CHAPTER FOUR

SPELLING DIFFICULTY IN A 10 YEAR OLD TRILINGUAL CHILD: A CASE STUDY AND REPORT OF AN EFFECTIVE INTERVENTION PROGRAMME

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Introduction

This chapter reports a case study of a 10-year-old multilingual girl, NT, who exhibited spelling difficulties in spite of average reading ability in Greek and English. An intervention was conducted with the aim of improving NT's spelling ability. The significance of the study derives from the fact that intervention case studies with multilingual students are rare (Bialystok 2007). Before introducing the investigations, we outline the theoretical framework, differences between the writing systems of Greek and English, potential reasons for spelling difficulties in children and some recent intervention case studies for spelling difficulties.

The investigations and intervention were based on the dual route (DR) model of spelling (Barry 1994). DR models postulate that competent spellers use two procedures for spelling. One procedure is known as the lexical or whole word route, and can deal with familiar words that are either regularly spelled (e.g. mint, land) or irregularly spelled (e.g., mortgage, yacht). The second, sublexical procedure involves stored knowledge of sound-spelling rules and allows us to spell unfamiliar words or pseudowords.

Research has indicated that spelling in English is more difficult than reading (Treiman 1993; Spencer 2010). This is also the case for other

languages, such as Greek, where feedback inconsistency is greater than feedforward consistency (Spencer, Loizidou-Ieridou, and Masterson 2010). This is because some phonemes can be spelled in different ways in these languages. Harris and Giannouli (1999) noted that Greek spelling is based on the etymology of the words rather than their current pronunciation and that this can be the cause of difficulty for children learning to spell in that language. Nunes, Aidinis, and Bryant (2006) point out that inconsistency in Greek lies in the context of a system that is otherwise highly consistent. However, for English spelling one cannot claim the same. According to Vousden (2008) 39% of graphemes, 16% of onsets, and 18% of rime mappings are inconsistent. This level of inconsistency might be expected to discourage use of sublexical or 'sounding out' processes in young children and encourage more reliance on whole-word, visual memorisation processes.

Potential causes of spelling difficulties

Frith (1980) reported seminal research (with English-speaking students) into good reading but poor spelling performance. She postulated that poor spellers-good readers rely on partial cues for reading. This allows them to read words successfully, but the incomplete orthographic representations result in poor spelling performance. Subsequent research has further investigated this particular type of pattern. For example, Masterson *et al* (2007) and Holmes and Quinn (2009) did not find evidence of a phonological impairment in adults with poor spelling but good reading, whereas Burden (1992) did find evidence of a phonological deficit in adults with poor spelling but good reading.

Several aspects of phonological processing (such as, phonological ability (PA), phonological short-term memory and rapid naming ability) have been reported to be impaired in children and adults with developmental dyslexia/dysgraphia. However, researchers have recently disputed the widely held view that the core deficit in dyslexia might be solely related to phonological processing (Vidyasagar and Pammer 2010). As a line of evidence, studies of participants with dyslexia\dysgraphia have looked at the role of multi-character processing deficit in reading and spelling. Multi-character processing difficulty as assessed by letter report tasks has been proposed as a deficit affecting a sub-sample of dyslexic/dysgraphic participants, especially those who demonstrate the characteristics of surface dyslexia/dysgraphia (i.e., poor performance with irregularly spelled words relative to regularly spelled words and

nonwords). Bosse, Tainturier, and Valdois (2007) found in a large cohort of dyslexic children that some of the participants showed a selective letter processing impairment and some a phonological deficit. Lowe (2009) in a group study with adolescents found that the majority of poor spellers in her sample (56%) showed a selective multi-character processing deficit. The remainder of the sample exhibited a phonological deficit or both a phonological and a multi-character processing deficit.

Further investigation of potential causes of dyslexia/dysgraphia in the absence of phonological impairment has been provided by case reports. Goulandris and Snowling (1991) reported JAS, a developmental dyslexic who appeared to have intact PA but poor performance in reading irregular low frequency words, as well as a spelling impairment. JAS was shown to have impaired visual memory, as assessed by report of arrays of Greek letters. Visual memory was also investigated in a case study with a developmental surface dysgraphic adult, AW. Romani, Ward, and Olson (1999) reported that AW showed poor performance when items were presented sequentially but not when they were presented simultaneously. They argued that his spelling difficulty could be the result of a problem with the encoding of serial order in visual memory. However, Holmes, Malone and Redenbach (2008) did not find evidence of inferior visual memory ability in unexpectedly poor spellers. Results are therefore discrepant across studies. This discrepancy is likely in part due to the fact that different measures are used to assess the constructs, and participants differ in terms of age, literacy ability and other critical variables across studies.

Currently then, research evidence does not seem to favour a single cause for spelling difficulties. Different patterns of deficit have been reported in studies of phonological and surface dyslexia/dysgraphia (Castles and Coltheart 1993; Manis *et al* 1996; Stanovich, Siegel, and Gottardo 1997; Brunsdon *et al* 2005). The dissociation in patterns has also been reported in transparent orthographies. For example Masterson, Coltheart, and Meara (1985) reported F.E. who exhibited surface dyslexia/dysgraphia in both of his languages (English and Spanish), despite the different characteristics of the two languages (English being opaque for both reading and spelling and Spanish being transparent for reading and less transparent for spelling). In English, irregular word reading was impaired in comparison to regular word reading; in Spanish, F.E. was able to read all of the words without errors. However, his spelling was very poor and exhibited a preponderance of phonologically appropriate errors, thus providing evidence for surface dyslexia in a transparent orthography (for a review see Hawelka, Gagl, and Wimmer

2010). Douklias, Masterson, and Hanley (2009) claimed that both phonological and surface developmental dyslexia were identified in Greek. They assessed 84 Greek-speaking poor readers aged 9-12 years and identified four cases, two of whom exhibited poor nonword reading, which the authors argued was characteristic of phonological dyslexia, and two of whom exhibited slow familiar word reading, a pattern that the authors suggested was equivalent to surface dyslexia. The former cases exhibited pronounced difficulties in tasks of PA, as well as poor nonword spelling.

To summarize, the literature to date indicates that spelling difficulties may not have a unitary underlying cognitive impairment, and the manifestation of deficits can vary according to characteristics of the orthography.

Recent intervention case studies for lexical spelling difficulty

Prior to presenting case study NT an outline of two recent spelling intervention studies with monoliterate children will be given. The studies targeted whole word or lexical spelling processes and the reason for presenting these is that the methods used formed the basis for the training programme in the present study. Brunsdon *et al* (2005) conducted a training programme with a twelve year old child, M.C., who had particular difficulty spelling irregular words (developmental surface dysgraphia). The intervention targeted the lexical route using techniques that had been successfully employed with acquired surface dysgraphics. This involved the use of flashcards with and without memory aids (mnemonics). Improvement in M.C.'s irregular word spelling was found following a four-week training. For the mnemonic aid they reported that it did not produce a significant gain in comparison to a flashcard technique without mnemonics. Kohnen *et al* (2008) followed up the results reported by Brunsdon *et al* by conducting an intervention study with a nine-year-old child with developmental surface dysgraphia. The researchers used the same intervention programme as Brunsdon *et al*, with the aim of investigating the nature of treatment generalisation. Improvement was again found for treated and untreated irregular words. Untreated words were more likely to improve if they had many orthographic neighbours and if they were of high frequency.

Method

We report case history details and assessments first and then describe the intervention that was carried out with NT.

Participant

NT attends a morning Greek school in London[i]. When NT began the Greek school she only spoke her mother tongue and she knew some English but no Greek. NT attended the Greek school as her father was a great admirer of the Greek language and civilization. She has one sibling, an older brother, who attends the same school. NT's developmental history, according to her parents, was uneventful and developmental milestones were attained at the appropriate ages, except that she started to speak later than her brother. NT's mother tongue is a Turkish origin one which uses the Latin alphabet, but she is now also a fluent speaker of Greek and English. She speaks English and her mother tongue at home, and with friends. She cannot read or write in her mother tongue and only uses it as a means of communication with her family and friends. At the time the assessment began NT was 10;03. Her teachers reported that her reading was good but her spelling in both Greek and English was very poor. NT's brother has no reported problems with reading or spelling and there is no history of literacy difficulties in the family.

Background assessments

The following background assessments were administered when NT was 10;03 and the results are given in Table 1. The British Picture Vocabulary Scale (BPVS II, Dunn *et al* 1997) was administered in order to assess receptive vocabulary for English. The norms for EAL children were used to obtain standardized scores. Receptive vocabulary in Greek was assessed using the Peabody Picture Vocabulary Test, adapted for Greek by Simos *et al* (2009). For this test normative data are not available. Consequently, three typically developing readers/spellers from the same school and class as NT were recruited to serve as a comparison group. The three ten-year-old children were boys (mean age: 10;6, s.d.=0;02) matched in age and non-verbal ability to NT. Two of the children were bilingual and the other was trilingual. All were reported to be exhibiting average levels of literacy ability by their class teacher. Years of schooling in the particular setting did not differ for NT and the three boys (number of years

in the setting was 4). Modified t-tests (Crawford and Howell 1998) were used to compare NT's score with those of the comparison group throughout the paper. Any significant differences are reported in the tables of results with asterisks. The results in the background assessments for NT, and for the comparison group for the Greek vocabulary assessment, are given in Table 1. For the Greek vocabulary assessment a significant difference was found between NT's score and the scores of the comparison group (t(3)=4.17, p<.05).

Table 4-1. Standardised scores in background assessments for NT and a comparison group matched to NT for age and nonverbal reasoning ability (scores in bold are raw scores).[ii]

	NT	*Comparison group mean*
Non-verbal reasoning[α]	108	96 (±13.1)
Arithmetic[b]	95	
Digit Span[b]	95	
English vocabulary[c]	87	108 (±11.5)
Greek vocabulary[c]	**72[*]**	**125 (±11.1)**

Reading and spelling assessments

The WIAT-II, Teacher's edition (Wechsler 2006) was used for the assessment of reading comprehension, reading accuracy and reading rate in English. It was also used for the assessment of spelling in English. For Greek, reading comprehension was assessed with a Greek adaptation of the Neale Analysis of Reading Ability (Neale, Christophers, and Whetton 1989, adapted by Loizidou, personal communication), and single word reading and spelling were assessed with a test developed by Mouzaki *et al*, (2007). Data were collected for the Greek reading and spelling tests from the same three children that served as a comparison group for the Greek

vocabulary test. The results for NT and the comparison group are given in Table 2.

Table 4-2. Standardised scores for reading and spelling assessments (scores in bold are raw scores). [iii]

	NT	Comparison group mean
English measures		
Comprehension	108	
Accuracy	105	
Rate	84	
Spelling	74	
Greek measures		
Comprehension	**34**	**41 (±3.3)**
Accuracy	**60**	**60 (±0.0)**
Rate (in seconds)	**361**[*]	**217(±37.1)**
Spelling	**21**[*]	**49.6 (±5.7)**

The results indicated that NT did not have a difficulty in reading comprehension or reading accuracy in either English or Greek, but reading speed and spelling in both languages were significantly impaired. Qualitative analysis of spelling errors showed that NT made predominantly phonologically appropriate errors, 83% in English and 97% in Greek (for example, knew-> new, for English, πετάνε-> πεταναι (they throw), πηγή-> πειγη (fountain) for Greek), whilst the comparison group made on average 76% in English and 100% in Greek of such errors. To summarize, the results of the background assessments indicated that NT showed slow reading speed, poor spelling and weak receptive vocabulary in both English and Greek.

Assessment of lexical and sublexical skills

Further testing was carried out to investigate strengths and weaknesses in lexical and sublexical reading and spelling processes, and then to assess PA, visual memory, rapid naming and letter report.

Single word reading and spelling to dictation

This was assessed using of a set of 60 words administered in both Greek and English. The list was developed by Masterson *et al* (2008). The

items were selected by Masterson *et al* to cover a wide range of psycholinguistic variables. They incorporated simple and complex spelling rules and consonant clusters and singletons in both Greek and English. In addition, the referents of the words are familiar concepts to children in both Greece and the UK from the age of 6 years and above. Cronbach's alpha for Greek and English reading was .80 and .91, respectively, and for Greek and English spelling .95 and .94, respectively, based on the scores of a sample of bilingual Greek- and English-speaking children (Niolaki and Masterson 2012).

Reading and spelling of irregular words and nonwords

For English, the irregular word and nonword subtests from the Diagnostic Test of Word Reading Processes (DTWRP, Forum for Research in Language and Literacy 2012) were used. For Greek reading, words cannot be classified into irregular and regular because of the high level of transparency. Thus Greek irregular words from Loizidou *et al* (2009) were used only to assess spelling, and nonwords were used to assess both reading and spelling.

In the English DTWRP test there are 30 irregular words and 30 nonwords, and in the Loizidou *et al* list there are 20 irregularly spelled words and 40 nonwords. NT was asked to read the items aloud in one session, and in another to spell the words to dictation. Items in Greek and English were presented in blocks. During spelling to dictation, each word was read aloud by the tester and then provided in the context of a sentence for disambiguation. In addition to the same age matched comparison group two different spelling ability matched comparison groups were formed, one group of children (*n*:10) was matched to NT in terms of performance in the Greek spelling test (Mouzaki *et al*) the other (*n*:11) was matched to NT in terms of performance in the English spelling test (WIAT-II spelling subtest). Children were recruited from the same school as NT, they were all bilingual and their mean age was 8;02 (s.d.=0;06) for the English spelling comparison group and 7;07 (s.d.=0;04) for the Greek spelling comparison group. A summary of the results of the reading and spelling assessments is given in Table 3.

Table 4-3. Percentage correct for NT and the chronological age and spelling ability matched comparison groups in single word reading and spelling to dictation.[iv]

	NT	Age matched	Spelling matched	ability comp.

		comp. group mean	group mean
English measures			
Reading 60-word list[a]	91.6	92.8 (±3.4)	88.5 (±9.8)
Spelling 60-word list[a]	63.3	89.5 (±5.9)**	63 (±17.2)
Reading irregular words[bc]	66.6	83.3 (±12.0)	71.3 (±16.3)
Spelling irregular words[bc]	33.3	85.6(±1.9)***	58.3 (±14.3)**
Reading nonwords[bc]	93.3	81.1 (±21.1)	78.3 (±16.0)
Spelling nonwords[bc]	36.6	92.2 (±5.1)**	75 (±16.1)*
Greek measures			
Reading 60-word list[a]	100	100 (±0.0)	97.4 (±2.1)
Spelling 60-word list[a]	43.3	87.8(±11.1)**	55 (±11.9)
Spelling irregular words[bc]	35	85 (±10.0)*	40.5 (±17.9)
Reading nonwords[bc]	95	98.2 (±3)	90 (±15.2)
Spelling nonwords[bc]	62.5	95.8 (±2.8)**	90 (±6.8)***

To summarise, results for both English and Greek spelling to dictation, assessed with the 60-word list, indicated a significant difficulty for NT. For English irregular word and nonword spelling NT's performance was significantly lower than that of both comparison groups. For Greek, NT's irregular word spelling differed from that of the same age comparison group, and nonword accuracy differed significantly from that of both comparison groups.

Regression analyses using irregular word spelling accuracy as the dependent variable

Regression analyses were used to explore predictors of irregular word spelling accuracy for NT and the comparison groups in English and Greek. For the English analyses, the dependent variable was accuracy for the 14 irregularly spelled words in the Masterson *et al* word list and the 30 irregular items from the DTWRP. For the Greek analyses the items were the 40 irregular words in the Masterson *et al* word list and the 20 irregular words from Loizides *et al.* The predictor variables in each of the analyses were printed word frequency and word length in letters. Values for printed word frequency for the English words were obtained from the Children's Printed Word Database (Masterson *et al* (2010), and for the Greek words they were obtained from Ktori *et al* (2008).

The analysis in NT's case involved binary logistic regression. For English spelling accuracy the effect of word length was significant (Wald χ^2=3.97, p<.05) but the effect of frequency was not. Simultaneous multiple regression analysis was conducted with the item totals for accuracy in spelling the English irregular words for the children in the age matched comparison group. The results revealed that frequency was a significant predictor (with 38% of variance explained). For the spelling ability matched comparison group, simultaneous multiple regression analysis revealed that word length and not word frequency was a significant predictor. Word length accounted for 34% of variance and frequency 1% of variance.

For the regression analyses for Greek irregular word spelling, the binary logistic regression analysis involving NT's data revealed that, as for the English data, word length was a significant predictor (Wald χ^2=4.29, p<.05) but word frequency was not. The simultaneous multiple regression analysis with the data of the same-age comparison group revealed that both predictors were significant. Frequency explained 6% and word length explained 8% of variance. The same analysis for the spelling ability matched comparison group revealed that word length and not word frequency was significant. Word length explained 12% of variance and frequency 6% of variance.

Table 4-4. Results of regression analyses conducted for spelling of irregular words for NT and chronological age and spelling age matched comparison groups.[v]

	English			Greek		
	NT	Age	Spelling	NT	Age	Spelling

		matched comp. group	matched comp. group		matched comp. group	matched comp. group
	Wald	β	β	Wald	β	β
Freq.	ns	.53**	ns	ns	.24*	ns
Length	4.64*	ns	-.52*	4.29*	-.28*	.34**

PHONOLOGICAL ABILITY AND RAPID NAMING

PA was assessed, for English with a blending subtest from the Comprehensive Test of Phonological Processing (Wagner, Torgesen, and Rashotte 1999) and for Greek, with a blending subtest from the Athena Battery (Paraskevopoulos *et al* 1999). Rapid naming ability for pictures was assessed for English with the Phonological Assessment Battery, Second Edition (PhAB, Frederickson, Frith, and Reason 1997). For Greek, the same test was used. A summary of the results for the PA and RAN tasks is given in Table 5. The comparison groups for each of the tasks consisted of chronological age matched and younger spelling ability and non-verbal ability matched comparison children (children were the same as in the previous comparison groups). NT's performance in English and Greek in all tasks did not differ from that of the comparison groups.

Table 4-5. Accuracy for phonological ability and time taken for rapid naming tasks for NT and the comparison groups.

	NT	Standard Scores	Age Matched Comp. Group	Spelling Matched Comp. Group
English Blending (max. 20)	16	105	14.33 (±1.15)	12.80 (±2.04)
Greek Blending (max. 32)	26	105	29.33 (±1.15)	21.22 (±9.37)
English Rapid naming (seconds)	75		59.83 (±21.8)	61.65 (±22.1)
Greek Rapid naming			67.50	72.78

| *(seconds)* | 60 | (±17.8) | (±15.8) |

Visual memory

The following four tasks were used to assess visual memory.

Memory for pictures and designs

The memory for pictures and memory for designs subtests from the Athena Test (Paraskevopoulos *et al* 1999) were used. These require reproduction of a series of abstract designs (Memory for Designs) or familiar pictures (Memory for Pictures) following a five second retention interval.

Visual simultaneous and sequential memory

The simultaneous visual memory task was adapted from the memory task of Hulme (1981). The current task used Arabic characters. The first three trials were practice trials. The sequential visual memory task employed characters from Tamil and Devanagari. It was an adaptation of the task used by Goulandris and Snowling (1991). For both tasks, following presentation of the test items, NT was asked to select the characters in the correct order from an array of characters intermixed with two new characters. The characters for both tasks were presented in font size 80 and the task was designed by the first author in PowerPoint for Windows 7. A summary of the results in the visual memory tasks for NT and a same age and non-verbal ability comparison group (*n*=19) is presented in Table 6. There were no significant differences.

Table 4-6. Accuracy in four visual memory tasks for NT and a same age comparison group.

	NT	Comparison group
Pictures (max 32)	18	17.11 (±6.2)
Designs (max 32)	15	14.53 (±4.1)

Simultaneus (max 12)	5	5.68 (±2.4)
Sequential (max 12)	5	6.11 (±2.7)

Letter report

The task developed by Bosse *et al* (2007) to assess multi-character processing ability was employed, with both English and Greek versions. NT was asked to name either a whole array of five consonant letters (global report) or was asked to name a single letter from an array of five letters, indicated by a cursor (partial report). Letter strings appeared in uppercase (Consolas 14) in the center of a computer screen for 200ms. To programme the task the DMDX software developed by Forster and Forster (2003) was used. The letters were presented on the screen of a Dell Inspiron portable lap-top with Windows 7, the video mode was 1366x768 at 60Hz. For the English version ten uppercase letters were used (B, D, F, M, L, T, P, H, S, R) and for the Greek version nine uppercase letters were employed (Γ, Δ, Θ, Λ, Ξ, Π, Σ, Φ, Ψ). We aimed at avoiding letters common to the two orthographies so the task would differ between the two languages. This resulted in the use of Greek letters with low frequency of occurrence (mean of 8,489, while the letters that we did not include had a mean 12,309, according to the frequency values of Ktori *et al*, 2008). This could result in more errors in the Greek version of the task in comparison to the English version. Since Greek letter names are not frequently used NT was asked to respond with letter sounds for the Greek version of the task.

NT was first tested in the English version and one week later in the Greek version. Her performance was contrasted with that of nine typically developing readers and spellers attending the same school, and who were all bilingual. Table 7 gives a summary of the results for NT and the comparison group. In global report, NT showed impairment in the task in both Greek and English versions. For partial report NT's performance in both versions was not significantly lower than that of the comparison group.

Table 4-7. Scores for NT and the comparison group in the letter report tasks.[vi]

	NT number correct	Comparison group mean correct

Whole report arrays English (max. 20)	4.00*	11.78 (±3.3)
Whole report arrays Greek (max. 20)	1.00*	6.67 (±2.7)
Whole report total letters English (max. 100)	70.0*	88.22 (±7.3)
Whole report total letters Greek (max. 100)	58.0**	79.13 (±6.6)
Partial report English (max. 50)	40.0	43.50 (±2.8)
Partial report Greek (max. 45)	28.0	38.00 (±6.1)

Summary of pre-intervention assessments

The assessments revealed that NT's nonverbal reasoning abilities, reading comprehension and reading accuracy were age appropriate, however her reading rate was slow and receptive vocabulary was weak in both English and Greek. NT also had difficulty in spelling that involved spelling irregular words as well as nonwords in both languages. Regression analyses with irregular word spelling accuracy as the dependent variable and word frequency and word length as predictors revealed that word length but not word frequency was significant. This indicates a reliance on sublexical processing for spelling as word length is considered to be a marker of sublexical processing for both reading and spelling (e.g. Share 2008; Spencer 2010). Qualitative analysis of NT's spelling errors in both languages showed that the majority of misspellings were phonologically appropriate, again suggesting reliance on sublexical processing for spelling and a difficulty in establishing orthographic representations. This may be due to NT's weak vocabulary knowledge. Further assessments revealed that NT did not appear to have difficulties in visual memory, PA or rapid naming. However, assessment in the letter report tasks indicated a weakness. In both the English and Greek versions of the global report task NT showed worse performance than the comparison group, but performance in the partial report tasks did not differ from that of the comparison group. This dissociation of global and partial report performance was also reported for the child described in Niolaki and Masterson (2013).

A weakness in letter report has been associated in the literature with a difficulty with irregular words in particular (Valdois *et al* 2003). NT

presented with a letter report difficulty without any indication of phonological impairment, in accordance with previous reports of a selective difficulty of multi-character processing reported by Bosse *et al* (2007; 2009), Lowe (2009) and Niolaki and Masterson (in press). However, NT also seemed to have difficulty spelling nonwords, suggesting a profile of mixed dysgraphia. More generally, NT showed the pattern of a Type B speller (Frith 1980), that is, adequate reading performance in the face of poor spelling. Lowe (2009) found that the majority of the Type B spellers in her sample (56%) showed a selective letter report difficulty. The remainder of the sample exhibited either a phonological deficit, or both a phonological and a letter report deficit.

Procedure

The intervention programme

A number of intervention case studies describing children with developmental reading and spelling difficulties have been published in recent years (e.g., Brunsdon *et al* 2005; Kohnen *et al* 2008; Rowse and Wilshire 2007). These case studies, involve investigation of the locus of the difficulty and training programmes aimed at improving the identified weakness(es). According to the assessments conducted in the present case (reported in the previous section), the locus of NT's impairment was with both lexical and sublexical spelling processes. NT presented with a deficit in letter report without a phonological impairment, in accordance with previous reports of a selective deficit of multi-character processing. However, NT also seemed to have difficulty spelling nonwords, suggesting mixed dysgraphia. Up to now most of the intervention case studies either focus on phonological or surface dyslexia and dysgraphia. Mixed dyslexia or dysgraphia is less reported (Valdois *et al* 2011). Additionally, interventions with multilingual children are sparse and this is the unique contribution of the intervention case study reported.

It was decided that, given NT's age and the impending move to secondary school, where poor spelling and weak vocabulary skills would be even more of a disadvantage than in her current setting, she would benefit most from an intervention that focused on building lexical-orthographic representations and vocabulary. Whole-word based flash card and visual imagery techniques were employed for establishing

orthographic entries, after Brunsdon *et al* 2005, 2002; Kohnen *et al* 2008; Rowse and Wilshire 2007), and intervention also targeted vocabulary knowledge of the taught items. According to Cummins (2007), in research conducted with multilingual children, literacy achievement relates to the English language learner's ability to associate knowledge from his/her first language to the second language. Watts-Taffe and Truscott (2000) also noted that teaching a new word should trigger a pre-existing concept and this can be achieved by providing examples, using drama and visual depictions. A lexically-based spelling intervention seemed justified since the assessments indicated (including the lack of a frequency effect in irregular word spelling and the fact that a preponderance of errors were phonologically appropriate) difficulty establishing lexical representations.

Stimuli

Two baseline pre-intervention assessments were carried out one month apart. Words from the Masterson *et al* 60-word list, from Loizides *et al* and from the DTWRP were presented for spelling to dictation (with a total of 120 English and 100 Greek words). Accuracy did not differ significantly across the two assessments for English (McNemar, $\chi^2=.008$, $p=.92$) or for Greek ($\chi^2=.010$, $p=.92$). Items misspelled at both baseline assessments were included in the intervention, which lasted nine weeks and targeted 54 English and 54 Greek words[vii].

The targeted English and Greek words were divided for use between the flashcard and visual imagery techniques. As in Brunsdon *et al* (2005), words used in the two techniques were closely matched for frequency, regularity and number of letters in both languages (Kruskal Wallis English frequency: $\chi^2= 2.009$, $p=.156$, regularity: $\chi^2=.291$, $p=.589$ length: $\chi^2=.013$, $p=.417$ Greek frequency: $\chi^2=.288$, $p=.592$, regularity: $\chi^2=.009$, $p=.753$, and length: $\chi^2=.162$, $p=.688$). Items included in each intervention session were matched for frequency (Kruskal Wallis: English: $\chi^2=.81$, $p=.999$ and Greek: $\chi^2=.000$, $p=1$) and number of letters (English: $\chi^2=.013$, $p=1$ and Greek: $\chi^2=.003$, $p=1$) across the sessions.

Intervention method

At each of the nine weekly intervention sessions, a new set of words was introduced. In each session 15 minutes each were devoted to the visual imagery and flashcard techniques, and 30 minutes for each

language. Order of language and techniques was counterbalanced among sessions.

For the visual imagery technique each word was shown to NT with the misspelt part highlighted in bold, and the word's meaning was explained. NT was asked to think of a picture that depicted the word. In that way NT would be able to relate the new information with her pre-existing knowledge either in her mother tongue or in her second or third language. The importance of connecting the pre-existing semantic knowledge with the orthography of the misspelled word as noted before was highlighted by Cummins (2007 p.1) who claimed

"the key to literacy engagement for English language learners is to connect what they know in the first language to English".

NT then drew the picture with the word embedded in it. NT copied the picture with the embedded word, then, after a delay of ten-seconds NT reproduced the drawing with the embedded word. In the case of an error NT had to look again at the picture and repeat the last activity. Finally, NT wrote the word without the picture. The difference between the intervention in the present study and that of Brunsdon *et al* (2005) was that NT had to devise the mnemonic cue and not the experimenter.

For the flash card technique each word was first shown written on a card, then dictated for spelling. The misspelt part was highlighted in bold by the researcher. Then a discussion of the word's meaning followed in order to connect the new information with pre-existing semantic knowledge (Watt-Taffe and Truscott 2000; McWilliam 2000; Cummins 2007). The word was written with large letters on an A4 card and NT traced it with her finger. NT then copied the word and, after a ten-second delay, reproduced the word (this time the word was not in view). In the case of an error NT was asked to look at the word again and the process was repeated. Finally, NT wrote again the target word.

Following each session NT practiced the items at home daily with her parents. Practice lasted 20 minutes per day; the words were dictated to NT. At each weekly intervention session with the researcher there was a re-test of items from the previous week. NT was not always 100% correct and the erroneously spelled words were not retrained.

Results and discussion

Three follow-up assessments were conducted at different times: immediately at the end of training (Time 1), one month later (Time 2) and four months later (Time 3). In Figure 1 a plot of the results is given. For

English spelling there was a significant increase in spelling accuracy from baseline to Time 1 (McNemar χ^2=41.023, p=.000). Accuracy at the second follow up assessment (Time 2) was not significantly different from that at Time 1 (McNemar p>.05), and accuracy did not significantly differ between Time 2 and 3 (McNemar χ^2=.593, p>.05). This indicates that, for English, spelling improved as a result of the intervention and improvement was sustained over time. For Greek spelling there was a significant increase in spelling accuracy from baseline to Time 1 (McNemar χ^2=17.92, p=.000). Accuracy at Time 2 was not significantly different from that of Time 1 (McNemar, p>.05), and finally accuracy did not differ significantly between Time 2 and Time 3 (McNemar, p>.05). This indicates that, for Greek also, improvement in spelling accuracy as a result of intervention was sustained over time.

Figure 4-1. Summary of NT's performance in English and Greek spelling during and after the programme *(proportion correct).*[viii]
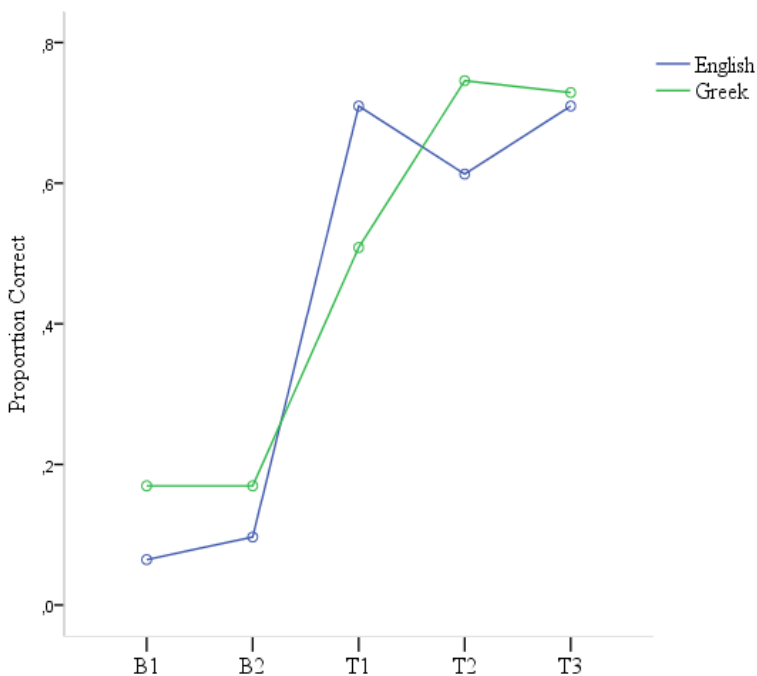
No difference in improvement was observed for the visual imagery and flash-card techniques for either language (Kruskal Wallis, *ps*>.05). NT was asked whether she had a preference for either technique. She reported that she liked both methods and that she thought they both helped with her spelling.

Improvement in spelling performance was also assessed by means of the WIAT-II spelling subtest for English and Mouzaki *et al*'s spelling test for Greek. In the former NT achieved a standardized score of 95 at Time 3 (versus 74 pre-intervention), and in the Greek test she achieved 60% correct at Time 3 (versus 35% correct pre-intervention). NT also showed a gain in receptive vocabulary. For English, on the BPVS, she obtained a standardized score of 102 at Time 3 (versus 87 pre-intervention), and in the Greek receptive vocabulary test a score of 51% correct at Time 3 (versus 37% pre-intervention). We also wanted to see if improvement was obtained for reading rate, since if the intervention was successful in improving lexical skills this might improve speed of reading. For English, on the WIAT-II, reading rate assessment NT obtained a standardized score of 85 at Time 3 (versus 84 pre-intervention), for Greek the time taken to read the text was 260 seconds at Time 3 (versus 361 seconds pre-intervention). Reading rate for Greek at Time 3 was no longer significantly different from that of the comparison group (mean = 217 secs, s.d. = 37.1)

In order to investigate the specificity of the effects of the intervention, the arithmetic subtest from WISC-IV (Wechsler 2003) was administered before and immediately at the end of the training. NT's score did not show any change (pre-intervention standard score = 95 and post-intervention score = 95).

Overview of results

The case study involved a trilingual child who was found to have mixed dysgraphia in English and Greek. NT exhibited a weakness in spelling irregular words and nonwords in both languages when her spelling performance was compared with that of comparison children matched in age and non-verbal ability. Assessment of receptive vocabulary revealed weakness in English and Greek. No difficulties were observed in PA, rapid naming or visual memory, however, NT's performance was significantly lower than that of the comparison children in tasks of multi-character processing. Her ability to report arrays of briefly presented letters seemed to be significantly impaired. This difficulty has also been reported in relation to poor spelling by Lowe (2009), and in relation to

poor reading by Bosse *et al* (2007). These researchers found in a sub-sample of dyslexic (Bosse *et al* 2007) and dysgraphic (Lowe 2009) children, participants with a selective letter report deficit but not a phonological deficit. This result is in accordance with our case study as NT did not have a phonological deficit.

Our report of NT adds to a growing body of research which suggests that a spelling difficulty may result from a variety of deficits. We found that NT's spelling improved following the intervention as did her receptive vocabulary. The results indicate that when intervention targets the specific difficulty it is successful, in accordance with the arguments of Kohnen and Nickels (2010). Additionally, the success of the intervention may be attributed to integrating NT's background knowledge and vocabulary in teaching the spellings of the words. Watts-Taffe and Truscott (2000) stress the significance of focusing on vocabulary growth and development in the multilingual classroom.

In the intervention we employed two different intervention techniques, a flashcard and a visual imagery strategy. Both were found to be effective in that improvement in spelling performance was observed at both immediate post-intervention and delayed post-intervention assessments. These results are in accordance with other English and Greek intervention studies targeting lexical processes (Behrmann 1987; De Partz *et al* 1992).

Educational implications

Although we did not find any difference in the results obtained with the visual imagery and flashcard techniques it may be that a difference in results might have been found if the strategies had been used during separate time periods. Further research using the two strategies could shed more light on this.

NT exhibited low levels of receptive vocabulary for English and Greek in the pre-intervention assessments, and analysis of the gains made in spelling during intervention revealed that greater improvement was observed for words whose meaning was known than for unknown words, for both languages. This is consistent with the findings of Ouellette (2010). Teaching the meanings of the words targeted for intervention was incorporated into the programme in the present study. However, the difference in spelling accuracy between words known prior to intervention and those taught at the time of intervention may indicate that it would be helpful in future studies to give instruction in meaning for unknown words prior to the work on spelling accuracy. We did not carry out follow-up

testing for retention of the meanings of taught words, although there is some indication that the intervention was effective here too from the post-intervention assessment of receptive vocabulary. Further research into the effects of knowledge of the meaning of words in studies of intervention for literacy difficulties seems important.

The positive result obtained after the intervention indicates that by triggering NT's pre-existing knowledge the new learning was securely acquired. This supports the importance of considering in multilingual classrooms the prior knowledge the children bring with them. Cummins (2007) stresses that when first language is related to new academic knowledge in the multilingual classroom then this can become a strategy that will mediate as a stepping stone in L2 achievement. According to Cummins (2000) a multilingual child will easily acquire L2 social communication skills but will struggle and take longer to achieve academic language proficiency. Therefore, Cummins emphasises the importance of vocabulary teaching and relating the unknown concept to pre-existing knowledge or to experiences in L1. This component was included in the intervention with our multilingual participant. In addition, during the intervention immediate feedback was given which according to Fulk and Stormont-Spurgin (1995) has a positive effect in teaching. Immediate feedback provides the opportunity to distinguish between the misspelling and the correct spelling at the point of learning.

Apart from a difficulty with spelling, pre-intervention assessment had indicated that NT's reading rate was slow. When assessed following the intervention NT's reading rate for Greek showed improvement. This is in accordance with other findings indicating that training in spelling can generalize to reading ability (Kohnen *et al* 2008; Brunsdon *et al* 2005, although these studies assessed only reading accuracy and not rate). The reading rate improvement in NT's case may have been due to improvement in vocabulary knowledge. It is not clear why improvement was not found in reading rate for English. Further research to improve our understanding of the factors that lead to generalization with spelling interventions is called for.

According to an accumulation of research it seems that in order to carry out effective intervention for literacy difficulties in monolingual and bilingual children and adults, detailed theoretically-based assessment is crucial. It is also now apparent that the properties of individual languages determine the characteristics of literacy difficulties. As both of NT's languages were opaque for spelling her difficulty was manifested in both orthographies. Results are consistent with Geva (2000) who claims that a deficit in literacy development will be apparent in both languages.

However, this may not be the case for biliterates who use different writing systems (see, for example, Wydell and Kondo 2003). Our case study adds to a growing body of research into literacy difficulties in multilingual children. However, further intervention studies are needed in order to increase our knowledge of which methods are optimum for remediating spelling deficits.

Finally, and in agreement with Fulk and Stormont-Spurgin (1995), our results from the intervention programme indicate that children with literacy difficulties will not spontaneously acquire spelling skill just from exposure to print or invented spelling. It seems crucial that detailed assessment is conducted in order to find the child's specific difficulty and that intervention tailored to the child's specific strengths and weaknesses is carried out. This applies not only to monolingual children but also to multilingual children, as NT's case study showed. The intervention programme offered individual targeted training which is recommended as vital for a child with learning difficulties (see Rose Review 2009) and at the same time it does not contradict the philosophy of support and inclusion in the mainstream classroom (Reid 2013; Norwich and Lewis 2007). Teachers of children such as NT who participated in the interventions noted that after the programme children were more enthusiastic and willing to participate in classroom activities, and frequently suggested strategies (such as the visual imagery technique) used to their peers or teacher.

Conclusion

A case study is reported of a ten year old girl (NT) who was a fluent speaker of a Turkish origin alphabetic language as well as Greek and English. The study focuses on NT's reading and spelling in English and Greek as she did not have literacy skills in her mother tongue. NT had average reading comprehension and reading accuracy in Greek and English although reading rate was slow. Her spelling ability for both familiar words and nonwords was impaired in both languages. Assessments revealed that NT did not appear to have a weakness of phonological awareness, however letter report was impaired and receptive vocabulary in both Greek and English was weak. An intervention was conducted with the aim of improving whole-word (lexical) spelling processes in English and Greek as well as vocabulary skills. Post-intervention assessments carried out immediately at the end of the intervention and one month and four months later showed a significant

improvement in spelling that was sustained over time. Therefore teaching spellings coupled with semantic information has a positive effect in spelling improvement of a multilingual child. Reading rate in Greek was also observed to improve after the intervention. The findings support the notion of specific profiles of developmental dyslexia/dysgraphia not only in monolingual English speakers (Castles and Coltheart 1993; Manis *et al* 1996; Stanovich *et al*, 1997) but also for speakers of other languages (Cholewa *et al* 2008; Douklias *et al* 2010). They also confirm the effectiveness of theoretically based targeted intervention for literacy difficulties (cf. Brunsdon *et al* 2005).

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Notes

[i] The morning school followed the Greek national curriculum. Pupils received instruction in Greek language art for eight hours per week and English literacy for 10 hours per week taught by a native English teacher.

[ii] αMatrix Analogies Test Naglieri (1985), bsubtests from WISC-IV, (Wechsler, 2003), c BPVS II (Dunn *et al.*, 1997), dPPVT-adapted for Greek (Simos *et al.*, 2009), * = p<.05

[iii] *p<.05

[iv] α60-word list (Masterson *et al*, 2008), βDTWRP (FRLL, 2012), cGreek words and nonwords (Loizidou *et al*, 2009), ***p<001*, **p<.01*, *p<.05*

[v] ns=not significant, **p<.01*, *p<.05*

[vi] **p<.01*, *p<.05*

[vii] The total number of words misspelt in both languages was 121, however, in order to have an equal number of matched items in each intervention session, a total of 13 low frequency items were excluded.

[viii] B= Baseline, T =Time

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