snowling, 2013; Krasowicz-Kupis, 2008). Of course it should not be forgotten that the foundation of reading alphabetic languages is also letter knowledge (Hulme, Snowling, 2013).

Although the most frequently mentioned symptom of dyslexia is poor decoding, the basic conditions for recognition of specific reading disorder in the International Classification of Diseases, ICD-10 includes reading in the broad sense of the word: “A score on reading accuracy and/or comprehension that is at least 2 standard errors of prediction below the level expected on the basis of the child’s chronological age and general intelligence; with both reading skills and IQ assessed on an individually administered test standardized for the child’s culture and educational system” (1993, p. 177). The assumption that a problem with decoding has a negative impact on reading comprehension, is quite widespread and not without reason. As common sense dictates, it must be hard to grasp the meaning of text when the reader’s decoding is not automatic (O’Brien, Wolf, Miller, Lovett, & Morris, 2011). However, difficulty in decoding and impairment of reading comprehension do not need to coexist, as the relationship between them is more complex than appears at first glance. It should be assumed that in general different pathologies underlie these problems and therefore require different therapeutic strategies. Poor word-level reading skills are associated with deficits in phonological processing. By contrast, problems with reading comprehension are most likely to be caused by “higher level” language deficits, such as: semantics (e.g., deficient knowledge of word meanings), lexicon (limited vocabulary in a given language) and grammar (ignorance of morphology and syntax) (Snowling & Hulme, 2011). Despite these differences, problems with decoding and reading comprehension are not separate nosological units of clear delimitation (Snowling & Hulme, 2012). The complex relationship between decoding and reading comprehension has been well explained by LaBerge and Samuels (1974) who argued that the cognitive components for reading are hierarchical in nature: when the lower level functions (processing consonants, vowels, syllables, grammatical endings, meaningful parts, and the spelling units that represent them) have become automatic, attention can be allocated to the acquisition of higher level components (fluency and comprehension) (LaBerge & Samuels, 1974). However, not all studies support this thesis (Calhoun, 2010). In conclusion, although dyslexics most frequently experience difficulty in decoding, their problem may concern only reading comprehension (in the case of partly compensated dyslexia), or both skills at the same time. Decoding and reading comprehension are intertwined,

the mature reader does not only decode correctly, but also reads texts while understanding their meaning (Snowling & Hulme, 2011), since the ultimate goal is to understand the text (Duff & Clarke, 2011).

Lack of environmental support can lead to dyslexic pupils experiencing increasing problems with reading, which partly explains the “Matthew Effect” described by Keith Stanovich (Stanovich, 1986). This phenomenon is an example of the vicious cycle mechanism and stems from the belief that children who are good readers, read more. As a result, their skills improve, which in turn facilitates their reading. In contrast, children who read slowly and without pleasure, read less, which further reduces their chances of success. Although the “Matthew Effect” has been described in the context of reading comprehension, a similar mechanism can also be observed in decoding. Besides, the “Matthew Effect” should be considered a psychological phenomenon. The more difficulties students experience in decoding, the less frequently they read and in consequence fall further behind. This situation usually leads to reluctance developing towards the activity, which may reduce the chances of success in mastering this difficult skill. It should also be borne in mind that reading skill is a tool needed to acquire knowledge in all school subjects. So if a child does not learn to read in the early grades of primary school, their learning difficulties may generalize and deepen. That is why it is critical to introduce therapeutic intervention at the earliest stage of education.

Methodological criteria for the selection of publications, which are the subject of the scientific analysis

Although this article is not a systematic meta-analysis, meeting stringent methodological standards, certain rules were formulated and followed to foster its objectivity. Literature search on the website, Ebsco Host, was limited to the following databases: Academic Search Complete, Medline, PsycARTICLES, PsycINFO. At the same time, the only articles that were accepted had been published:

- in full (in special cases when on the Ebsco Host only description of relevant article was available, we searched the Internet to find the full text on another page and when it was found, we analysed it);
- in the English language;
- from 2009 to 2015.

The keywords used for the search engine included the following: *dyslexia/dyslexic/specific reading difficulties/specific reading disabilities* as well as *intervention/remedial teaching/remediation/therapy/treatment*.

From the collection of articles selected by the web search engine Ebsco Host, papers which did not meet the conditions were disqualified. The next stage excluded articles reporting experiments, which did not satisfy basic methodological requirements, for example:

- experimental group had fewer than eleven subjects;
- no control group;
- experimental design contained an obvious methodological error, e.g., potential participants did not meet

the study criteria, and were then assigned at random to the experimental or control group to ensure unbiased allocation to the groups (Bishop, 2013).

The following problems we encountered during selection:

- It was not always clear whether children with dyslexia or at risk of dyslexia were the subjects of study. Dyslexia is diagnosed at different ages in different countries, depending on educational system – most critically, when children begin formal reading instruction. For instance, in Poland as a result of MEN¹ regulation, developmental dyslexia is a disorder diagnosed after third year at primary school, i.e., when a child is expected to have mastered reading and writing skills (eight to nine years old).
- Some of the articles described studies in which participants had reading difficulties/disabilities but not always of a specific character (dyslexia).
- In some studies, children with learning disabilities were diagnosed with various disorders (e.g. delayed speech, dyslexia and ADHD). It also happened that some subjects simultaneously suffered from several disorders. Therefore, it would be difficult from the published results to conclude authoritatively whether the intervention was effective specifically for dyslexia.
- As mentioned earlier, there is no consistent terminology for dyslexia. For example, in Europe the term used is Specific Learning Disability (SLD) and its American equivalent is Learning Disability (LD). The problem is that this term in European countries refers to a non-specific disorder. Terminological inconsistency can be misleading in the interpretation of studies concerning effective therapy. Article authors also variously describe interventions: phonological-based reading (Griffiths & Stuart, 2013), phonics instruction (Duff & Clarke, 2011), phonics-based programmes (Hornsby & Miles, 1980, in: Brooks, 2013²), teaching of grapheme-to-phoneme correspondences (Byrne, 1998, in: Griffiths & Stuart, 2013), (training) basic sound-to-letter correspondences (Brooks, 2013), phonological/phonics programmes (Brooks, 2013), training in phoneme skills (Brooks, 2013), grasping the alphabetic principle, or (teaching) letter-sound knowledge (Snowling & Hulme, 2011). The names and descriptions of methods suggest that they refer to a similar therapeutic approach. However, confusion lies in the murky boundary between phonological awareness training, explicit teaching of grapheme-to-phoneme correspondences, learning letters and phonological-based reading interventions, in particular since articles do not always describe therapeutic intervention in detail. Duff and Clarke's explanation only confirms the fact that these therapeutic methods have no clear-cut boundaries: "While phonics

instruction is similar to phonological awareness training that includes letter knowledge, it is characterised by focusing more on teaching the alphabetic principle (grapheme-to-phoneme correspondences) and how this can be applied to the tasks of reading and spelling [...]. When grapheme-to-phoneme correspondences are taught in an explicit, organised and sequenced way, this is referred to as 'systematic phonics' [...]" (2011, p. 4).

Following the selection process, only five studies met the above criteria. Additionally, nine review or meta-analysis articles satisfactorily described experiments verifying efficacy of therapeutic interventions.

This review serves as an introductory discussion about effective reading therapies while not making claims about their efficacy. Whilst not being an exhaustive and systematic report of the current state of effective remediation in Poland the review offers a description of selected therapies for specific reading disorders. It is important to note that the efficacy of many approaches is yet to be proved.

Secondly, only literature published within last six years is reviewed. So, it cannot be excluded that some research from prior to 2009 was ignored while it may have proven the effectiveness of a method used. Thirdly, the research selection criteria applied from the methodological point of view do not allow reliable assessment of these methods by comparison of their results. Although the studies presented have been described in one article, the authors' intention is not to encourage the reader to compare one experiment with another, since different groups of children took part in the studies (in terms of age, socio-economic status and reading problem) and selection of dyslexic students was made using different diagnostic methods. The studies differed according to group size, therapist competence, therapy intensity, nature and setting.

In order to determine which available therapies are more effective it would be necessary to conduct additional studies testing the effectiveness of methods not covered by this review, and then to compare the results obtained from procedures applied in all studies, those described here and any more recent. Such material could provide a starting point for a future article – a meta-analysis with detailed methodological description and statistical analysis of the experiments conducted.

Typology of selected therapeutic programmes described in contemporary English literature

The offer of various methods of treatment of specific disorders is at present so rich, that it would be impossible to be aware of them all, let alone to list and describe them in detail. Therefore, description of selected methods will be preceded by an attempt to categorize them. For the purpose of this article three categories were introduced, drawn

¹ Resolution of the Ministry of Education, 17th Nov. 2010 – reforming conditions and methods for evaluation, classification and representation of pupils and students plus procedures for tests and examinations in state schools (Dz.U. Nr 228, poz. 1491).

² Only articles that were accepted in this review were published from 2009 to 2015. An exception was made in the case of earlier articles describing single experiments referred to in reviews and meta-analytical papers.

from three levels of developmental disorders: biological, cognitive and behavioural, following the classical model proposed by Frith (2008). For dyslexia, the behavioural level corresponds to the symptoms observed in the functioning of dyslexic people (primarily difficulty with reading and/or writing), the cognitive level refers to the pathological mechanism of dyslexia (deficits related to the cognitive functioning), and the biological level is associated with genetic predisposition and neurobiological features. The following categories have been presented relating to the three levels of therapeutic and educational impact:

- **biological** – a form of support for dyslexic people, which influences the nervous system by stimulating the brain (e.g., Biofeedback) or enhances the sense organs. This trend also uses the achievements of the classical and alternative medicine such as pharmacology (e.g., Omega-3 and Omega-6 oils), special diets, chiropractic/osteopathic manipulation, homeopathy, aromatherapy, acupuncture/acupressure, massage, reflexology, etc. (Bull, 2009).
- **cognitive** – covering methods of support for learning processes. Therapeutic methods which represent this approach develop and improve cognitive functions such as: memory, perception, concentration of attention etc. Above all, however, its purpose should include training phonological functions (e.g., phonological awareness and phonological memory), which play an important role in the reading process. An example of a cognitive program is Fast ForWord.
- **behavioural** – refers to improving reading skills through practice or teaching of some strategies, e.g., paired reading (Pollock & Waller, 2001), “reading in instalments” (Bogdanowicz & Adryjanek, 2004).

The proposed breakdown of each classification has its advantages and disadvantages. Its undoubted limitation is the fact that not all types of dyslexia treatment can be placed in one of the categories presented. Therefore, some should be categorized as mixed types referring to two levels of intervention at the same time, e.g., cognitive-behavioural. An example of this is classical remedial teaching, in which the aim is usually to improve impaired cognitive function and train academic skills (mainly reading and writing). In a typical remedial lesson, a teacher stimulates his or her students’ phonological awareness, memory and visual perception, as well as encouraging reading and writing practice in a fun way.

Effectiveness of chosen reading interventions in light of modern research

This chapter presents scientific reports on selected reading interventions following the previously described typology.

Interventions at the biological level improve sensory input and affect the nervous system by stimulating the brain or with the use of classical or alternative medicine. One of the objectives set by Bull (2009) in her research was a review of complementary and alternative reading interventions used in Britain on dyslexic children. The

results indicate that 55.4% people (82) used this type of remediation. The most popular treatments chosen by respondents were nutritional supplements/special diets (63 children) followed by homeopathy (29 children) and osteopathy/chiropractic manipulation (29 children). Interestingly, there was no association between socio-demographic factors and use of methods. However, results showed that parents who viewed dyslexia as an illness more often decided to use such methods. It could be assumed that if similar research had been done in Poland, the results would have been different since dyslexia in the United Kingdom, is legally classed as disability.

Biofeedback is slightly different than these examples. There are several varieties of this therapy. For example the patient in therapy with neurofeedback is trained to modify their brain waves, to make the brain work more efficiently and faster. The popularity of this method for treatment of ADHD is steadily increasing (Bishop, 2013). For this disorder, the objective of therapy is modification of the frequency spectrum of spontaneous neural oscillations. Training is through interactive cooperation with a computer, in which the patient consciously reacts to tasks set by a specialist teacher. Bishop (2013) reported that although the results of preliminary tests were inconclusive, there was some encouraging evidence that biofeedback may be helpful for children who cannot control their attentional state, and it is therefore useful for ADHD (Bishop, 2013). In spite of the fact that biofeedback is advertised as an effective treatment for ADHD, ADD, dyslexia and other disorders, little is known about its efficacy in a context other than attentional. However, Bishop (2013) does not rule out such a possibility as the electrophysiological studies on subjects with SLI and dyslexia indicate abnormal functioning of some oscillatory mechanisms in this group of people. Studies using neuroimaging methods to monitor changes with intervention might therefore be used in the future to select specific oscillatory frequencies to target in biofeedback training (Bishop, 2013).

Cognitive therapy, based on the development of selected mental abilities is another approach used. A good example of this form of support is phonological awareness training. The results of two meta-analyses indicated a positive effect on children’s reading level (Duff & Clarke, 2011). Interestingly, this method emerged to be more effective for dyslexia than for typically developing children. Another example of cognitive therapy is Fast ForWord (FFW), popular in the United States. This is a suite of computer-based therapeutic language programmes designed to improve reading and oral language skills. The programmes are based on the assumption that language disorders are often a result of a rapid auditory temporal processing deficit, which in turn has a negative effect on the development of phonological representations (Strong, Torgerson, Torgerson, & Hulme, 2011). As described on the website of one of the Polish centres offering therapy with this programme: “Fast ForWord is based on an effective method which significantly accelerates and supports the learning process. This method develops, improves and reinforces cognitive skills: memory, attention, phonological

analysis and synthesis as well as information processing and organising. The Scientific Learning team have been carrying out research on the brain activity characteristic for the learning process and the development of phonological skills (speaking, reading, writing) for over 30 years. Based on the idea of brain plasticity, scientists have developed a method which quickly, permanently and effectively builds and improves general language skills (own translation)."³. Meanwhile, there is no empirical evidence confirming the effectiveness of this tool in the treatment of language disorders and reading difficulties, as reported by Strong et al. (2011), who performed a systematic review on FFW. To begin with, experiments which did not meet the methodological standards were excluded, as were those in which results had not been published in peer-reviewed journals. Based on the meta-analysis of the remaining (six) articles, it was found that none of the experimental groups who participated in the FFW programme made more progress than those in the control groups (who did not perform any tasks) or the placebo group (who performed other tasks). Bishop (2013), who conducted a research review of six neuroscientific studies on intervention for children with language impairment, evaluated three which involving FFW. Detailed methodological analysis of these experimental trials led to the conclusion that none proved effective for FFW and one reason for this were methodological errors which invalidated some reports.

A method, which does not directly influence cognitive function but has an indirect effect is music training – more particularly, rhythmic training. The general claim endorsed by Flaunacco, Lopez, Terribili, Montico, Zoia, and Schön (2015) in their paper was that dyslexic children show deficits in temporal processing, both for language and music (rhythmic skills). The hypothesis is that music training should positively impact phonological awareness and in turn improve reading skills. The results presented supported this view: after music training the children performed better than the control group in tasks assessing rhythmic abilities, phonological awareness and reading skills. According to Flaunacco et al. (2015), their study was the first randomized control trial testing the effect of music training in enhancing phonological and reading abilities in children with dyslexia.

Behavioural interventions focus on training reading skills. The authors could not find any articles which discussed the effectiveness of this type of method in decoding impairment and at the same time met the previously mentioned methodological criteria in the scientific publication database. An exception in this respect were interventions in which the primary objective was to improve reading fluency, which might be defined as quick and effortless reading. This cannot be achieved without automation of word-level reading, which implies correct word identification and the right pace for the decoding of words in a text. Therefore, the general assumption is that training both components mentioned should lead to more fluent reading. The majority of researchers agree

that the purpose of reading is reading comprehension. Children who do not read fluently have a problem with grasping the meaning of the text. Unfortunately, there is a limited understanding both of the causes and the appropriate ways to automate the reading skills, which negatively affect progress in creating effective remedial programmes (Snowling & Hulme, 2011; Torgesen, 2005). Some researchers are convinced that slow reading is a consequence of slow processing speed and others assert that it is more specific to decoding of printed words (Snowling & Hulme, 2011). Torgesen (2000) argued that difficulties with fluency may result from many years' failure reading and hence a small sight vocabulary. However, reading fluency is not exclusively regarded as an educational outcome. Some scientists define it as a set of integrated subskills which can be targeted through instruction. "Within this view, explicit training of accuracy precedes the training of speed for each component process to achieve the ultimate goal of fluent reading" (O'Brien et al., 2011, p. 113). Unfortunately, lack of reading fluency is often resistant to therapy, although this applies to older students in particular (Duff & Clarke, 2011; Snowling & Hulme, 2011). An example was shown in research by Torgesen, Rashotte and Alexander (2001, in: Snowling & Hulme, 2011), in which intensive eight-week 67 hour therapy compared two forms of phonics instruction combined with phonological awareness training in the context of a broader programme for reading practice. No significant difference was observed between the methods. Each contributed to an improvement in decoding accuracy and better reading comprehension, an effect which lasted for two years and helped 70% of children in the experiment. However, these gains did not extend to reading fluency and many continued to read more slowly than their peers (Torgesen et al., 2001, in: Snowling & Hulme, 2011).

Some reports, however, maintain that there are effective interventions for poor reading fluency (Snowling & Hulme, 2011). The most popular intervention applied for this outcome involves repeated reading of the same text passages. This improves both reading speed and prosody (Alexander & Slinger-Constant, 2004; O'Brien et al., 2011). Moreover, a number of studies have proved that guiding the reader to follow letters visually as they are erased from the screen at progressively increasing rates is effective (Breznitz & Bloch, 2010; Breznitz, Shaul, Horowitz-Kraus, Sela, Nevat, & Karni, 2013; Horowitz-Kraus, Cicchino, Amiel, Holland, & Breznitz, 2014). The programme, successfully used in the articles mentioned is The Reading Acceleration Program (RAP). It is a reading fluency programme that improves reading speed and accuracy. This was effective for children, both with and without dyslexia (Breznitz et al., 2013; Horowitz-Kraus et al., 2014; Niedo, Lee, Breznitz, & Berninger, 2013).

While the articles on effective decoding interventions using behavioural methods are scarce (with exception for those concerning the reading fluency), the number of publications on dyslexic child remediation using combined

³ <http://www.centrumapf.pl/?s=Dzieci,dzieciMetody,dzieciMetodyFastForWord>

behavioural and cognitive methods is presumably unlimited. For example, Lovett, Borden, DeLuca, Lacerenza, Benson, and Brackstone (1994, in: Snowling & Hulme, 2011) compared the effectiveness of two different interventions. One promoted phonological analysis, blending of printed words and direct instruction in grapheme-to-phoneme correspondences, the other – training in word identification strategies focusing on large orthographic units. While children in both groups made gains in comparison to the control (which had received instruction in a variety of study skills), each method had a different effect on the treated group. The phonological intervention group scored better than the word identification group, but the word identification group demonstrated better ability in reading exception words.

Duff and Clarke (2011) in their review of effective reading intervention argued that gains in reading were greater when phonological awareness training incorporated letter knowledge. An approach accommodating this is called “phonics intervention” and includes phonological awareness, letter knowledge and grapheme-to-phoneme correspondences training in the context of reading and spelling. In contrast to phonological awareness therapy, phonics intervention worked similarly for children with or without dyslexia (National Reading Panel – NRP, 2000, in: Duff & Clarke, 2011; Torgerson, Brooks, & Hall, 2006, in: Duff & Clarke, 2011).

Two sizeable meta-analyses reported by Bus and Van IJzendoorn (1999, in: Duff & Clarke, 2011) and NRP (2000, in: Duff & Clarke, 2011) also confirmed that gains in reading were greater when phonological awareness training incorporated letter knowledge. The NRP research (2000, in: Duff & Clarke, 2011) also evaluated instruction with systematic or unsystematic phonics, or without it. The results demonstrated that phonics instruction was effective for both dyslexic and typically developing children. This pattern of results was also found in a subsequent meta-analysis by Torgerson et al. (2006, in: Duff & Clarke, 2011). The same authors referred to the studies described by Torgesen (2005, in: Duff & Clarke, 2011), which compared the effectiveness of various reading therapy programmes which all included explicit training in phoneme awareness and phonics. All interventions exerted a positive impact on both word reading and reading comprehension.

Torgesen’s contribution (2005, in: Duff & Clarke, 2011) was to demonstrate high consistency between all intervention programmes. He argued that choice of reading intervention was not as important as inclusion of phonological awareness training and phonics. Torgerson et al. (2006) observed that phonics instruction tended to be in the context of a broader literacy curriculum and not in isolation, potentially accommodating elements of meaning-focused instruction, group reading, and writing activities. This led to re-interpretation of the NRP (2000) report on phonics instruction. In their re-analyses, both Camilli, Vargas, and Yurecko (2003) as well as Stuebing, Barth, Cirino, Francis, and Fletcher (2008)

supported the conclusion that systematic phonics was effective on reading, although its effect size was probably initially overestimated. The results suggested increased effectiveness of systematic phonics when introduced within a curriculum engendering broad literacy. A review conducted by Snowling and Hulme (2012), a meta-analysis carried out by Melby-Lervåg, Lyster, and Hulme (2012) as well as Galuschka, Ise, Krick, and Schulte-Körne (2014) led to very similar conclusions.

In their significant article, *What works for children and young people with literacy difficulties? The effectiveness of intervention schemes*, Brooks et al. (2013) described studies proving the effectiveness of reading intervention. For children with poor word-level reading skills they recommended phonics teaching accompanied by graphic representation and reading for meaning so that irregular as well as regular patterns could be learnt.

This review shows that intervention programmes did not only differ as to their general efficiency but also influence on children with and without reading difficulties. The remedial programme, which seems preferentially effective for dyslexic children is phonological awareness (Duff & Clarke, 2011). By contrast, phonics intervention is equally effective for all (NRP, 2000, in: Duff & Clarke, 2011; Torgerson et al., 2006, in: Duff & Clarke, 2011). The related issue concerns the question of how reading intervention for struggling readers ought to differ to general classroom instruction. It has been suggested that dyslexic students should be:

- taught more directly (explicit teaching of different skills) (Torgesen, 2002, in: Duff & Clarke, 2011);
- offered more intense teaching (learning hours should be increased and they should learn in smaller groups) (Torgesen, 2002, in: Duff & Clarke, 2011);
- given reading intervention to supplement but not replace general classroom literacy instruction (Brooks, 2007, in: Duff & Clarke, 2011; Torgerson et al., 2006, in: Duff & Clarke, 2011).
- provided more academic (e.g., with the use of scaffolded learning⁴) and emotional support. Some researchers even attach particular importance to the motivation in intervention for pupils with dyslexia, as low motivation is a serious barrier to learning (Guthrie & Davis, 2003, in: Griffiths & Stuart, 2013; Roberts, Torgesen, Boardman, & Scammacca, 2008, in: Griffiths & Stuart, 2013). Moreover, motivation, especially for older pupils is a predictor of progress (Duff, 2008, in: Griffiths & Stuart, 2013). Using the term “support” in the context of teaching, it is worth remembering its literal meaning: the teacher should help the pupil with learning and, if necessary, assist them step by step. But when the child achieves the set goals and no longer needs support, it should be discontinued, as in the case of physical support.

In summary, a review of contemporary English literature dedicated to effective intervention for those with poor word-level reading skills showed that there was good

⁴ <http://edglossary.org/scaffolding/>

evidence that phonological-based or phonics interventions were generally effective for this group of children. Such methods usually comprised phonological awareness and grapheme-to-phoneme correspondences training, letter knowledge and their application to reading and writing. Thus it has been proved that the most effective reading interventions are those addressing both cognitive and behavioural levels. This is surprising since one of the best documented theories for dyslexia as a phenomenon explains it as phonological deficit. Its most radical adherents argue that there is a cause-effect relation between phonological awareness and reading problems. If that were the case, the most effective therapy should be phonological awareness training, an example of a cognitive approach (Snowling & Hulme, 2012).

Additional factors influencing the effectiveness of reading intervention in the light of research results

The evidence-based interventions presented in this paper do not only differ in the therapeutic methods exploited. Even within phonics intervention, emphasis may be on a different component of the programme: phonological awareness and grapheme-to-phoneme correspondences training, letter knowledge (some authors teach Letter-name, others: letter-sound knowledge and some do not even distinguish the difference), reading or writing skills. In addition, intervention may be more or less systematic. There are potentially also some other specific conditions that could influence outcome: age, size of therapy group, specialist teacher competence, intensity, nature and setting.

Griffiths and Stuart (2013) noted that few researchers systematically manipulated these variables in research appropriately designed and conducted methodologically. Therefore, further research is needed to verify the interaction between these variables and their impact on the effectiveness of reading intervention. Additional factors which should be taken into account in design of intervention include:

- **Age:** The younger the child, the more progress achieved in therapy and the better the prognosis for the future (Griffiths & Stuart, 2013; Rose, 2009). Some authors specify that intervention is most effective before the second year of formal learning to read (KPR, 2000, in: Griffiths & Stuart, 2013; Scanlon, Vellutino, Mały, Fanuele, & Sweeney, 2005, in: Griffiths & Stuart, 2013; Wanzek & Vaughn, 2007, in: Griffiths & Stuart, 2013). According to Torgesen (2005, in: Griffiths & Stuart, 2013) the chance of achieving success with older pupils is smaller. From 15 to 60% of dyslexic children (depending on the methods used to assess reading skills) make no significant, long-term progress in reading, when tested up to two years after the intervention has ended. For younger children – at risk of dyslexia, effective therapy should, in general, be on the same foundations as intervention for older children (Snowling & Hulme, 2011; Snowling & Hulme, 2012; Torgesen, 2000).

However, some reports prove that children before and at the beginning of formal reading instruction can be successfully remediated solely with phonological awareness (Galuschka et al., 2014).

- **Size of therapy group:** Learning in small groups (three–four pupils to one specialist teacher) can be as effective as one-to-one lessons (Elbaum, Vaughn, Hughes, & Moody, 2000, in: Griffiths & Stuart, 2013; Hatcher, Hulme, Miles, & Snowling, 2006, in: Griffiths & Stuart, 2013; Vaughn, Linan-Thompson, Kouzekanani, Bryant, Dickson, & Blozis, 2003, in: Griffiths & Stuart, 2013). Research has shown that even older pupils with deep dyslexia and persistent reading problems can benefit from group therapy, provided that it is intensive (e.g., 100 hours). It then seems to be as effective as individual therapy (Lovett, Lacerenza, & Borden, 2000, in: Griffiths & Stuart, 2013; Rashotte, MacPhee, K., & Torgesen, 2001, in: Griffiths & Stuart, 2013; Torgesen, Rashotte, Alexander, Alexander, & MacPhee, 2003, in: Griffiths & Stuart, 2013). Duff and Clarke (2011) presented the NRP report (2000) in which phonological awareness training performed more effectively when delivered to small groups of 2–7 children compared with individual lessons or lessons involving the whole class. In contrast to the presented results concerning phonological awareness training, when the phonics instruction was delivered, no significant differences in effect sizes were observed, irrespective whether the participants were trained individually, in small groups or in whole classes (NRP, 2000, in: Duff & Clarke, 2011). To sum up, although scientific reports on recommended group size are rather inconsistent, in general small groups are considered better than individual lessons or whole class teaching. However, the influence of this factor on the effectiveness of intervention is probably also dependent on the individual needs of the pupil, their intellectual potential and the extent of deficit. For example students with profound dyslexia required individual therapy or tuition in a very small group (Griffiths & Stuart, 2013).
- **Specialist teacher competence:** Many authors highlighted the role of a qualified teacher in effective therapy (Brooks, 2013; Rose, 2009; Snowling & Hulme, 2011). In their review, Griffiths and Stuart (2013) listed the following conditions to evaluate a specialist teacher as well-prepared to carry out their duties: “detailed understanding of the cognitive processes involved in word reading and spelling, so that they are able to assess each component process and interpret the results of their assessment to locate as precisely as possible the source of an individual child’s difficulties, and then design, implement and evaluate interventions which target these difficulties. This also requires knowledge and understanding of single-case intervention methodology” (p. 17). The Dyslexia-SpLD Trust’s image of the ideal specialist teacher is similar: “A Specialist Teacher is

trained to use a toolkit of skills based on a thorough understanding of the structure of language. He or she has been trained to understand the theory of literacy learning and the deficits which may underlie literacy difficulties, including the phonological deficit commonly associated with dyslexia-SpLD. He or she has detailed understanding of the role phonological awareness and phonemic decoding have in learning to read and spell, knows the phonic structure ‘inside out’ and has in depth knowledge of speech and language skills, which, as spoken language, underpin written language skills. Specialist Teaching is much broader than teaching of reading. It aims to improve not only literacy, including reading, writing, and spelling, but also organisation, concentration and learning, so that the pupil is able to access the curriculum and, in the process, become an independent learner. It is always multisensory, structured, cumulative, and individually tailored not only to a learner’s needs but also his/her interests.” (2013, p. 82).

- **Intensity of therapy:** Intensity of the therapeutic programme can be as important as its nature (Griffiths & Stuart, 2013; Snowling & Hulme, 2011). However, it is not always clear what is meant by the term “intensity”. This factor can be described, regarding: length of an individual meeting/session (e.g., one hour) and its frequency (e.g., twice a week), the duration of the intervention programme (e.g., six months), etc. The studies presented differed in intensity of therapy in all aspects. Few studies have examined the impact of intensity of instruction on research outcomes. For example Griffiths and Stuart’s (2013) paper describes the typical length of a therapeutic lesson as 20 to 50 minutes. According to Rose, “researchers and teachers report that regular daily sessions can be particularly effective” (2009, p. 14). Otherwise the National Reading Panel (2000, in: Snowling & Hulme, 2011) recommended that intervention incorporating training in phoneme awareness and work on letters were most effective when the therapy was no longer than 20 hours. A trend which can be observed is that longer sessions are usually recommended for older pupils with persistent and profound reading difficulty (Griffiths & Stuart, 2013). Another rule is that intervention with more or longer treatment tends to be more effective on literacy skills than less intensive or short therapies (Galuschka et al., 2014). Rose (2009) partly contradicted these previous assertions: children should be remediated: “little and often”, but also stressed the need for time to reinforce knowledge. Although in the papers reviewed there was no explicit recommendation that remedial sessions should be regular (except for Rose’s 2009 report), we should remember that a typical experimental trial (including the successful one) is based on systematic intervention, i.e., routine.
- **The nature of therapeutic sessions:** Researchers agree that successful reading intervention should be structured (Rose, 2009; The Dyslexia-SpLD Trust, 2009, in: Brooks, 2013), multi-sensory (The Dyslexia-

SpLD Trust, 2009, in: Brooks, 2013; Snowling & Hulme, 2011) and cumulative (The Dyslexia-SpLD Trust, 2009, in: Brooks, 2013). Training should take the form of explicit – direct instruction (Griffiths & Stuart, 2013; Melby-Lervåg, Lyster, & Hulme, 2012; Snowling & Hulme, 2011). In some articles, the need for individual therapy is emphasised (The Dyslexia-SpLD Trust, 2009, in: Brooks, 2013; Duff & Clarke, 2011; Snowling & Hulme, 2011).

- **Setting:** In the research of Tressoldi, Brembati, Donini, Iozzino, and Vio (2012) reading intervention, carried out in the home environment was compared to reading intervention in a treatment facility in terms of efficacy and efficiency (cost-effectiveness) in improving reading skills. Effectiveness was evaluated while accounting for reading accuracy and fluency. Efficiency (cost-effectiveness) comparison was reflected from the ratio of score gain (reflecting the progress made in reading) to hours treatment. Efficacy and efficiency measures yielded starkly contrasting results. The efficacy comparison showed a clear superiority of the clinic-based over home-based settings for treatment. Efficiency comparison, on the other hand, showed the superiority of home-based treatment. Tressoldi et al. (2012) assumed that assessment of cost ratio for the therapy programme to its effectiveness in practice may be more useful than assessment of effectiveness itself. In other words, a cheaper therapeutic intervention, which results in an average improvement may be preferable to effective, but expensive therapy.

Conclusions and practical implications

Effective therapy intervention for dyslexic students should focus not only on the training the affected skills, but also the amelioration of cognitive deficits. Therefore the most highly recommended therapeutic interventions are not limited to reading training, but also develop the cognitive abilities underlying this skill. The most effective form of reading therapy is phonologically based and which typically engender training in phonological awareness, letter knowledge, explicit and systematic instruction in phonics, and the application of these skills to actual reading and writing (Duff & Clarke, 2011; Melby-Lervåg, Lyster, & Hulme, 2012; Snowling & Hulme, 2011; Snowling & Hulme, 2012).

Although the majority of the methods initially mentioned in this paper were not proven effective, it should not be implied that they do not have therapeutic value. However, existence or lack of evidence may provide clues for specialist teachers and parents of dyslexic children. It is crucial, also, not to make the simple transfer from the English to the Polish situation, because although both languages are based on the Latin alphabet, there are some salient differences. Above all, Polish as a language is much more clearly represented in print than English (Bogdanowicz, 2011). This reservation does not change the fact that this review of the literature concerning effective

therapy is a valuable source of information to guide help for dyslexic pupils in English-speaking countries, where research on specific reading and writing disorders is better established than in Poland. It is also worth noting that besides having problems with reading in their native Polish language, dyslexic people often also have difficulties in mastering this skill in English (Bogdanowicz, 2011; Jurek, 2004). That is why the conclusions of this article could also be relevant to English teachers.

Although the presented research leads to the conclusion that there are effective therapies for reading disorders, Torgesen (2000) pointed out that approximately 2 to 6% of children would remain poor readers in spite of the best interventions. Few would argue with his assertion that, knowing “what kind of instruction is most effective is not the same thing as knowing how much of that instruction, delivered under what conditions, will lead to adequate development of word reading and passage comprehension skills in children with phonological processing weaknesses (Torgesen, 2000, p. 63)”. In other words the conditions for treatment resisters to acquire adequate decoding skills have not yet been discovered. Unfortunately, despite the fact that Torgesen’s article is 15 years old, it is still valid. In light of modern knowledge of dyslexia, it seems unlikely that at any time in the future could a universal programme be discovered which would ensure that all children with this disorder would enjoy success with reading. This is due to the very nature of reading impairment. As it is well known, each dyslexic individual has a different cognitive profile, a unique combination of skills, difficulties and strengths. In addition, some dyslexic children have co-existing disorders.

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