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INVESTIGATING THE WORKING MEMORY AND LANGUAGE ACQUISITION STRATEGIES AMONG MONOLINGUAL AND BILINGUAL CHILDREN IN A CLASSROOM'S SETTING

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Abstract:
The present study aimed at comparing the working memory of Greek monolingual students to bilingual ones from migrant backgrounds who all attend primary school. Secondly, an effort was made to investigate the correlation of the working memory with the academic performance in both groups. Moreover, the correlation of the vocabulary strategies, employed by monolingual and bilingual students in an integrated memory-based text framework (Rachanioti, Griva & Alevriadou, 2017), with their working memory was explored. The sample consisted of 20 monolingual and 20 bilingual students of Albanian origin, who attended the 5th and 6th grade of three primary schools in Eastern Thessaloniki, Greece. The monolingual and bilingual students were matched according to their mark reports on academic performance. The Automated Working Memory Assessment (Alloway, 2007) was used to assess the students' working memory. The data revealed that monolingual and bilingual students did not differ either in the verbal working memory or the visuospatial working memory performance. A statistically significant positive correlation between working memory and academic performance was found in both monolingual and bilingual students. The correlation of the *Process strategies* with the verbal working memory was statistically significant in monolingual students, as well as in the bilingual ones. The *Memory strategies* were positively correlated with the verbal and visuospatial working memory in both groups. The *Confirmation/consolidation strategies* were positively correlated with the verbal

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working memory only in the bilingual students. Results are discussed in terms of memory strategy instruction that may compensate for a poor working memory of both monolingual and bilingual students in a classroom's setting, thus aiding to improve their academic performance. This study is the first trial of the AWMA in Greek students as well as bilingual immigrant ones.

Keywords: working memory, academic performance, vocabulary strategies, monolingual students, bilingual students

1. Introduction

1.1. Working memory

Working memory generally refers to our ability to maintain and manipulate a limited amount of information for a short period of time in our mind, when completing cognitive tasks (Baddeley, 1992). Despite its limited capacity, working memory has been found to play a significant role in diverse mental activities such as language comprehension, numeracy and problem solving (Carruthers, 2013). Working memory is involved in reading and listening comprehension, vocabulary acquisition, verbal problem solving and first and second language use as well (Baddeley, 2000; Daneman & Hannon, 2007).

There are at least two opposing hypotheses about the relationship between working memory and bilingualism. The first hypothesis suggests that bilingualism can hinder efficient processing of information in the working memory due to the cognitive load imposed by the simultaneous management of two linguistic systems (Sweller & Chandler, 1994; Van Merrienboer & Sweller, 2005). In contrast, the second hypothesis suggests that the developed ability of bilinguals to inhibit one language when using the second one may increase their efficiency of working memory, because they manage its sub-components by using similar types of inhibitory controls (Bialystok, Craik, Klein, & Viswanathan, 2004; Bialystok, Craik & Luk, 2008).

Several studies that compare the working memory of the bilinguals with the monolinguals present conflicting results as to whether bilinguals enjoy an advantage in working memory over the monolinguals. Martin-Rhee and Bialystok (2008) investigated the advantage of bilingualism in working memory and found that this is related to the nature of the memory task. Bilinguals seem to have a bigger working memory capacity than monolinguals in tasks requiring greater attention control (Engle, 2002; Kane, Bleckley, Conway & Engle, 2001).

Similarly, Morales, Calvo and Bialystok (2013) compared the performance of monolingual and bilingual children in cognitive tasks that required different levels of working memory efficiency. The results confirmed the superiority of bilinguals in working memory, however, only when the cognitive task being performed requires additional processes of executive function.

In the same line, the cognitive advantage of bilingualism as well as the specific affected cognitive processes associated with executive processing, were investigated in relation to low socio-economic status in young children by Engel de Abreu, Cruz-Santos, Tourinho, Martin and Bialystok (2012). The participants were 40 Portuguese-Luxembourgish bilingual children from low-income immigrant families in Luxembourg matched with 40 monolingual children from Portugal who all completed visuospatial tests of working memory, abstract reasoning, selective attention, and interference suppression. Bilinguals performed better than monolinguals, demonstrating that the advantage of bilingualism is neither confused nor limited by socio-economic and cultural factors.

On the contrary, other studies have failed to find an advantage in the bilingual working memory. Engel de Abreu (2011) studied Luxembourgish monolingual and bilingual children, who had also been learning another language from birth (French, German, Dutch, etc.). The participants were six, seven and eight year olds, selected according to their demographic profile and measures were taken at three different times. The children were compared in two working memory tests, adapted from the AWMA (Alloway, 2007). In the first test, the participants had to count the circles in a successive series of images, containing triangles and circles. The performance was measured at the end of each test by recalling the number of cycles that were present in each image and in the same order, they were presented. Participants also performed a backward digit recall test. The analyses did not show any advantage of the bilinguals at any time of the tests.

Whether the bilingual advantage in non-verbal tasks could be better defined in a general as well as in a more specific domain was assessed by Bonifacci, Giombini, Bellocchi and Contento, 2011. In the case of the specific domain, an attempt to identify the basic cognitive skills involved was made. Bilingual and monolingual participants were divided into two age groups (children, youths) and performed a series of tests consisting of a choice reaction time task, a go/no-go task, two working memory tasks (numbers and symbols) and an anticipation task. The bilingual children did not differ, except for the anticipation task, where bilinguals were found to be faster and more accurate than the monolinguals.

Similarly, the relationship between working memory and visually-controlled attention in young bilingual and monolingual children was explored by Namazi and Thordardottir (2010). Fifteen monolingual children of French origin, 15 monolinguals of English origin and 15 early bilinguals in English and French, performed verbal short-term memory, verbal working memory, visual working memory and visually controlled tasks. Detailed information on language exposure was collected for all participants. The researchers also evaluated their language skills in both linguistic systems. A bilingual advantage was not found. Bilingual and monolingual children successfully ignored the irrelevant distraction on Simon task. Additionally, visual working memory was significantly correlated with visually controlled attention task. Bialystok (2009) reports that it is not clear that bilingualism affects the working memory. A composite analysis from various studies involving 544 monolinguals and bilinguals, either children or adults who performed a simple working memory task, did not show any difference between the two groups. In this case, the participants had to listen to increasing strings of words and recall them in alphabetical order or to two-digit numbers and recall them in ascending order. Thus, the results of the above composite analyses did not confirm the enhanced working memory in the bilinguals, although it is an integral part of the executive function (Bialystok, 2009).

Language proficiency, and in particular, lexical access as well as attention control in conflict resolution from competing language systems, play an important role in speech production by bilinguals. A combined analysis of several studies that included a total of 190 children, that were asked to recall increasingly long strings of animal names, showed no evidence for any difference between monolingual and bilingual children (Bialystok & Feng, 2009).

Working memory, lexical retrieval, and executive control were also investigated by Bialystok, Craik and Freedman (2007) in a study, involved ninety-six participants, who were younger (20 years) or older (68 years) adults and either monolingual or bilingual. Younger participants performed in most of the tasks better than older participants, thus confirming the effect of aging on these processes. Bilinguals and monolinguals did not differ regarding their working memory performance but monolinguals performed better on lexical retrieval tasks. Bilinguals performed better on executive control tasks. Therefore, the difference was not in the memory, but rather in the demands for more control and interference suppression.

Furthermore, phonological memory deficits have been confirmed to be closely related to disorders in language development (Chiappe, Siegel & Hasher, 2000; De Beni, Palladino, Pazzaglia & Cornoldi, 1998; Gathercole, Alloway, Willis & Adams, 2006; Gathercole & Baddeley, 1990; Gathercole, Hitch, & Martin, 1997; Gathercole, Service,

Hitch, Adams & Martin, 1999; Pham & Hasson, 2014). However, research data on the interface of bilingual development with language disorders has been limited over the last ten years and refers to efforts to identify clinical indicators of language difficulties diagnosis for bilingual students (Engel de Abreu, Cruz-Santos & Puglisi, 2014; Orgassa & Weerman, 2008; Verhoeven, Steenge & van Balkom, 2012). Correlations were found in phonological memory, phonological awareness as well as grammar and reading comprehension skills in both languages. Moreover, a correlation of L1 proficiency with L2 proficiency was found and the level of proficiency in both languages is closely related to verbal working memory, which seems to influence the development of both languages.

1.2. Working memory, academic performance and language acquisition strategies

Previous studies have demonstrated that the complex abilities of working memory are linked to the academic performance of children (Alloway & Alloway, 2010; Cain, Oakhill & Bryant 2004; Gathercole & Pickering 2000; St Clair-Thompson & Gathercole 2006). At the same time, it was observed that a deficit or some form of inefficiency in working memory is associated with the learning difficulties some students encounter (Gathercole, Alloway, Willis & Adams, 2006) as well as language impairments (Alloway & Archibald, 2008). In the same line, other studies have demonstrated that individual differences in the working memory performance have profound effects on the reading comprehension process (Engle, Cantor, & Carullo, 1992; Turner & Engle, 1989).

Regarding the language acquisition strategies, it has been suggested that people, who are more strategic, will have better working memory. Alternatively, the strategy use as a result, suggests that those who have bigger working memory capacity are more strategic, which in turn contributes to a better performance of working memory. Although the use of strategies can be both the reason and the result of an efficient working memory, Dunlosky and Kane (2007) carried out a study, which demonstrated that strategy use is the result of a good working memory performance.

The aforementioned hypotheses led the researchers to investigate whether working memory performance could be enhanced by means of memory strategy instruction. St Clair-Thompson et al. (2010) used memory strategy training such as oral repetition, clustering, visualization as well as storytelling in school children and found improvements in working memory. Similarly, Bailey, Dunlosky and Kane (2008) showed that memory training by means of imagery can improve performance on a word recall task in young as well as older adults and this improvement can also be transferred to the working memory performance.

Regarding individual differences in working memory performance, Budd, Whitney and Turley (1995) investigated whether they are associated with the different working memory strategies students apply while reading an explanatory text. Overall, the results indicated that different working memory management strategies are adopted for the most difficult text processing tasks by readers with poor and good working memory respectively and these strategies affect what they have learned from reading the text. In the same line, Holmes, Gathercole and Dunning (2009) investigated the relationship of the problems children with a low skill level of working memory face in reading and mathematics and explored whether these problems can be overcome with an educational program designed to enhance working memory. Their findings showed that deficits in working memory and learning difficulties can actually be overcome by enhancing working memory.

People with good memory performance are those that are able to strategically encode information by means of mental linkages, for example, to relate new information to prior knowledge stored in the long-term memory. As a consequence, teaching or improving the use of encoding strategies may result in the increase of the available information amount in the short-term memory (Kintsch, 1994). For example, people with good working memory performance can benefit to a greater extent from the existing knowledge compared to those with insufficient working memory (Hambrick & Engle, 2002). While the working memory has long been considered to have limited capacity (Cowan, 2001; Miller, 1956), increasing evidence suggests that the capacity can be enhanced by targeted training (Klingberg et al., 2005; Westerberg & Klingberg, 2007). Examples of memory strategies instruction aimed at the practice of encoding include clustering (St Clair-Thompson, Stevens, Hunt, & Bolder, 2010), creating a story with the words to be learnt (McNamara & Scott, 2001), using images (Carretti, Borella, & De Beni, 2007), teaching verbal repetition (Turley-Ames & Whitfield, 2003), teaching imagery (Bailey, Dunlosky & Kane, 2008).

The purpose of the present study was to explore the working memory performance of Greek monolingual students as well as bilingual ones from migrant backgrounds who all attend primary school.

The basic objectives of the study were set as follows:

1. Comparing the working memory of Greek monolingual students and bilingual ones from migrant backgrounds.
2. Investigating the correlation of the working memory with the academic performance in both groups.

3. Exploring the correlation of the strategies employed by monolingual and bilingual students in vocabulary acquisition as well as text comprehension and memorization with their working memory.

2. Method

2.1. Participants

The sample consisted of a total of 20 Greek monolingual and 20 bilingual students from schools in Eastern Thessaloniki, northern Greece. The participants' selection criteria were:

a) The bilingual students were only of Albanian origin.
b) Monolingual and bilingual students had to be equivalent in academic performance.
c) Monolingual and bilingual students had to be taught by the same teacher.
d) Monolingual and bilingual students were not to have a diagnosis of learning disabilities.

The 45% of monolingual and bilingual students were attending the sixth grade and 55% of the total number of the students was attending the fifth grade. 70% of all children (N = 28) were male and 30% (N = 12) were female. All bilingual students (100%) belonged to the category of "simultaneous bilingualism". The mean of their academic performance grade was 9.4 with a standard deviation of ± 0, 46. 82.5% of all students (N = 33) had high grades (9 to 10) and 17.5% (N = 7) had lower (8 to 8.9) according to their teachers' records.

2.2. Procedure

In order to assess the participants' working memory, the Automated Working Memory Assessment (Alloway, 2007) was administered. It is a PC-based assessment of working memory skills in the age groups of 4-22 years. The AWMA consists of 12 subtests: three tapping phonological short-term memory (digit recall, word recall, nonword recall), three targeting verbal working memory (listening recall, counting recall, backward digit recall), three aimed at visuospatial short-term memory (dot matrix, mazes memory, block recall), and three tapping visuospatial working memory (odd-one-out, Mr. X, spatial recall). There are three levels of assessment within *AWMA*. The *AWMA Screener* is made up of two tests and is suitable for screening individuals with suspected working memory difficulties. *The AWMA Short Form (AWMA-S)* consists of four tests and is recommended to screen individuals who are suspected to have memory difficulties, but the specific area of their difficulties is not known. Finally, the *AWMA*

Long Form (AWMA-L) consists of all 12 tests and is recommended for confirmation of significant working memory problems for individuals identified as having working memory problems in the classroom. The administration and scoring are fully automated. The testing sequence is pre-set and the test scores are calculated by the computer program. Moreover, an interpretation of how the working memory scores will affect learning is provided. The psychometric properties of this tool were evaluated for their reliability as well as validity in England and Northern America and found satisfactory (Alloway, Gathercole & Pickering, 2006; Alloway, Gathercole, Kirkwood & Elliott, 2008).

In the course of the assessment, the participants have to activate all the individual memory components of the Baddeley and Hitch model (1974), which we adopted in this study. The access to Phonological loop, the Visuo-spatial sketchpad and the Episodic buffer is required for the oral information as well as visual sequences recall. Both oral and visual information increases successively and the retrieval errors are automatically recorded by the computer.

In our study, the AWMA *Screener* was administered. It consists of a Listening Recall test and a Spatial Recall test and its duration is 15 min. In the Listening Recall subtest, which taps the verbal working memory, the student heard a sequence of sentences (e.g., "Dogs have four legs") and at the end of each sentence had to confirm whether it was true or false. Then, at the end of each trial, after the confirmation of all sentences in a sequence being true or false, she/ he should recall the final words of each sentence exactly in the same order as they had been presented (e.g., "legs"). The subtest began with a block of 1 sentence and increased to a block of 6 sentences.

In the Spatial Recall subtest, the student was presented with a pair of identical shapes, in which the right shape has a red dot above it and is rotated clockwise or counterclockwise. During the presentation, she / he should identify whether the shape with the red dot is the same or the opposite of the other shape. The shape with the red dot may take three different orientations, consequently the red dot can be found in three different locations that are to be remembered. A block of trials starts with a presentation of 1 pair of shapes and increases to the sequential presentation of 7 pairs of shapes. At the end of each block, the student should recall the positions of the red dots by pointing on the computer screen the three possible locations, exactly in the same order as the sets were presented.

The translation of the AWMA into the Greek language was done, after written consent[ii] had been given by Pearson Assessment. Digital audio files in the Greek language were created with the use of software in order to convert text to audio files, which were incorporated into the existing image ones.

The study was carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki). It did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

2.3. Data analysis

The data processing included inferential statistical analysis. The comparison of the Greek monolingual students' working memory with the bilingual ones' from migrant backgrounds was examined with T-test and Levene's test. The correlation of the working memory with the academic performance and the strategies of vocabulary acquisition as well as text comprehension and memorization, were examined by calculating Pearson correlation coefficient. All statistical analyses were carried out with the SPSS statistical software.

3. Results

3.1. Verbal working memory and visuospatial working memory performance

The analysis of the data, related to the comparison of the Greek monolingual students' working memory with the bilingual ones' from migrant backgrounds (Table 1) revealed no statistical difference between measures of central tendency (T-test) and dispersion (Levene's test). No statistical significance in both indexes of Verbal Working Memory and Visuo-spatial Working Memory was found.

Table1: Verbal Working Memory and Visuospatial Working Memory Performance of Monolingual and Bilingual students

Independent Samples Test					
	Levene's Test for Equality of Variances		**t-test for Equality of Means**		
	F	**Sig.**	**t**	**df**	**Sig. (2-tailed)**
Verbal Working Memory	1,193	,282	,902	38	,373
Visuo-spatial Working Memory	2,049	,160	-,628	38	,534

[ii] Automated Working Memory Assessment Greek Research Edition Copyright © 2007, 2015 by Pearson Education Ltd. Adapted with permission by Pearson Education Ltd. This test may not be reproduced, in whole or in part, without written permission from the publishers. All rights reserved

3.2. Working memory and academic performance

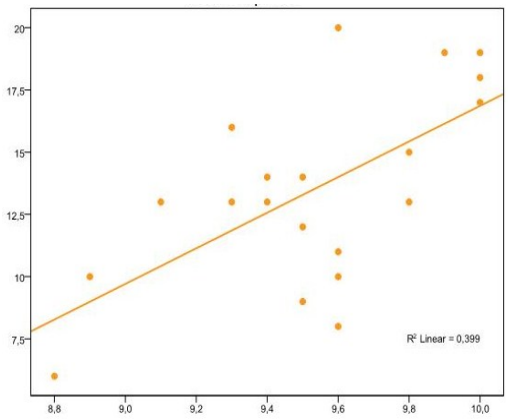
The correlational analyses of the working memory performance of monolingual and bilingual students related to their academic performance revealed some statistically significant positive correlations. In particular, the verbal working memory positively correlates with the general grade of the academic performance (Table 2) in both monolingual students [r (20) = 0,632 and p = 0,003] and bilingual ones [r (20) = 0,488 and p = 0,029]. A higher score in the verbal working memory results in a better general grade of academic performance for both groups. No correlation of visuospatial memory with the general grade was found for any of the two groups.

Table 2: Verbal Working Memory and Visuospatial Memory of Monolingual and Bilingual students in relation to general grade of academic performance

Group			**General Grade**
Monolingual students	Verbal Working Memory	Pearson Correlation	,632**
		p (2-tailed)	,003
		N	20
	Visuo-spatial Memory	Pearson Correlation	,079
		p (2-tailed)	,742
		N	20
Bilingual students	Verbal Working Memory	Pearson Correlation	,488*
		p (2-tailed)	,029
		N	20
	Visuo-spatial Memory	Pearson Correlation	,139
		p (2-tailed)	,559
		N	20

The correlation among the variables of the verbal working memory, monolingualism and the general grade of academic performance (r = 0,632, R^2 = 0,399) is shown in Graph 1. The coefficient of determination indicated that the academic performance is affected 39, 9% by the monolingual students' verbal working memory.

A. Group: Monolinguals

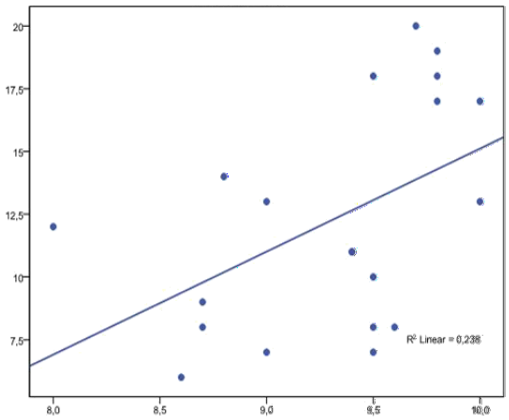


General grade of academic performance

Graph 1: Correlation of verbal working memory, monolingualism and general grade of academic performance

Similarly, Graph 2 shows the correlation among the variables of verbal working memory, bilingualism and the general grade of academic performance (r = 0,488, R^2 = 0,238). The coefficient of determination showed that the academic performance is affected 23.8 % by the bilingual students' verbal working memory.

B. Group: Bilinguals



General grade of academic performance

Graph 2: Correlation of verbal working memory, bilingualism and general grade of academic performance

3.3 Working memory and language acquisition strategies.

In a previous study of Rachanioti, Griva and Alevriadou (2017), students reported the employment of a series of vocabulary acquisition strategies as well as text comprehension and memorization strategies, during the "think aloud sessions" and the retrospective interviews, at a macro and micro level of the text. The identification of the

strategies employed in an integrated memory - based text framework resulted in the compilation of a strategy model: a) *exploration strategies,* b) *process strategies,* c) *memory strategies* and d) *confirmation/consolidation strategies*. In addition, they explored the correlation of the strategies employed with students' academic performance. The correlation of the *process strategies* with the academic performance was statistically significant in monolingual students, as well as in bilinguals. A stronger positive correlation was found between the *memory strategies* and the monolingual students' academic performance, while a positive trend also emerged for bilingual ones. In the current study, the correlation of the abovementioned four basic strategic categories with the working memory was investigated.

3.3.1 Working memory, Process strategies and Memory strategies

The statistically significant positive correlation of the *Process strategies* as well as *Memory strategies* with the working memory in monolingual and bilingual students are presented in this part. More specifically, the data analysis revealed that the *Process strategies* positively correlate with the verbal working memory in monolingual students[r (20) = 0,547 and p=0,013] as well as in bilinguals ones [r (20) = 0,676 and p = 0,001]. It was revealed that the students with better verbal working memory performance employ more *Process strategies* in both groups. Regarding the visuospatial working memory, no significant correlation was found with the *Process strategies*. The *Memory strategies* positively correlate with the verbal working memory in monolingual students [r (20) = 0,830 and p = 0,000] as well as the bilinguals ones [r (20) = 0,595 και p = 0,006]. Similarly, the *Memory strategies* correlate with the visuospatial working memory [r (20) = 0,450 and p = 0, 46] in the monolingual students as well as in the bilinguals ones [r (20) = 0,466 and p = 0,038]. The findings revealed that regardless of the monolingualism-bilingualism factor, *Memory strategies* have a stronger positive correlation with the verbal working memory as compared to the visuospatial working memory.

3.3.2 Working memory, Exploration strategies and Confirmation/consolidation strategies

Regarding the *Exploration strategies*, no significant correlation was found either with the verbal working memory or the visuo-spatial working memory in both groups (Table 3). The *Confirmation/consolidation strategies* positively correlate with the verbal working memory only in the bilingual students [r (20) = 0,716 and p = 0,000]. Bilingual students with better verbal working memory performance adopt more *Confirmation/ consolidation*

strategies. The number of the *Confirmation/consolidation strategies* does not correlate with the visuospatial working memory in both groups.

Table 3: Exploration-Confirmation strategies of Monolingual and Bilingual students in relation to Verbal Working memory and Visuospatial Working Memory

Group			**Exploration Strategies**	**Confirmation/consolidation strategies**
Monolingual Students	Verbal Working Memory	Pearson Correlation	,259	,202
		Sig. (2-tailed)	,271	,393
		N	20	20
	Visuo-spatial Working Memory	Pearson Correlation	,208	,236
		Sig. (2-tailed)	,379	,317
		N	20	20
Bilingual Students	Verbal Working Memory	Pearson Correlation	,358	,716**
		Sig. (2-tailed)	,121	,000
		N	20	20
	Visuo-spatial Working Memory	Pearson Correlation	,233	,124
		Sig. (2-tailed)	,324	,603
		N	20	20

4. Discussion

In the present study, Greek monolingual students' working memory was compared with the bilingual ones' from migrant backgrounds. Moreover, an effort to comparatively investigate the correlation of the working memory with the academic performance as well as the vocabulary strategies employed by monolingual and bilingual students in an integrated memory-based text framework (Rachanioti, Griva & Alevriadou, 2017) was attempted.

Monolingual and bilingual students were found not to differ either in the verbal working memory or the visuospatial working memory performance. These findings are

in line with those of previous studies which failed to find an advantage in bilingual working memory compared to monolinguals (Bialystok, 2009; Bialystok, Craik & Freedman, 2007; Bialystok & Feng, 2009; Bonifacci, Giombini, Bellocchi & Contento, 2011; Engel de Abreu, 2011; Namazi & Thordardottir, 2010).

The analysis of the data, with respect to the academic performance, revealed a significant positive correlation with verbal working memory for monolingual students, as well as bilingual ones. A higher score performance in verbal working memory relates to a higher grade of academic achievement. The findings of this study are consistent with those of previous studies which demonstrated that the complex abilities of working memory are closely linked to the academic performance of children (Alloway & Alloway, 2010; Cain, Oakhill & Bryant 2004; Gathercole & Pickering 2000; St Clair-Thompson & Gathercole 2006). However, it should be noted that the verbal working memory affects the monolingual students' academic performance by a considerable percentage and less the bilingual ones'. No correlation was observed in visuospatial memory with the academic performance in any of the two groups.

Regarding the language acquisition strategies, it was found that the *Process Strategies* positively correlate with the verbal working memory in monolingual students, but also in bilingual ones. The better performance in verbal working memory, monolingual and bilingual students have, the more strategic will be. The number of the *Process Strategies* is not related to visuospatial memory, neither in the monolingual students nor in the bilingual ones.

The *Memory Strategies* positively correlate with the verbal as well as the visuospatial working memory in both groups. The findings indicated that regardless of the monolingualism - bilingualism factor, *Memory Strategies* have stronger correlation with the verbal working memory as compared to the visuospatial one. Students with poor performance in working memory use a smaller number of comprehension and memory strategies than students with high performance (DeMarie, Miller, Ferron & Cunningham, 2004; McNamara & Scott, 2001; Schelble, Therriault & Miller, 2012).

Moreover it was found that the *Confirmation/consolidation Strategies* positively correlate with the verbal working memory only in the bilingual students. It seems that oral repetition, which is the main *Confirmation/consolidation Strategy,* improves the verbal working memory of the bilingual students (Minear & Shah, 2006).

5. Conclusion

Taking the aforementioned findings into consideration, we suggest that memory strategy instruction may compensate for a poor working memory of both monolingual

and bilingual students in a classroom's setting, thus aiding to improve their academic performance. Besides, there are a rapidly increasing number of studies demonstrating that educational training aimed at improving the capacity of working memory can also enhance a number of important cognitive skills (Morrison & Chein, 2011). This training includes memory strategies instruction, as an effective approach for encoding, maintenance and retrieval of information from the working memory. The primary purpose of teaching memory strategies would be to increase the capacity of working memory in tasks which require the retention of information for a specific time period.

With regard to bilingual students, it is widely accepted that children with limited proficiency in the language of schooling are certain to experience increased difficulty in coping both academically and socially. The results of the current study suggest that teaching cognitive skills to improve the academic performance and the literacy development of bilingual students included in a mainstream class is feasible. Since schools in Greece are orientated towards a monolingual approach and given the financial problems the country faces, creating an educational framework which responds to the needs of all students would be not only cost-effective, but it will promote inclusive practices for immigrant children as well.

The instruction of memory strategies may not aim directly at improving the performance of working memory since the limited capacity of the working memory is bypassed by grouping or encoding in the long-term memory and not directly affecting the capacity of the working memory. Nevertheless, if we consider that the working memory is integrated into a single memory system, the components of which interact (Nairne, 2002), the memory strategy instruction will affect the working memory as well. Given the limited number of the target population and the restricted context of conducting this study, the results of the present study cannot be regarded conclusive. A larger sample of both bilingual and monolingual students should be included in a further study, in order to comparatively investigate the working memory capacity, its relation with the strategies employed for vocabulary acquisition as well as comprehending – memorizing a text and the impact on the academic performance in a more valid way. Further research in primary education, overcoming the limitations observed, is needed to confirm the results obtained.

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