Does the early introduction of English as an L2 boost children's cognitive skills? The case of the 3rd experimental school in Evosmos, Thessaloniki

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Το άρθρο καταγράφει τα αποτελέσματα διετούς έρευνας (2010-12) που έγινε σε δύο δημοτικά σχολεία της Θεσσαλονίκης, το ένα από τα οποία είναι πειραματικό και διδάσκει την Αγγλική ως ξένη γλώσσα (ΞΓ) από την πρώτη τάξη. Τα ευρήματα είναι κομμάτι εκτενέστερης έρευνας που εξέτασε το αν η πρώιμη έκθεση στην ΞΓ έχει κάποιο θετικό αντίκτυπο στις γνωστικές ικανότητες των μικρών μαθητών. Έρευνες στη Γλωσσική Έφεση (Alexiou 2005 & 2009) καταλήγουν πως οι δεξιότητες που αφορούν τη μνήμη και την αναλυτική ικανότητα των παιδιών είναι παρούσες από την ηλικία των 6/7 και συσχετίζονται στενά με την επίδοση στην ΞΓ. Τα ευρήματα του παρόντος άρθρου είναι ενθαρρυντικά και ελπιδοφόρα και οδηγούν στο συμπέρασμα πως η πρώιμη έκθεση στην Αγγλική ως ΞΓ ουσιαστικά και σημαντικά ενισχύει συγκεκριμένες γνωστικές ικανότητες των μικρών μαθητών.

1. Introduction

The present paper reports the results of a longitudinal study that took place between 2010-12 which among other things, investigated the cognitive impact of the early introduction of EFL on Greek learners in a school context. The paper publicizes part of this study's findings that pertain to the relation between EFLL and the enhancement of young learners' aptitude. To my knowledge, this has never before been examined as EFLL studies so far have primarily focused on the linguistic or affective outcome of EFLL (García Lecumberri & Gallardo 2003, Mihaljevic Djigunovic & Krevelj 2009, Mihaljevic Djigunovic & Lopriore 2010, Muñoz 2006 & 2010, Nikolov 2009).

1.1. The rationale of the study: The two schools under investigation

The two participating primary schools were both located in the western part of Thessaloniki, in Evosmos, where families are of a low to average socio-economic status. The 2nd primary school (the control group) introduces EFL in Grade 3 while the 3rd experimental one (the experimental group) does so in Grade 1.

Since 2005 the experimental school is under the custody of the Theoretical and Applied Linguistics Department (School of English, Aristotle University of Thessaloniki). The department supervises the school's operations with respect to the teaching of English and is responsible for issues that relate to curriculum design, staff selection, teaching methods. The program followed is intensive: English is taught for 5 hours a week in the first two grades and for 8 hours a week from grade 3 onwards. As of 2010-11, Content Language Integrated Learning is also practised from Grade 3 in various subjects (Science, Geography, Religious Education, Arts and Crafts, History, and Environmental Study). The teaching method followed is Asher's (1982) Total Physical Response, which is very popular in the earliest years of FLL in communicative classrooms (Ellis 2003, Krashen 1982 & 1985).

From 2010-11 the Greek Ministry of Education and Religious Affairs runs a pilot program in 800 primary schools throughout the country, where English is taught for 2 hours a week from Grade 1. Even so, the case of the experimental school is unique because of the intensity of the program followed. So, if the findings demonstrate that EFLL has a boosting effect on children's cognitive skills, then this would lend further

support to the issue of bi-directionality raised and the positive interaction witnessed between the L1 and FL achievement (Mihaljevic Djigunovic 2010). Cummins (1980) speaks of a *Common Underlying Proficiency* which makes possible the influence of the L2 on the L1, manages the two language channels, is dependent on and develops with L2 proficiency. In other words, the processing of either language has access to and is supported by a common pool of cognitive resources. The purpose of this paper is to examine whether these resources can be further enhanced by the early FL experience.

2. Theoretical background

The theoretical framework underpinning the paper relates to Foreign Language Aptitude (FLA) and EFLL.

2.1. Foreign Language Aptitude

FLA has been viewed from a number of perspectives and defined in a number of ways. It is one of the many individual differences found among FL learners (Ellis 2003, Lightbown & Spada 1999) which determine their rate of acquisition and ultimate attainment (Kiss & Nikolov 2005, Sawyer & Ranta 2001). The central claim in FLA research is that aptitude is an innate quality, a specific talent for learning FLs, given that learners have ample opportunities to practise the FL during school learning (Abrahamsson & Hyltenstam 2008, Carroll 1981, Ellis 2003). Some conceive FLA to be relatively stable (Carroll ibid, Dörneyi & Skehan 2003), others believe it is dynamic and amenable to training (Alexiou 2005, Cook 2001, Neufeld 1978). Finally, strong correlations have been reported between FLA and (F)LL proficiency (Dörneyi & Skehan 2003, Robinson 2001, Sawyer & Ranta 2001, Skehan 2002).

According to Carroll (1981) the aptitude construct is comprised of at least four basic capacities: a) phonemic coding ability, b) grammatical sensitivity, c) inductive language learning ability, and d) associative memory. Multiple tests have been devised since the 50s (for a review see Carroll 1981 & 1990, Kiss & Nikolov 2005), with *The Modern Language Aptitude Test* (Carroll & Sapon 1959) being the most prevalent of all. However, to their great majority they address older students. The most recent aptitude test, suitable for the age group examined in this paper is *The Young Learners' Aptitude Test* (YLAT) (Alexiou 2005), designed for 5- to 9-year-olds. It has a pure cognitive orientation as so young children do not yet possess sophisticated language skills. Among other things, Alexiou (ibid) suggests that a) language aptitude can be tested as early as the age of 5 in different cognitive skills, b) there is a strong relation between cognitive development and FLL, c) memory, analytic thought and phonological skills play an important role to FL achievement, d) at this early age, aptitude is still dynamic and plastic, e) young learners develop intellectually and cognitively much earlier than previously believed (Piaget 1966/1974, as cited in Cole & Cole 2001).

2.2. Early Foreign Language Learning

EFLL is a byproduct of the temporary family mobility which, in turn, is the outcome of the globalization of professional activity that requires both competence in the target language (TL) and adaptation to the TL community and way of living. EFLL and the consequent early contact with another culture can be facilitative as they both bring children to a better understanding of differences, a faster development of multicultural understanding and a smoother integration in the TL community (Gürsoy 2011).

Presently, teaching FLs to young learners is gaining popularity all over the world, with the age for learning a FL being reduced in many countries, driven by 'the younger the better in the long run' view of Singleton (1995), given that learners are adequately exposed to the TL. The trend of introducing much earlier the FLs (from the first year of primary school) in the school curriculum has also been influenced by the Critical Period Hypothesis and the various neurobiological accounts proposed (Lenneberg 1967, Peal & Lambert 1962), which suggest that at this early age the potential for learning a language is at its highest peak. An abundance of studies also demonstrates that young children are highly motivated, have a low affective filter (Krashen 1985) and are overall less inhibited than older ones (McLaughlin 1984). Also, it is that case that young children learn implicitly through play-like activities in a 'fun' and pleasant way, enjoy an optimal environment and are exposed to an easy and simplified input (Johnstone 2009). Additionally, because of their earlier start and prolonged FL exposure, they have ample opportunities to experiment with and practise the FL. Thus, the sooner a child is exposed to the FL the better the results will be in the long-term.

Recently, an earlier start is promoted with the aim of establishing and further developing a plurilingual citizenry (Blondin et al. 1998, Enever 2009). The Council of Europe (2001) and the European Commission (2003) (see Csapó & Nikolov 2009) have strongly supported EFLL in all EU member states provided that they "should move towards ensuring that foreign language learning at primary school and kindergarten is effective…" (cited in Tragant 2010). In addition, since 2008 the EU sponsors *ELLiE*: Early Language Learning in Europe, a longitudinal project which investigates EFLL across seven European countries. Its aim is to find out the realistic achievements of EFLL in European state schools, where the FL teaching begins from the age of 6/7 as one of the school subjects. The 2008 report demonstrates an overall positive attitude of school principals, teachers and parents (Tragant 2010) and the learners' initial heightened motivation, although a very mixed pattern emerges with regard to teacher qualifications and the time allotted to FL teaching (Krikhaar & Lopriore 2010).

Because instructed EFLL differs markedly from child SLA in a bilingual context in terms of amount and quality of input, opportunities for language practice, massive contact with the native speakers of the language, etc. (Muñoz 2010, Unsworth & Blom 2010), it is only natural that younger FL learners need a longer time than younger SL ones to learn the language in question (Nikolov & Mihaljevic Djigunovic 2006). Thus, by definition alone EFLL programmes do not aim at native- or near-nativelikeness but at the development of favourable attitudes towards languages and language learning in general that will eventually help young learners "become proficient users of foreign languages as adults" (ibid: 240). In today's globalised world and the increasing professional mobility witnessed, this is truly significant.

3. The methodology of the study

3.1. Recruitment of participants

All participants were Greek native speakers. 49 children (23 boys, 26 girls) were recruited from either school. The mean ages and standard deviations (SDs) of the experimental group were 6 years and 4 months (M); 3 months (SD) for Grade 1 and 7 years and 8 months (M); 3 months (SD) for Grade 2. The respective mean ages and SDs of the control group for Grade 1 were 6 years and 7 months (M); 3 months (SD), while for Grade 2 these changed to 7 years and 7 months; 3 months (SD). Informed consent was obtained from the parents while the informants were located through a

questionnaire and a letter distributed in the beginning of Grade 1 via the school principals.

3.2. Testing procedure: Tool used and skills tested

Nonverbal ability is a cognitive skill linked with children's capacities to acquire knowledge and skills in the early school years. Both groups completed the computerized version of the *YLAT* (Alexiou 2005) which examines analytic skills (Classification, Spot the Differences, Jigsaw, Story Sequences) and memory skills (Short-term Rote Memory, Paired Associates pictorial game, Semantic Integration). The test runs in Greek, as due to their small age, learners are not yet literate in English. All data was codified and analyses were conducted through SPSS 21 for Windows. The test is comprised of the following sub-tasks:

The *Classification* game tests participants' inductive learning ability. 6 colors represent 6 different groups (i.e. red=animals, blue=flowers, etc.). A small software demo precedes the actual task to make sure the child understands the task demands. Alexiou (2009) holds that to perform well in this test learners need to discover and apply new rules, the same way they discover foreign grammatical rules.

The *Spot the Differences* game tests informants' visual perception twice. The child observes two seemingly identical pictures to identify 6 differences in the first slide and 12 in the second that relate to color, number of objects in the picture, etc. The activity identifies their ability to recognize the presence, absence or change in information (Alexiou 2009).

The *Jigsaw* game examines their sensitivity to image perception and spatial ability. The child is asked to observe three unfinished puzzles, from the very easy to the more difficult, that progressively appear on the screen. (S)He needs to identify the three missing pieces left outside each puzzle that fit the equivalent number of voids and choose 9 pieces in total. According to Alexiou (2009: 53), their ability to "break up the visual field and keep part of it separate" is essential to language use. As all children easily got the correct nine pieces, the points of this task were not calculated in the aggregate YLAT score.

The *Story Sequence* game tests twice their reasoning ability with the help of situational clues. The first slide contains 4 jumbled pictures and the second 6, which the child has to put in the correct order to make some sense of two stories. To create the stories and see the whole picture from the parts, children have to imagine logical rules. Alexiou (2009) argues this activity resembles cloze tests or gap-filling tasks.

In the *Short-term Rote Memory* game, the first slide shows 8 unrelated objects for 30 seconds. When they disappear, the child needs to recall randomly as many as possible. The second slide consists of 12 objects, all different from the previous ones.

The *Paired Associates* task examines twice their ability to retain sign pairs. The first slide displays 6 different picture cards coupled with 6 various shape-like figures (e.g. a turtle makes a match with a line ending in a triangle). In the following slide the set of figures is given but the pictures are jumbled. The child is asked to provide all 6 perfect matches. The second slide contains 8 sets of matches, 6 of which were included in the first slide. 2 sets of pictures-figures matches are new to the child. Alexiou (2005) argues that paired associative memory is necessary in the retention of FL vocabulary.

The *Semantic Integration* task tests twice participants' recoding ability (shapes with numbers). The first slide contains a learning list of 4 shapes (square, hexagon, diamond, X) which the child needs to observe carefully. The second slide follows with a

recognition list of 6 shapes (triangle, parallelogram, X, circle, hexagon, and a star) and the child is asked to find the new entries (triangle, parallelogram, circle, star). In the third slide the child needs to find the shapes that appeared in the first ονε. Finally, in the last slide of the first set, the child needs to recall the shapes that were present in the learning list but are now omitted (square, diamond). In the second set of slides the learning list is comprised of 6 shapes and the recognition list of 8. Alexiou (2009) suggests that the ability to recognize the presence or absence of significant information may be associated with the capacity to learn language features such as word endings.

4. Data analysis

4.1. Eliminating the outliers

The means and SDs of each test were computed for both grades and groups. Two participants from the experimental group were excluded as they exceeded ±2 SDs in more than 35% of the tasks in both grades. The means and SDs of the tests were re-calculated. When participants scored ±2SDs in only a couple of tests, their scores were replaced by the mean score(s) of the test(s).

4.2. Descriptive Statistics

First, we examined whether the two groups displayed any marked differences before the FL intervention on the experimental group, i.e. at the beginning of Grade 1. This was viewed a necessary step to take, in order to keep track of any differences that would emerge in the experimental group's performance by the end of Grade 2. Table 1 displays the descriptive statistics of the two groups across the two grades.

Tasks	Experimental group (n=47)		Control group (n=49)	
	Mean 1/Mean 2	SD 1/SD 2	Mean 1/Mean 2	SD 1/SD 2
Memory	9.17 / 11.09	1.96 / 2.50	8.94 / 10.60	2.54 / 2.19
Classification	35.28 / 42.88	13.51 / 7.08	31.69 / 40.93	15.51 / 11.21
Differences	10.69 / 12.77	2.83 / 3.02	9.30 / 12.53	2.86 / 2.25
Paired Associates	6.79 / 10.35	3.90 / 2.24	6.44 / 8.18	3.16 / 3.18
Semantic Integration	12.99 / 13.97	1.85 / 2.12	12.52 / 13.39	1.62 / 2.00
Story Sequences	3.98 / 4.45	2.27 / 1.22	3.11 / 3.18	2.01 / 1.76
YLAT_Total	80.69 / 95.72	14.66 / 9.34	73.02 / 89.92	18.53 / 11.53

Table 1: Descriptive statistics of the two groups (Grades 1 and 2)

The scores of the two groups show a clear developmental trend. The mean scores of the experimental group in Memory, Classification, Differences, Paired Associates, and Semantic Integration are much higher than those reported in Alexiou (2005: 181) as these were the means of each test for the age-group of 5- to 9-year olds as a whole.

4.3. Statistical analyses

To explore whether EFLL has a positive impact on young learners' aptitude skills, we conducted a number of independent and paired samples *t*-tests and two-way ANOVAs).

4.3.1. Independent samples *t*-tests

A number of independent samples *t*-tests were performed for each test and grade. Several significant differences emerged for the experimental group. This was

considered accidental as both schools address the same local residents, while the experimental school practises no special exclusionary procedure upon 1st grade enrollment. Table 2 below gives a detailed picture of the performance of the two groups.

		Grade 1			Grade 2		
Measure	**School**	**Mean**	***t*-test**	**SD**	**Mean**	***t*-test**	**SD**
Memory	Experimental	9.17	p = ns	1.96	11.09	p = ns	2.50
	Control	8.94		2.54	10.59		2.19
Classification	Experimental	35.28	p = ns	13.51	42.88	p = ns	7.08
	Control	31.69		15.51	40.93		11.21
Differences	Experimental	10.69	p = .019	2.83	12.77	p = ns	3.02
	Control	9.30		2.86	12.53		2.25
Paired Associates	Experimental	6.79	p = ns	3.90	10.35	p = .000	2.24
	Control	6.44		3.16	8.18		3.18
Semantic Integration	Experimental	12.99	p = ns	1.85	13.97	p = ns	2.12
	Control	12.52		1.62	13.39		2.00
Story Sequences	Experimental	3.98	p = .049	2.27	4.45	p = .000	1.22
	Control	3.11		2.01	3.18		1.76
YLAT_Total	Experimental	80.69	p = .027	14.66	95.72	p = .008	9.34
	Control	73.02		18.53	89.92		11.53

Table 2: Independent samples *t*-tests (Grades 1 and 2)

In Grade 1 the experimental group was significantly better in Differences ($t(94) = 2.397$, $p < .05$), Story Sequences ($t(94) = 1.995$, $p < .05$) and YLAT_Total ($t(94) = 2.253$, $p < .05$). Memory, Classification, Paired Associates, and Semantic Integration yielded no significant differences between the two groups. In Grade 2 the experimental group fared significantly better in Paired Associates ($t(94) = 3.847$, $p < .001$), Story Sequences ($t(94) = 4.107$, $p < .001$) and YLAT_Total ($t(94) = 2.702$, $p < .01$). No differences emerged between the two groups for Memory, Classification, Differences, and Semantic Integration.

4.3.2. Paired samples *t*-tests

To evaluate the magnitude and importance of the differences found in the experimental mean scores before and after the FL intervention, a number of paired samples *t*-tests were conducted. Table 3 displays the differences in percentages. We performed the same *t*-tests in the control data. Table 4 gives the respective picture of the control data.

Measures	**Grade**	**Mean**	***t*-test**	**SD**	**Means difference % (Grade 1 and Grade 2)**
Memory	Grade 1	9.17	p = .000	1.96	20.94
	Grade 2	11.09		2.50	
Classification	Grade 1	35.28	p = .001	13.51	21.54
	Grade 2	42.88		7.08	
Differences	Grade 1	10.69	p = .000	2.83	19.46
	Grade 2	12.77		3.02	
Paired Associates	Grade 1	6.79	p = .000	3.90	**52.43**

	Grade 2	10.35		2.24	
Semantic Integration	Grade 1	12.99	p = .010	1.85	7.54
	Grade 2	13.97		2.12	
Story Sequences	Grade 1	3.98	p = ns	2.27	11.81
	Grade 2	4.45		1.22	
YLAT_Total	Grade 1	80.69	p = .000	14.66	18.63
	Grade 2	95.72		9.34	

Table 3: The experimental group differences (%) found in the test means across the two grades

Measures	**Grade**	**Mean**	***t*-test**	**SD**	**Means difference % (Grade 1 and Grade 2)**
Memory	Grade 1	8.94	p = .000	2.54	18.46
	Grade 2	10.59		2.19	
Classification	Grade 1	31.69	p = .000	15.51	29.16
	Grade 2	40.93		11.21	
Differences	Grade 1	9.30	p = .000	2.86	34.73
	Grade 2	12.53		2.25	
Paired Associates	Grade 1	6.44	p = .002	3.16	27.02
	Grade 2	8.18		3.18	
Semantic Integration	Grade 1	12.52	p = .013	1.62	6.95
	Grade 2	13.39		2.00	
Story Sequences	Grade 1	3.11	p = ns	2.01	2.25
	Grade 2	3.18		1.76	
YLAT_Total	Grade 1	73.02	p = .000	18.53	23.14
	Grade 2	89.92		11.53	

Table 4: The control group differences (%) found in the test means across the two grades

What becomes immediately clear is that both groups increased their test means, with significant differences emerging in 6 out of 7 cases. The control group marked increased differences in Memory, Classification, Differences, Paired Associates and the YLAT_Total. The differences found in the first three tasks were not considered noteworthy as in the independent samples *t*-tests these yielded no significant differences between the two groups. The most marked difference of all, due to its magnitude, was found in the scores of Paired Associates. The experimental group increased the test mean by 52.43% in Grade 2 while the control group only by 27.02%.

4.3.3. Two factor analyses of variance (ANOVAs)

Two-way ANOVAs were performed in either grade to examine the effect of school and year on each test score. In Grade 1 the experimental group scored significantly higher than the control in Differences: $F(1,188) = 44.713$; p = .000 but lost this advantage in Grade 2. Irrespective of school, the following tests marked significant differences in

their scores from Grade 1 to Grade 2: Memory, $F(1,188) = 28.833$; $p = .000$; Classification, $F(1,188) = 22.621$; $p = .000$ and Semantic Integration, $F(1,188) = 1.419$; $p = .001$. The experimental group scored significantly better in Grade 2 in Paired Associates: $F(1,188) = 3.948$; $p = .048$, while it strengthened the already established difference from Grade 1 in Story Sequences, $F(1,188) = 15.897$; $p = .000$ and the YLAT_Total: $F(1,188) = 62.488$; $p = .000$. Overall, the two-way ANOVAs confirmed the findings from the independent samples *t*-tests.

5. Discussion

The main issue investigated in this paper is whether EFLL has a positive impact on young Greek learners' aptitude when the learning context provides a substantial amount of input (5 hours a week, 360 hours in total). The results indicate that EFLL can positively affect certain aptitude components in young learners. Paired associative memory, inductive reasoning and general cognitive ability were the cognitive skills that were enhanced by the early and intensive two-year FL intervention.

Paired Associates index participants' ability to form new links in mind between unrelated things. This is a truly significant finding for a number of reasons. First, in the earliest FLL stages the learner needs to 'build' the FL vocabulary with the new FL 'building blocks', which is an associative process. By the age of 6, learners have established a conceptual map that will be further enriched and remapped by the FL experience. They will be asked to form new links between the L1 referents in their long-term memory (LTM) and the FL words that have different phonological realizations (Papagno & Vallar 1992). Thus, it is clear that the ability to form associations in memory is closely linked to the retention of FL vocabulary. According to the Working Memory model of Baddeley and Hitch (1974) which was further extended by Baddeley (1986), surrounding information needs first to be attended to (via the attention controller), then become intake to be sent for further processing. If this stage is ensured, then an enhanced ability to form links in memory can only facilitate the retention of the new FL words (Alexiou 2005).

Story sequences taps learners' inductive reasoning and analytic thought. It is a cognitively demanding activity for learners of this early age as they need to process the information coming from the pictures to make up a story that aligns with the information ('scripts') already stored in their LTM. The task follows an analysis by synthesis procedure which is rather effortful and presupposes rational thought. The experimental group strengthened the already established difference from Grade 1, indicating thus the boosting effect the early FL exposure exercised on this skill, too. The finding is significant because the development of higher-order processes such as inductive reasoning have been held responsible for learners' further success in a wide range of scholastic subjects (Csapó & Nikolov 2009). Also, it confirms previous findings (Alexiou 2005) which suggest that young learners are more analytic than previously thought. Finally, the experimental group managed to strengthen further the aggregate cognitive score (YLAT_Total), suggesting thus the dynamic nature of FLA (Alexiou 2005). This is in accord with Piaget's prediction (1966/1974, as cited in Cole & Cole 2001), i.e. that the FL schooling experience may accelerate children's cognitive development.

6. Conclusion

So far, the great majority of the relevant EFLL research has focused on the linguistic and affective impact of EFLL. This paper demonstrates that after a two-year intensive FL intervention, the experimental group experienced a remarkable change in some of the cognitive skills tested. A boosting effect was detected in the learners' inductive learning ability, their general aptitude ability and their associative memory. The importance of these findings rests on the fact that these are all cognitively demanding activities that presuppose a top-down processing of incoming information and the best of children's cognitive resources. The findings also implicate the earlier activation of learners' explicit learning mechanisms which, in their turn, may lead to a faster and more efficient language performance, be this L1 acquisition that is still in progress, L2 or L3 learning (Mihaljevic Djigunovic 2010).

To conclude, the findings are more than encouraging. They demonstrate that EFLL has a significant positive impact on young learners' cognitive skills and aptitude components. It is hoped they will serve as a powerful argument in today's discussion of whether learners should be exposed to FLL earlier or not.

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