

Reading ability and Diglossia in Kuwaiti primary schools

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The candidate confirms that the work submitted is her own and that appropriate credit has been given where reference has been made to the work of others.

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Abstract

This project investigated the relationship between children's reading ability and their phonological awareness, phonological short term memory and visual short term memory in a diglossic setting. The study was conducted in Kuwait where children grow up speaking a Kuwaiti local form of the Arabic language. This form of Arabic is linguistically distinct from the literate Arabic. The children also deal with another type of words, which are Kuwaiti shared words. The effect of these different types of Arabic words on children's reading ability and phonological sensitivity was investigated. Four measures were administered in both studies; single word reading ability, phonological deletion, phonological short term memory and visual short term memory.

Two studies were conducted; a cross-sectional study and a longitudinal study using four measures. In the cross-sectional study, forty-nine 6 year-old students participated. Results indicated that all predictor measures, phonological awareness, phonological short term memory and visual short term memory, correlated with reading ability. But regression analysis showed that only children's phonological awareness uniquely predicted reading ability when controlling for age and Verbal IQ. Anova showed that there was also a significant effect of word type on children's reading ability but not their phonological awareness. So children found it easier to read the modern standard Arabic and shared words than the local dialect words.

In the longitudinal study, all tasks were administered to participants three times; 85 children at the beginning of first grade, 81 children at the end of first grade, and 78 children at the start of second grade. All participants' reading abilities and both phonological and visual short term memory improved over time. Phonological awareness still uniquely predicted reading ability when controlling for age and Verbal IQ across all the time points. But there was a change in how word types affected phonological awareness.

Very few studies have investigated reading ability in Arabic. This project helps further understanding about the unique contribution of the different cognitive skills towards reading ability. Also, it improves the awareness of Arabic children's needs and complications in acquiring a successful Arabic reading in a diglossic setting.

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Abbreviations

Modern Standard Arabic (MSA)

Local Dialect (LD)

Kuwaiti Local Dialect (KLD)

Shared Words (ShW)

Modern Standard Arabic Words (MSAW)

Kuwaiti Local Dialect Words (KLDW)

Kuwaiti Shared Words (KShW)

Initial Phoneme Deletion (IPD)

Initial Unit Deletion (IUD)

Chapter One

Introduction

1.1 Overview

During the early school years, young children start to develop a process of understanding speech in a written form (Ziegler and Goswami 2005). This process is called reading. It is an essential and challenging cognitive process (Taha 2013), which emerges in young children initially as a consequence of a complex interaction and coordination between various perceptual and linguistic processes (Abu-Rabia 1995). These include phonological awareness and short term memory, both phonological and visual (Brunswick et al. 2012; Ellis and Large 1988).

Reading ability has been well investigated across many languages, and English in particular. Research has found that phonological awareness and both phonological and visual short term memory are important for the development of reading (Taibah and Haynes 2011). Studies related to the reading of English orthography emphasised that phonological awareness develops before children start to read and it is the most important skill in the reading process (Goswami and Bryant 1990; Mann and Liberman 1984; Rohl and Pratt 1995).

On the other hand, little is known about reading and the other cognitive reading-related skills in Arabic. The Arabic language is characterised by diglossia; there exist two varieties of language: the modern standard Arabic, which is considered as a formal form, and local dialect, which is considered as informal. This diglossia has been found to impact on children's reading ability and consequently their general learning achievement (Ibrahim and Aharon-Peretz 2005; Maamouri 1998). Obviously, when considering reading ability, phonological and visual skills are very important. A small number of studies, related to reading Arabic orthographies, discovered that children rely more on visual skills during the early reading development than on phonological skills (Elbeheri et al. 2011; Taha 2013). In fact, it is not clear whether the key role in the reading process in Arabic is played by phonological awareness and phonological short

term memory or by visual short term memory. The nature of the relationship between reading and the other cognitive skills, both phonological and visual, may be different from the relationship in English because the two languages differ in the complexity of their linguistic and orthographical structure.

The aim of this project is to investigate the relationship between children's reading ability and their phonological awareness, phonological short term memory and visual short term memory. Also it aimed to investigate whether phonological awareness, phonological short term memory and visual short term memory are independent predictors of the early reading ability of Arabic Kuwaiti children. The effect of the different types of words of the Arabic language was also investigated. These words are modern standard Arabic which is the literary Arabic, Kuwaiti local dialect which is the informal everyday dialect communication, and those words that are exactly the same in both varieties, which are called Kuwaiti shared words.

In order to explain the nature of the relationship between reading ability and phonological awareness and short term memory in Arabic, a concise description of these skills will be presented. Then, the characteristics of the Arabic language will be explained and a definition of diglossia will be given. A background of the Kuwaiti educational context during kindergarten and the first two years of the primary school period will be described. The review of the related literature regarding the relationship between reading ability and phonological awareness, phonological short term memory and visual short term memory, in both English and Arabic, will follow.

1.2 Phonological Awareness

Phonological Awareness is considered as one of the most important cognitive skills for reading acquisition. It is the understanding of the different sound structures of spoken words and the capability to manipulate and distinguish them (Bowey et al. 1992; Bryant et al. 1990; Carroll et. al. 2003; Castles and Coltheart 2004; Wagner and Targesen 1987). Children need to understand that each small spoken sound, known as a phoneme, is represented in print by a letter or a group of letters, and each letter or group of letters can be pronounced by a specific phoneme (Saiegh-Haddad 2005). For instance, the

word ‘bat’ consists of three letters /b/ /a/ and /t/ which are the phonemes /b/, /ae/ and /t/ (Buh, aah, tuh).

Table 1: Examples of tasks used to assess phonological awareness (Mann and Liberman 1984; Yopp 1988)

Tasks	Example
Recognition or production of rhyme	Does sun rhyme with run?
Isolation of a sound	What is the first / last sound in rose?
Phoneme segmentation	What sounds do you hear in the word hot?
Phoneme blending	Combine these sounds: /c/-/a/-/t/.
Invented spellings	Write the word monster
Phoneme reversal	Say os with the first sound last and the last sound first.
Phoneme counting	How many sounds do you hear in the word cake?
Syllable counting	How many syllables do you hear in the word table?
Phoneme/ Syllable tapping	Tap out the number of phonemes / syllables in each verbally presented word by a small wooden dowel on the table. Three taps for /fat/ because there are three phonemes One tap for /fat/ because there is one syllable Select the odd word out of the following verbally presented words
Phoneme / syllable/ rhyme oddity, some times pictured word applied.	Initial or final phonemes Singleton-onset (car, cat, sun) Syllables Rhymes (boat, sail, nail)
Initial / final Phoneme deletion	What word would be left if /s/ were taken away from the stand? /d/ were taken away from the stand?
Initial / final Syllable deletion	What word would be left if /pen/ were taken away from the word pencil? /cil/ were taken away from the word pencil?

When phonemes combine together, syllables can be formed. A word can be built by one or more syllables and each syllable consists of one vowel and at least one consonant (Lurenz 2012). For example, the word ‘bat’ consists of one syllable (CVC), where C is the consonants /b/ and /t/, and V is the vowel /a/; the word ‘basket’ has two syllables

(CVC-CVC). The reader should segment a word into its phonological components, and blend these components to be able to start to read the word (Shaywitz 1998).

Children's phonological abilities can be demonstrated by applying a wide range of phonological awareness tasks (see Table 1) that vary in their nature and level of segmentation ability (Gathercole and Baddeley 1993; Yopp 1988). It is worth mentioning that some studies have obtained remarkably clear results showing that measures of phoneme awareness are excellent simultaneous and longitudinal predictors of early reading skills (Carroll et al. 2003; Hatcher and Hulme, 1999; Høien et al. 1995; Hulme et al. 2002; Hulme et al. 1998; Muter et al. 1997; Nation and Hulme 1997).

1.3 Short term memory

Short term memory is another factor important for the reading process; it involves both phonological short term memory (Hansen and Bowey 1994) and visual short term memory (Baddeley 1986). Short term memory is the capacity to store material over short periods of time, and among its other functions it is essential in language processing (Baddeley 2000). According to Baddeley and Hitch's (1974) working memory model, working memory has three components. The first is the central executive, which is responsible for retrieval of information from long-term memory and regulating the flow of information within the two other components. The other two components are called slave systems and are often referred to as short term-memory; the phonological loop, which is related to phonological short term memory; and the visuo-spatial sketchpad, related to visual short term memory, each of which has limited capacity in terms of processing and storage (Gathercole 1999; Harley 2008). Kandel et al. (2000) stressed that although both working memory slave systems manage different of information to some extent, they are interrelated to perform particular tasks.

Phonological short term memory and visual short term memory are of primary interest in this thesis. Phonological short term memory comprises two sub-components, a phonological store and a sub-vocal rehearsal process. Verbal material can be held as a phonological form in the phonological store but it decays within a short period of time.

However, this duration of storage can be maintained for longer by the sub-vocal rehearsal, which refreshes the phonological representations as well as recoding the non-phonological inputs, for example printed words and pictures, into their phonological form, to be held in the phonological store. As a consequence, the phonological loop is a significant structure that plays a role in phonological processes (Gathercole 1999; Harley 2008) and represents one of the key factors for learning the phonological structure of new words (Gathercole 1999; Gathercole et al. 1999) and for reading development (Wagner and Torgesen 1987).

Visual short term memory, on the other hand, is responsible for the manipulation and temporary storage of visual information such as shapes, colours, and spatial information such as motions, directions (Baddeley 2003), as well as of verbal materials which are subsequently encoded in the form of imagery (Gathercole and Baddeley 1993). Visual short term memory plays an important role in supporting the recognition of words according to their shapes rather than their phonological representation (Brunswick et al. 2012; Ehri and Wilce 1985)

These three components of the Baddeley and Hitch (1974) model are found to be in place and can be reliably assessed by the age of four years old (Alloway et al 2005; Alloway 2006). Assessment of both phonological short term memory and visual short term memory can be achieved by measuring the ability to hold and reproduce small amounts of material in a consecutive manner. Some examples of phonological short term memory tasks are digit span and word recall. Corsi blocks and visual-patterns tasks can be used to measure visual short term memory ability (Bull 2008).

1.4 Background of Arabic Language and Diglossia

The Arabic language belongs to the Semitic language family, which comprises a group of languages, such as Hebrew and Aramaic, which show a level of similarity in their phonology and morphological structure. Arabic developed in the Arabian Peninsula and it has spread since the early appearance of Islam during the 7th century (Holes 1995).

The Arabic language is the heart of Islamic religion. It is the language of the holy book of Islam, the Holy Qur'an. All Muslims, regardless of their origin, have to learn some Arabic, at least enough to enable them to recite and read the Quran and undertake the religious obligations of Islam. The Qur'anic Arabic is the official form of Arabic and is structured on a very precise phonology, morphology, syntax and semantic model. Similar to Latin, in modern times this type of Arabic is nobody's native language at present and it is called Classical Arabic (CA).

Due to the need for a larger and more contemporary vocabulary and lexis than what was already found in CA, and in order to respond to modernisation and the need for a less complex syntactical structure, a simplified and updated version of CA has emerged. This version is called Modern Standard Arabic (MSA). MSA is the literary language used in most formal current, printed Arabic publications. It is the language of instruction in Arabic schools and can only be mastered through formal education. In addition, MSA is used in formal communications in all Arab countries and understood by most educated Arabic speakers. Both CA and MSA are called "*Fusha*" in Arabic (Holes 1995).

Neither CA nor MSA are used for informal everyday communication, but there are different varieties called Local Dialects (LD) or "*Ameiah*". Hereafter these will be called LD. The linguistic nature of these varieties is acquired naturally, as by native speakers of any language with regard to their mother tongue (Al-wer 1997). These varieties, such as Gulf Arabic, Levantine Arabic and North African Arabic, differ widely from one another—both from country to country and within a single country, sometimes causing them to become "mutually unintelligible" (Saiegh-Haddad 2007). The linguistic distance between these varieties on the syntactic, semantic, morphological and phonological levels is significant (Saiegh-Haddad 2004; Saiegh-Haddad 2007). For instance, certain phonemes of some words can be found in a specific dialect but are absent in the dialect of another geographical area (Taha 2013); for example, the sound 'ch' can be used in Kuwaiti dialect but not in Palastinian or Saudi dialects.

In addition, all the variations of LDs differ from MSA (Taha 2013). For example, although *Fusha* and LD share a high number of phonemes, morphosyntactic and lexical structures, LD has some which are not available in *Fusha*, and *Fusha* has some which

are not available in LD. *Fusha*, MSA in particular, is introduced to children only at the beginning of their literacy learning, which is usually in the first grade of primary school (Maamouri, 1998; Saiegh-Haddad 2007). However, children can hear some MSA words from TV cartoons and nursery songs (Mahfoudhi et al. 2011).

Although there are no written forms of LD, people translate their spoken words into printed form based on their phoneme-grapheme conversion skills (Bentin and Ibrahim 1996), borrowing MSA letters which represent similar sounds in LD. This ability is often, if not always, limited to skilled readers who are already introduced to all Arabic letters and can, to some extent, read and write fluently. LD appears in certain types of literature, for example, plays, poetry, some media and some printed advertising.

The sociolinguistic relationship between two varieties of the same language in general or between *Fusha* and LD in the Arab world in particular is called "diglossia". Diglossia is defined by the term's founder, Charles Ferguson as:

“a relatively stable language situation in which, in addition to the primary dialects of the language (which may include a standard or regional standards), there is a very divergent, highly codified (often grammatically more complex) superposed variety, the vehicle of a large and respected body of written literature, either of an earlier period or in another speech community, which is learned largely by formal education and is used for most written and formal spoken purposes but is not used by any sector of the community for ordinary conversations.” (Ferguson 1959, p. 245)

With relation to the previous explanation of Arabic varieties and according to Ferguson's definition of diglossia, the high variety in Arabic is *Fusha* and the low variety is LD.

It is believed that diglossia could be a significant factor disturbing children's capability to acquire the basic reading processes (Abu-Rabia 2000; Saiegh-Haddad 2007). In other words, in Arab countries, including the state of Kuwait where this study experiment was conducted, some aspects of MSA, such as certain phonemes and certain words, are not present within the LD (Saiegh-Haddad 2005). Therefore, diglossia can have a negative impact on the development of MSA reading processes. Leikin et al. (2013, p. 1) found that the linguistic gap between MSA and LD “seems to impact the level of mastery over

linguistic structure in both forms of Arabic". Abu-Rabia and Taha (2006) found that the most frequent errors in children from grade 1-9 were phonological errors directly related to MSA, which affects their reading level. According to Maamouri (1998), the discrepancy between the spoken language and the language of literacy appears to be an important reason for low learning achievement in school, and low adults' literacy levels everywhere in the Arab world. For instance, it has been established that the reading abilities of Arabic speaking children (grade four) in different Arab countries was poor in general, and in the state of Kuwait in particular, which was one of the bottom three countries out of 45 participating countries and educational entities in a league table for students' reading attainment (Zuzovsky 2010).

Some researchers have found that, for children, learning MSA literacy is to some extent comparable to learning a second language (Ibrahim 2009; Ibrahim and Aharon-Peretz 2005). For example, a study conducted by Ibrahim and Aharon-Peretz (2005) on 48 Arabic Palatines students (grade 11 and 12) compared the semantic priming effects in auditory lexical decisions of Palestine Local Dialect with MSA or Hebrew as the other language. Students who participated had been introduced to MSA and Hebrew in school from the second grade and were equally skilled in both languages. The task included a total of 288 words: 96 words in MSA, 96 words in LD and 96 words in Hebrew. All word types were mixed in one block. Participants were asked to listen to each word, and make a lexical decision by pressing an appropriate button provided. Participants' performance was assessed according to the accuracy and speed of their responses. The researchers found that although children practise MSA and Palestine LD intensively in daily life, and both forms are considered as two forms of one language, MSA words and Hebrew words took more time and effort to process than Palestine LD. A possible explanation of this is that the connection between words and their meanings in a second language is weaker than the connection between words and their meanings in the first language (Ibrahim 2009). Therefore, as Ibrahim (2009) believed, MSA and Palestine LD are typically processed differently in the cognitive system, taking into account that the MSA presentation of Arabic speakers does not influence the lexical decisions for words in Palestine LD. However, they are organized separately in the child's lexicon with MSA acting like a second language (Ibrahim 2009; Ibrahim and Aharon-Peretz 2005).

Based on the view that MSA is considered as a second language (Ibrahim and Aharon-Peretz 2005), cross-language research also found that children's vocabulary development might be influenced in each language. For example, children who learn to read a second language use vocabularies in the first and second language less frequently than do children who read only one language. Therefore, the lexical representations of children who read two languages would have accumulated less practice overtime, and the links between the semantics and phonology of both languages become weaker compared to the children who use only one language system (Gollan et al. 2005). This is because words that are more frequently used are easier to produce (Gollan et al. 2005).

On the other hand, some research has found that learning to read a second language plays a positive role cognitively and linguistically in learning the first language (Bialystok 2002; D'Angiulli 2001; Kuo 2012). For example, Demont (2001) found a strong relationship between learning a second language and improving children's linguistic awareness, as children became better in grammatical judgment, correction tasks and word recognition after attending bilingual classes during kindergarten. Bialystok (2003) also examined the development of phonological awareness in monolingual (English) and bilingual (Spanish-English) children between kindergarten and Grade two. The results showed that the Spanish-English bilingual children performed better than English-speaking monolinguals on a phoneme segmentation task. It was thought that those children who were introduced to a language with more predictable grapheme-phoneme correspondences, such as Italian and Spanish, could enhance their phonological skills in other languages such as English (D'Angiulli et al. 2001). In fact many factors may play a role in learning to read a second language, such as age (Fathman 2006), individual differences and motivation as well as social (parent and culture) and educational context (classroom and teachers) (Gardner 2007; Pecenek 2011).

It is worth mentioning that in some countries in the Arab world, in particular North African countries, the discrepancy between LD and MSA is described as bilingualism, not diglossia. This is because of the colonial legacy of French and English that affected the local vernacular in fundamental ways (Ayari1996). In other words, many Arabic speaking countries are using French or English as a standard language of instruction, and sometimes, in other countries, as official languages alongside Arabic. These foreign

languages, whose structures are considerably different from literary Arabic, have tended to exacerbate the discrepancy between the two varieties of Arabic (Ayari1996).

1.4.1 The basic orthographical and phonological structure of MSA

The Arabic alphabetic system includes 28 consonant letters. Some letters are similar in shape but different in sound and can be distinguished by the dots positioned above or under them, for example : /ب/ ‘b’, /ت/ ‘t’ and /ث/ ‘t’’. Arabic letters do not have a consistent shape; their shapes can be slightly changed according to their position in words: initial, medial and final or standing alone (Table 2). Arabic scripts are cursive; six letters connect to the preceding letter while the rest connect to both sides (Table 2). This produces three types of letter connectivity levels: fully connected words / عَسَل / ‘Honey’, partially connected / نور / ‘light’, and non-connected / دَرْسٌ / ‘lesson’, (Taha 2013).

Three of the 28 letters can be used as long vowels: ‘ā’, ‘ū’ and ‘ī’ are represented by the letters ‘alif /ا/, wāw /و/ and yā’ /ي/ respectively. Long vowels are sometimes not included in words, but sometimes they are written as an original part of a word or as a grammatical indication. Besides the long vowels, the Arabic language includes three main short vowels which are indicated in writing by strokes above or under a word: ‘damma’ /َ/, ‘fatha’ /َ/ and ‘kasra’ /ِ/, which are identical to the vowels ‘a’ ‘u’ and ‘i’ in English respectively. Along with the vowels, there are two diphthongs (aw and ay) in MSA. There are two other symbols in Arabic: ‘skoon’ /ْ/ which is the absence of a vowel and ‘shadda’ /ّ/ which is doubling of a consonant.

Words in MSA cannot begin with a vowel (V), which can appear only between two consonants or at the end of a word; they must begin with a consonant (C). A vowel can be combined with a maximum of two Cs to build a syllable in a word. There are two types of syllables in Arabic; a short syllable, which is a single consonant attached to a vowel in a CV form, and long syllables which exist in other forms, such as, CVC and CVV forms.

Table 2: List of Arabic consonants

Isolated Arabic consonants	Arabic Consonant names	International Phonetic Alphabet	How the consonants change in different positions		
			Initial	Medial	Final
أ	'alif	a	أ	أ	أ
ب	bā'	b	ب	ب	ب، ب
ت	tā'	t	ت	ت	ت، ت
ث	ṭ'ā'	ṭ'	ث	ث	ث، ث
ج	jīm	j	ج	ج	ج، ج
ح	ḥā'	ḥ	ح	ح	ح، ح
خ	ḫā'	ḫ	خ	خ	خ، خ
د	dāl	d	د	د	د، د
ذ	ḏāl	ḏ	ذ	ذ	ذ، ذ
ر	rā'	r	ر	ر	ر، ر
ز	zāy	z	ز	ز	ز، ز
س	sīn	s	س	س	س، س
ش	šīn	š	ش	ش	ش، ش
ص	ṣād	ṣ	ص	ص	ص، ص
ض	ḏād	ḏ	ض	ض	ض، ض
ط	ṭā'	ṭ	ط	ط	ط، ط
ظ	ẓā'	ẓ	ظ	ظ	ظ، ظ
ع	'ayn	ʿ	ع	ع	ع، ع
غ	ġayn	ġ	غ	غ	غ، غ
ف	fā'	f	ف	ف	ف، ف
ق	qāf	q	ق	ق	ق، ق
ك	kāf	k	ك	ك	ك، ك
ل	lām	l	ل	ل	ل، ل
م	mīm	m	م	م	م، م
ن	nūn	n	ن	ن	ن، ن
هـ	hā'	h	هـ	هـ	هـ، هـ
و	wāw	w	و	و	و، و
ي	yā'	y	ي	ي	ي، ي

Arabic orthography has two orthographic depths. One is considered as a shallow orthography; it is fully vowelized using almost all the vowels and symbols, particularly in the Qur'an, primary school books and children's books. Although shallow Arabic is often considered as a highly consistent orthography with one-to-one correspondences between MSA phonemes and letters in this level of Arabic, this correspondence is

actually not always consistent. For example, for grammatical reasons, some letters are pronounced but not written; ‘nunation’, is a short vowel + a final nūn sound (an, in, un) added to a noun or adjective, and this final sound is not written but indicated by diacritics. Also, ‘shaddah’, which is a symbol used above a consonant where there are two identical consonants in a sequence, so the first consonant is deleted.

Conversely, some letters are written but not pronounced: the definite article /الـ/, which represents the English definite article ‘the’. According to phonetic constraint rules, there are two types of letters in Arabic called sun and moon letters (Table 3). If the first letter after the definite article is a sun letter, the definite article is elided and the sun letter doubled: /الشَّمْسُ / (ash-shams) ‘the sun’. But when the definite article is followed by certain letters known as moon letters, the definite article is fully pronounced with no elision and the letter is not doubled /القَمَرُ / (al-Qamar) ‘the moon’.

Table 3: Sun and Moon Arabic consonants

Consonant types	Arabic consonants													
Sun letters	ن	ل	ظ	ط	ض	ص	ش	س	ز	ر	ذ	د	ث	ت
Moon letters	ه	ي	و	م	ك	ق	ف	غ	ع	خ	ح	ج	ب	ء

The other orthographic form, in which all of the diacritical marks are omitted, is called deep orthography. This type is less transparent and mostly used by advanced readers and can be found in newspapers, journals or any other formal publications. In fact, in Arabic, some un-vowelized isolated words can be read in various ways with different meanings (Table 4). However, if these types of words are written within a context, the contextual influences should be taken into consideration to facilitate word identification and understanding. Ibrahim (2013) emphasized that readers will have to employ their literacy knowledge involving vocabulary, morphology and experience with written words as well as understanding the characteristics of Arabic vowels to achieve a successful reading.

Table 4: examples of using different vowels to create different meanings

Arabic word	English meaning
عَقْدَة	Necklace
عَقْد	Contract
عَقَدَ	To hold / to tie
عَقَّدَ	To complicate
عَقْدَات	Complications / knots

1.4.2 The basic differences between Modern Standard Arabic and Kuwaiti Local Dialect

According to the definition of diglossia, the discrepancies between varieties of a language can lead to a significant linguistic distance between these varieties. In Kuwait, children grow up speaking a Kuwaiti Local Dialect (KLD), which is structurally distinct from MSA. The first time they are exposed to MSA formally is when they start school.

MSA and KLD have considerable phonemic, semantic and lexical differences. Not all of the 28 MSA consonants are accessible in KLD; for example, the sound (ḍ) is always replaced by the sound ʒ ((Al-Qenaie 2011). For instance, the word ‘ḍuhr’ (noon) in MSA is pronounced ‘zuhur’ in KLD. Also, KLD contains nonstandard phonemes that are not available in MSA, such as (g), (v), (p) and (ch); in MSA, (g) and (ch) are replaced with (q) and (k) respectively. So ‘qalb’ (heart) in MSA is pronounced as ‘galb’ in KLD. In addition, some words in MSA are pronounced differently in KLD due to the exchange between phonemes that are accessible in both varieties, as in the case of ‘masjid’ (mosque) in MSA and ‘masyid’ in KLD.

MSA and KLD share all the six vowels; three short vowels (*a, u and i*) and three long vowels (*ā, ū and ī*) as well as the two diphthongs (*aw and ay*). But KLD has an additional diphthong that is not employed in MSA, which is (*iy*) (Al-Qenaie 2011). Also, the vowel length in some of the MSA words is slightly transformed in KLD. Therefore the syllables of the MSA words can be shortened or lengthened in KLD. For example ‘nam’ (CVC, sleep) in MSA changes to ‘nām’ (CVVC) in KLD. Additionally, the type of short vowel can be converted, as in ‘madrasah’ (school) in MSA and ‘madrisah’ in KLD. Further, most MSA words can be verbally presented within KLD, to

a certain degree; however, the phonemes ‘e’ or ‘u’, should be initially appended to those words, for example ‘kitāb’ (book) in MSA becomes ‘ektāb’ in KLD.

At the level of the lexicon, some lexical items are shared by MSA and KLD (although some are rather differently pronounced), but there are many words that exist in KLD or MSA only. Thus, the MSA word ‘nāfithah’ (window) is not present in KLD and the word ‘dirīshah’ is used instead. However, while there are obvious phonological and semantic discrepancies between the two varieties, MSA and LD, a level of overlap still exists which results in Shared Words (ShW). These words are exactly the same in both varieties having the same phonetic and lexical structures and are almost all nouns, such as the words ‘maktab’ (disk), ‘wardah’ (flower) and ‘hamamah’ (pigeon).

With regards to writing, there is no written form of the KLD. However, it is possible to apply the MSA consonants that are accessible to KLD in order to write some KLD words in Kuwaiti newspaper headings, TV advertising or poetry. Further, for informal written communication, for example, texting, Kuwaiti people usually borrow letters and numbers from foreign languages such as English and Persian, especially for those phonemes accessible in KLD only. Therefore a new informal writing system has been invented for the KLD form. This, obviously, is not manageable for beginning readers, as it requires acceptable literacy ability in both Arabic and other languages such as English.

According to the above description of the differences between word types - MSA Words (MSAW), KLD words (KLDW) and Kuwaiti ShW (KShW) - it is clear that each has its characteristics in terms of reading ability. Obviously, each type can present different challenges for children. To be more precise, KLDW and KShW are perceived as the native Arabic form for Kuwaiti children. Children can deal phonologically with both word types easily compared to the MSAW. This is due to the great experience and practice of the spoken language phonemes (Saiegh-Haddad 2007). However, KLDW is thought to be the most difficult type of word in the Arabic reading process. This is because there is no written form for the spoken words in Arabic in general. Most LD words are very unfamiliar orthographic patterns to children (Bentin and Ibrahim 1996), as they haven’t seen them in a written form, especially at the early literacy age. However, LD words sound like real words, albeit in spoken and not in literary Arabic

(Bentin and Ibrahim 1996). Therefore, LD in general and KLDW in particular are observed as pseudohomophones. This is because they are familiar phonologically but not orthographically (Goswami et al. 2001). Hence, this can make them more difficult or slower to recognize and read than MSA or words that are available in both standard and spoken Arabic (Bentin and Ibrahim 1996; Coltheart 1996), such as ShW. MSA is the literary Arabic involving new vocabulary that children learn at school. KShW exist in both forms; KLD and MSA; and children use them in everyday communications, written or spoken, which is thought to make them familiar and easy.

From the above description of the specific linguistic structure of Arabic, it is clear that although Arabic is considered as a highly consistent language with almost regular phoneme-grapheme correspondences, Arabic children may still face a number of challenges because of its complexities.

1.4.3 The Educational context of mainstream primary schools in Kuwait

According to the Kuwaiti Ministry of Education, the levels of education in Kuwait are separated into four levels as follows: two years of kindergarten, five years of primary schooling, four years of secondary schooling, three years of high schooling. There are 6 educational regions in Kuwait, each of which oversee an appropriate number of kindergartens and schools.

Kuwaiti children start mainstream kindergarten at the age of 3 years and 6 months, spending two years in kindergarten with limited teaching of MSA writing and reading skills depending on their teachers' efforts (AlMushaan 2000-20001).

With regard to primary schools in Kuwait, primary education is compulsory. Students start at the age of 5 years and 6 months and the sexes are segregated in all the government schools starting in the first year primary level. Different primary schools maintain a different number of classes depending on the population of each area (some include three classes for each grade and others include eight classes).

At the beginning of the first year, pupils start to receive their school instruction in MSA and are only introduced to MSA as a school subject. The children attend two Arabic subject lessons a day, learning reading, speaking, listening and writing in MSA. During the first term of the first year most pupils should be trained to be able to read and write simple short texts from the schoolbook. They also will be able to analyze, recognize, memorize and use the following letters with their three sounds (attached to the three short vowels) (أ ، ن ، ل ، ر ، م ، ت ، ع ، ك ، د ، ب ، ج ، د). In addition, during this term children should be able to use different graphemes to form words and reorganize different words to form useful sentences

During the second term of the first year, most pupils should be trained to be able to read and write texts from the schoolbook, analyze, recognize, memorize and use the following letters attached to the three short vowels as well as the three long vowels (ث ، غ ، و ، ظ ، خ ، س ، ذ ، ض ، ز ، ص ، ي ، ش ، ف ، ط ، ح ، ق).

During the first term of the second year, most pupils should be trained to be able to differentiate between the short and the long vowels, to recognize and use different exceptional rules in Arabic linguistics such as the sun letters and the moon letters, as well as improving their listening, speaking and composition skills. During the primary school period, the teaching approaches focus mainly on the syllable structure of Arabic words and do not involve systematic instruction in phonemic skills. Therefore, children manipulate the words' sound structure according to their larger phonological unit.

Further description of the later grades of the basic Arabic linguistics curriculum of primary schools in Kuwait will not be included because it is beyond the scope of this thesis.

1.5 Literature review: Children's reading ability and its relationship to phonological awareness, phonological short term memory and visual short term memory

This section reviews the literature regarding the relationship between reading ability and the cognitive skills of phonological awareness, phonological short term memory and visual short term memory, in both English and Arabic related literature.

1.5.1 Children's reading ability and phonological awareness

There is a wealth of literature strongly supporting the concept that there is a relationship between successful reading ability of English speaking children and their phonological awareness, (Bowey et al. 1992; Bryant et al. 1990; Carroll et al. 2003; Castles and Coltheart 2004, Hansen and Bowey 1994; Wagner and Targesen 1987) and this section will consider these studies in detail. A close positive association has been demonstrated between the awareness of sounds and learning to read in an alphabetic system such as English (Badian 2001; Ehri et al. 2001; Ellis 1990; Rego and Bryant 1993; Johnston et al. 1996; Wagner and Targesen 1987). There are different interpretations regarding the nature of this relationship (Wagner et al. 1997).

The first interpretation is that phonological awareness is fundamental to children's early reading acquisition. This is because it represents the basic ability of spelling-sound correspondence acquisition (Stanovich 1993). Goswami and Bryant (1990) stressed that the understanding and manipulation of spoken words can be built up before children are introduced to literacy, and these abilities subsequently influence how skilled they become in reading.

Various longitudinal studies have confirmed a strong correlation between English-speaking children's reading ability and phonological awareness where phonological awareness is a strong predictor of their early reading ability (Torgesen et al. 1997; Nithart et al. 2011; Storch and Whitehurt 2002; Wagner et al. 1997). For example, Mann and Liberman (1984) gave 62 Kindergarten children a syllable tapping test in which children were asked to tap out the number of syllables in each verbally presented word (Table 1). The researchers stressed the importance of using a syllable test rather than a phoneme test with preschool children, because they may not understand the concept of

phoneme awareness and would thus face difficulties during a standard phoneme-tapping task (Mann and Liberman 1984). They also took a measure of participants' verbal IQ. Participants' reading ability was tested one year later. Linear regression analysis revealed that phonological awareness (syllable counting) was significantly correlated with early reading skills and could also predict subsequent reading abilities even when controlling for verbal IQ.

Another longitudinal study was conducted by Rego and Bryant (1993), to assess the phonological awareness of 53 first year primary school students aged 5-6 years old, in two sessions separated by 5 months. In the first session, children's phonological skill was tested using 2 tasks. First was a phoneme oddity task (Table 1). This task tested children's ability to understand the different speech sound structure of words, and consequently their capability to distinguish between words. In this experiment, the task was administered verbally but the children were asked to choose the odd word using pictures that represented each word. Second was a phoneme tapping task (Table 1). In addition, in order to check that the children participating in the study were all preliterate at the time of the first session, their reading abilities were tested using a single word reading task. In the second session, in order to assess participants' ability to employ the alphabetic code, their spelling skills were measured by a spelling test. In the test, the children were asked to use plastic alphabetic letters to build up the required word. The researchers found that there was a significant relationship between phonological awareness - both phoneme oddity and phoneme tapping - and spelling. They also ran a multiple regression analysis on the findings and found that phonological skills positively predicted invented spelling.

Further support was provided by Rohl and Pratt (1995). They gave phonological awareness tasks to 76 pre-reading pupils from 5 classes in three schools in Western Australia over a period of two years. These tasks included onset and rhyme, phonemic segmentation and phoneme deletion tests. Also tasks in reading real words and non-words were applied. The researchers administered the Peabody Picture Vocabulary Test (Revised (PPVT-R) by Dunn and Dunn (1981), in order to control for children's verbal intelligence. Additionally, to ensure that all children participating in the study were preliterate, Clay's Ready to Read word test was applied initially to help identify and exclude any child who may have some reading skills and would therefore not fit within

the participants' criteria. All the measures took place 3 times during three years, at the beginning of grade one, the end of grade one and the beginning of grade two, except the reading test, which was administered only in times two and three of the study. The result of the study revealed, using multiple regression analysis, that phonological awareness made a strong contribution to later reading abilities when controlled for verbal intelligence.

Moreover, studies of children with reading disability support the view of the positive relationship between phonological awareness and children's reading ability and the importance of phonological awareness in acquiring reading skills (Cornwall 1992; Fletcher et al. 1994; Torgesen et al. 1999; Mather et al. 2001 and Morris et al. 1998). They have all found that a lack of phonological awareness is associated with reading difficulties. Torgesen et al. (1999) claimed that when children were unable to understand the phonemic structure of words, i.e. phoneme-grapheme correspondence ability and vice versa, especially for unfamiliar printed words, a delay of their reading ability occurred. Felton and Pepper (1995) stressed that measuring phonological awareness early on can identify children who will have problems with reading. Therefore, an early intervention with their phonological awareness can be designed which will help them with their reading.

Some studies revealed that phonological awareness instruction and effective practice play an important role in the process of phonological awareness and subsequently reading ability for children with reading disability (Al Otaiba et al. 2009; Hatcher and Hulme 1999). For example, Ziolkowski and Goldstein (2008) conducted an intervention phonological awareness program on 13 preschool children with language delay. The program included rhyme and initial sound awareness instructional activities within shared storybook reading. Ziolkowski and Goldstein found that explicit instruction in phoneme and rhyme awareness improved children's phonological awareness. Torgesen et al. (1999), in addition, investigated the effect of instructional activities on two groups of children with reading disabilities. These activities included 88 hours of two types of phonemic decoding instructional approaches varying in intensity (strong vs. standard). The results revealed that the stronger the phonemic decoding approach was, the better reading abilities were.

Another study worth mentioning was carried out by Bowyer-Crane et al. (2008) who compared the effectiveness of 20 weeks of daily school intervention programs on 152 poor oral language children (mean age 4 years 9 months). The participants were separated into two groups at the beginning of the school year. One group received a phonology (letter-sound knowledge, phonological awareness) and reading (book level reading skills) intervention program. The other group received an oral language intervention program (vocabulary, comprehension, inference generation and narrative skills). The researchers observed children's improvement over four time points; pre-intervention, mid-intervention and post-intervention, and the last intervention was after five months delay. At the end of the study, results revealed that the phonology and reading intervention groups gained better literacy and phonological skills than the oral language intervention group. It was concluded that providing children with phonology and reading training improves their decoding ability (Bowyer-Crane et al 2008).

Similar studies were conducted on normal readers and showed similar results. For example, training in phonological awareness, segmentation and blending skills, positively affected children's word learning (Torgesen et al. 1992) and reading ability (Cunningham 1990). Additionally, phonemic awareness training with children provided significant development in word decoding and spelling (Byrne and Fielding-Barnsley 1993) as well as non-word reading and reading comprehension (Byrne and Fielding-Barnsley 1995). Although many studies support the positive relationship between phonological awareness and reading ability, and the notion that phonological awareness is a strong predictor for reading ability, the role of each of these cognitive skills can vary across the first two years of children's reading acquisition.

The second interpretation of the nature of this relationship is that children's reading acquisition influences the development of their phonological awareness (Wagner and Torgesen 1987). For example, Ehri (1989) claimed that children with dyslexia show insufficiencies in their phonological awareness because they lacked exposure to reading and spelling instruction and thus did not develop their spelling knowledge appropriately. Consequently, this negatively influenced their phonological conversion skills. Wagner and Torgesen (1987) argued that during reading acquisition activities, children could obtain an "explicit knowledge" of their language phoneme-grapheme conversion roles. Tunmer (1991) proposed that it is important not to include preschool children with

initial abilities in reading in longitudinal experiments. This is because those children may achieve better performances on phonological awareness measures than children with very little or no abilities in reading, since preschool reading ability could positively impact on the development of both skills and could influence the results of this relationship (Tunmer 1991). Therefore, it is essential to control for initial reading ability in predictive studies, exclude all children who have some initial abilities in reading during their preschool age and ensure that all participants are preliterate (Tunmer 1991).

The third interpretation suggests that the relationship between phonological awareness and reading skills is reciprocal. In other words, phonological awareness facilitates the progress of early reading skills and early reading skills facilitate the improvement of phonological awareness (Elli 1990; Perfetti et al. 1987). This is because children's basic levels of both phonological awareness and early reading acquisition are developing simultaneously during school age (Burgess and Lonigan 1998; Goswami and Bryant 1990).

Wagner et al. (1994) examined the causal status of the relationship between phonological awareness and the acquisition of reading skills by studying 244 children from kindergarten to second grade. All participants were selected randomly from six elementary schools, had an average age of five years 8 months and had not received instruction in reading. In the first year of the study, Wagner and his colleagues presented the participants with 22 tasks consisting of different phonological awareness assessments, reading and pre-reading skills. Later, at the beginning of their first year, all tasks were re-administered to the same children. The results of the study, according to the structural equation modelling analysis, revealed that phonological awareness had a significant contributory link to later reading development and that reading development had a significant contributory link to later phonological awareness (see also Wagner et al. 1997).

Another example to be considered is by Burgess and Lonigan (1998). They conducted a one-year longitudinal study on 97 children, who came from middle class families and were preliterate at the initial time of the study. During time one, the children undertook four phonological sensitivity tasks. Two tasks were applied nonverbally only, which administered words on pictures: a rhyme oddity task and an alliteration (singleton onset)

oddity task (see Table 1). The other two tasks were administered verbally and nonverbally (see Rego and Bryant 1993 on page 18); these were a phoneme / syllable deletion task and a blending task (see Table 1). One year later, Burgess and Lonigan administered the same tests to all the participants. The researchers found that phonological awareness and initial reading abilities, particularly children's letter knowledge, were reciprocally associated in pre-school-age children.

Also, a recent longitudinal study by Brunswick et al. (2012) was conducted on 142 (72 girls and 70 boys) English-speaking children from the beginning of kindergarten level, in which participants were preliterate, to the second grade of primary school. Children were tested across several stages. Time one took place through the first three months of kindergarten and time two was by the end of the same year. Time three was carried out during the beginning of the first primary school year followed by time four, which was at the end of the same year. Finally, time five was by the end of the first semester of grade two. During all stages students were subjected to the same set of measures including the phonological awareness task (phonological oddity) in which they had to select an odd word out (within three words) which differed in its initial, middle or final phoneme. The word reading task ran starting on or after time three. The results revealed that there was a significant correlation between phonological awareness and reading ability as well as the bidirectional relationships between both of these cognitive skills at all stages over the duration of the study. Interestingly, there was a marked correlation between phoneme position and rhymes awareness (middle and last phoneme oddity), and later reading ability during the first stages. However onset awareness (first phoneme oddity) correlated with reading after reading instruction had been administered to children. This was also found in Carroll et al. (2003). This has been claimed to be related to the way in which children are taught in British kindergartens. For instance, Brunswick et al. (2012) stressed that

“a large amount of time is spent teaching children nursery rhymes and songs that emphasize the rime (e.g., “Humpty Dumpty sat on a wall, Humpty Dumpty had a great fall”

This can influence their sensitivity to manipulate rhymes more easily than onsets, which involves the detection of smaller phonological units and usually single consonants. It was concluded that children's later reading ability at the end of grade one can be influenced by teaching methods (Brunswick et al. 2012).

Although the previously mentioned studies found that the relationship between reading ability and phonological awareness is reciprocal, children are able to acquire a level of phonological sensitivity towards word sounds before they acquire reading (Hoover 2002). This suggestion came from the viewpoint that preliterate children may gain extensive phonological awareness informally from home activities. These may include looking at children's books and playing games that raise children awareness of letter names and their relation to sounds in words (Thompson et al. 1993). Consequently, they may acquire basic phonological awareness ability before they start their formal education (Thompson et al. 1993). This suggests that phonological awareness plays the stronger part in children's reading ability. Children's phonological awareness improves with age which consequently helps in the development of reading ability, and indeed Harley (2014) has stressed that phonological awareness plays an essential role in driving reading development.

1.5.2 Children's reading ability and phonological awareness in Arabic diglossia

With regard to the literature studying reading ability and phonological awareness within the Arabic Language, there are very few studies investigating the link between Arabic speaking children's phonological awareness and reading acquisition (Abu-Rabia 1995; Al-Mannai and Everatt 2005; Elbeheri and Everatt 2007; Taibah and Haynes 2011). Also, most of these studies were conducted in Palestine, so the results are not necessarily true for Kuwait. This is because of the differences between the Arabic dialects across countries, which create inconsistency in the linguistic variations between MSA and LDs. Additionally, some of these predictive studies regarding phonological awareness and reading ability were conducted without taking account of the Arabic diglossia settings, and so did not take into account the different forms of Arabic including both MSA and LDs (Abu-Rabia 1995; Al-Mannai and Everatt 2005; Taibah and Haynes 2011). For example, a recent investigation by Taibah and Haynes (2011) was conducted on 237 Arabic speaking children from kindergarten to grade three. This study was conducted in Saudi Arabia to assess the influences of phonological awareness on reading performance. All children were taught MSA from the kindergarten stage. Reading performance was tested by several tasks; word decoding, oral reading fluency, non-word reading fluency. Phonological awareness was measured by an elision task;

which proceeded from deleting a whole word from a set of compound words to deleting individual phonemes, and a blending task, which proceeded from combining syllables to combining phonemes. The researchers controlled for children's non-verbal intelligence ability (Arabic TONI 2; correct completion of matrix). The data analysis showed that phonological awareness assessment was the best predictor for word recognition, non-word reading fluency and oral reading fluency across all age groups compared to phonological short term memory.

Another study, which also did not consider the discrepancies between MSA and LD, demonstrated the role of phonological awareness in reading ability. Findings reported by Al-Mannai and Everatt (2005) showed that phonological awareness correlates with reading ability for both MSA words and non-words. Al-Mannai and Everatt examined 171 randomly selected Arabic-speaking children from government schools in Bahrain, 84 male and 87 female, in grades one, two and three. Pupils' reading ability was studied using single word reading and spelling tests. Also, their ability to decode letter strings was tested by means of a non-word reading test while children's phonological awareness was measured by word and non-word rhyming tests. The researchers found that phonological awareness was the best predictor of reading acquisition in Arabic speaking children.

Also, Abu-Rabia (1995) investigated the associations between reading ability and phonological awareness in Arabic children who were skilled and poor readers, but without taking into account the diglossic setting. He gave different Arabic tasks to 143 Arab pupils aged 8-11 from Arab villages in central Israel, attending Arabic instruction schools. Various tasks were applied in the study including reading real words and non-words, a phoneme awareness task such as phoneme deletion, odd word out, sound isolation, phoneme segmentation, and phoneme counting, and a phonological condition task (adapted from Olson et al. 1985) in which the child was required to select the closest pronunciation to a real word from a pair of words consisting of pseudo-homophone and pseudo-words. Results revealed that there was a main effect of age on all the tasks, reading and phonological. In addition, for the reading task, children were divided into two groups, poor and normally achieving readers; here it was found that although normal readers performed significantly better on all the tasks compared to the poor readers, reading skills in both groups of participants' were highly correlated with

their phonological skills. Therefore, phonological awareness is an important factor not only for children who are normal readers but also for children with reading difficulties.

In relation to Arabic diglossia, when Arabic children begin to read they have to learn another form of Arabic language (MSA) including new phonemes and vocabularies that vary from their acquired one (LD) (Saiegh-Haddad 2007; 2004). This is not the case with other languages like English in which children use the same language that they are familiar with when learning to read. To put it in another way, once Arabic children start receiving literacy instruction in primary school, they learn new words that do not exist in their spoken Arabic, alongside their growing spoken vocabularies. This can have an impact on the quality of the phonological representation of words as it raises the load for a very specific segmental representation (Saiegh-Haddad 2004).

One example to be considered is an investigation by Saiegh-Haddad (2003) into the influence of linguistic variation on children's phonological awareness on their initial reading acquisition using pseudo-word decoding. The study involved a total of 65 mainstream primary school children with the same Arabic Palestinian LD (23 kindergarteners and 42 first graders). It is worth mentioning that teaching in the participating schools was not performed in formal MSA, but carried out through the medium of the local dialect. For first graders MSA was only taught as a school subject, using oral and written syllabification to help children process the multisyllabic structure of Arabic words and not involving any systematic instruction in phonemic awareness. The researcher developed two tasks; one task was a phonemic awareness of pseudo-words task that required initial and final isolation of either MSA phonemes only or Palestinian LD phonemes only. The second task was a pseudo-words decoding task in which children in kindergarten and first grade were tested on their reading ability by decoding errors related to phonemes, syllable structure in MSA and Palestinian LD. Saiegh-Haddad demonstrated that initial phoneme deletion, in the case of Palestinian LD or MSA words, was significantly harder to isolate than the final phoneme for both groups. In addition, the results revealed that there was a significant effect of linguistic affiliation (standard phonemes vs. spoken phonemes), in which Palestinian LD phonemes were less difficult to isolate than MSA phonemes. She also found that children made more decoding errors of pseudo-words with MSA phonemes and syllable structure than Palestinian LD. Therefore, she emphasised that phonological variation between MSA and Palestinian LD

was found to impact on the basic reading acquisition of children. Also, it can be an important reason for the phonological awareness delay in children and consequently reading development.

Saiegh-Haddad (2005) carried out another study related to reading fluency in the diglossic context on a different age group. This was conducted on 42 first grade children, randomly chosen from their local schools and all speaking the same Arabic local dialect as in her previous studies. To meet her aim, she applied several measures. The phonological awareness measure included phoneme discrimination and phoneme isolation. This task comprised a list of 10 non-words using Palestinian LD phonemes only and another list of 10 non-words consisting of one MSA phoneme either in the initial or final position of each word. Children's reading ability was assessed by MSA vowelized pseudowords reading fluency as well as vowelized pseudowords consisting of Palestinian LD phonemes. The results showed that all predictor measures correlated with reading fluency; however, reading fluency was not influenced by phonological awareness measures directly. The hierarchical multiple regression analysis demonstrated that phonological awareness strongly predicted letter-recoding speed, which thereafter was the most significant predictor of reading fluency in vowelized Arabic. In addition, children found it easier to isolate the Palestinian LD phonemes than the MSA phonemes. Saiegh-Haddad concluded that the influence of diglossia on children's phonological awareness and consequently their reading development is significant. She stressed that children's ability to decode and read new words is related to their awareness of standard Arabic phonemes (Saiegh-Haddad 2005; Taha 2013).

The above studies show how diglossia can affect reading and how phonological awareness is linked to reading ability in Arabic. There are other studies that have not considered the relationship between phonological awareness and reading ability but have only looked at the ability to manipulate phonemes in relation to Arabic diglossia. For instance, an experiment was undertaken by Saiegh-Haddad (2004). She investigated the effect of the lexical status of words (MSA, Palestinian LD) on children's ability to isolate phonemes (MSA, Palestinian LD). The experiment involved 66 Northern Palestinian Arabic participants (24 kindergarteners and 42 first graders), speaking the same spoken vernacular, from a middle class background. Initial and final phoneme deletion tasks were administered, including three different types of word stimuli:

Palestinian LD words, MSA words and pseudowords. Saiegh-Haddad found that there was no effect of the lexical status of words (MSA, Palestinian LD and pseudowords) on children's ability to isolate phonemes even if the target phonemes were within their local dialect words. The findings confirmed the results of her previous study (Saiegh-Haddad 2003) concerning phoneme position and phoneme affiliation, namely that children found it harder to manipulate initial phonemes than final phonemes across pseudo-words that either included MSA phonemes only or Palestinian LD phonemes only. Moreover, Palestinian LD phonemes were less difficult to isolate than MSA phonemes. She emphasized that "diglossia challenges the acquisition of basic reading processes in Arabic" (Saiegh-Haddad 2012, p. 43). This is because the phonological structure of Palestinian LD influences the development of MSA phonological decoding ability (Saiegh-Haddad 2012).

On the other hand, Ibrahim (2010) conducted a study that found the opposite result to Haddad's investigations (2003; 2004; 2005) regarding the impact of diglossia on phonological awareness. The subjects were 571 Arab students from different age groups (grades 1 - 12) selected randomly from mainstream primary and secondary schools in Northern Israel. Subjects carried out a phonemic deletion task requiring initial and final phoneme deletion. This task consisted of two lists including two types of words, 9 MSA words and 11 Palestinian LD words. The results showed that all participants performed better on MSA deletion words than Palestinian LD words and better on initial phonemes than on final phonemes.

Therefore, there is some disagreement as to whether Arabic speaking children perform better on phonological tasks with MSA words or LD words. In addition, all the research discussed so far has been conducted within communities that speak a Palestinian LD. Palestinian LD is different from Kuwaiti LD and the differences between MSA and KLD are not consistently the same as the differences between MSA and Palestinian LD. Only one study has been conducted in Kuwait investigating the relationship between children's phonological awareness and reading ability, and this study only used MSA (Al-diyar and Salem 2013). This study carried out a large-scale study by testing 500 Kuwaiti children (age range 9.05 ± 0.49 years). The researchers studied the relationship between children's phonological awareness and their non-word reading accuracy measure. The phonological awareness measure involved syllable and sound deletion

ability, and consisted of 20 words. During this test, participants listened carefully to words played by a CD player, then deleted a syllable from the word, and then proceeded to deleting only one sound of the word. The non-word reading measure consists of 25 pseudowords. Findings of the study revealed that there was no correlation between the syllable and sound deletion measure and the non-word reading accuracy measure.

To sum up, according to the literature reviewed above, most of the studies were conducted in Palestine where the participants speak dialects that differ from the Kuwaiti dialect on the level of phonemes, semantic and syntax. Also, most of the studies included MSA and LD words in their phonological tasks and only MSA in the reading task. None of the previous studies included both real words types in both measures or included shared words, which comprise a third level of Arabic words in the Arabic diglossic context, as an additional word type in the phonological or reading tasks. Additionally, and most importantly, only one study has been conducted in Kuwait on Kuwaiti normal readers to investigate the relationship between phonological awareness and reading ability in the Arabic language but they only considered MSA and did not include the three word types; MSA, KLD and KSh words.

Therefore, even though there is a more substantial body of information regarding the relationship between phonological awareness and reading skills in English speaking children compared to Arabic, it has been found that the various interpretations of this relationship depend on a number of factors, such as the influence of the complexity of the language and its orthography. This has been explained by Usha Goswami using a psycholinguistics theory known as Grain size theory (Ziegler and Goswami 2005).

1.5.3 The Grain size theory

As discussed earlier, when preliterate children start to read, they start to acquire the ability to map the visual symbol, or letter, with the appropriate sound, or phonological unit, which is called the phonological recoding. This process enables the reading of thousands of words already present in children's everyday spoken language. Ziegler and Goswami (2005) stressed that the phonological system is already structured prior to reading. Consequently, it is possible that the quality of the phonological recoding prior

to reading influences the facility of reading acquisition. This can be explained by three main reasons.

The first reason is related to the availability of symbols and sounds. When both symbols and sounds are available in children's everyday spoken language, the converting system will be accessible. Therefore, their phonological recoding will be successful and lead to successful reading. However, some of the phonological units cannot be accessible in some languages prior to reading acquisition, such as Arabic, where there are MSA and LDs (see page 13). This, therefore, requires further cognitive development for effective reading (Ziegler and Goswami 2005).

The second reason relates to the variations in consistency of the phonological correspondence across orthographies. Ziegler and Goswami (2005) stressed that there is a universal agreement that the development of phonological sensitivity emerges from larger to smaller grain size. However, differences between orthographies across languages can lead to fundamental variations in the nature of the phonological recoding. One such difference is between the Arabic and English orthographies. Although Arabic and English are both based on common alphabetic origins, Arabic has unique orthographic characteristics that differ from English (Mahfoudhi et al. 2011). Arabic orthography has two orthographic depths. One is considered as shallow orthography: fully vowelized with diacritic marks, and a highly consistent structure in terms of phoneme-grapheme relationship, used especially in first primary school years (Saiegh-Haddad 2005; Smythe et al. 2008). Here, only one pronunciation exists for each letter or letter cluster, but some exceptions exist according to grammatical or phonetic constraint rules. This means it is a partially consistent orthography. The orthography becomes less transparent during advanced stages, and is called deep orthography. This orthography makes a script highly opaque with a large number of homographs in which most words can be read in several ways (Elbeheri et al. 2006), (for more discussion see Pages 5-14).

This is unlike English orthography, which is considered as deep throughout all the reading levels. English is characterised by a complex and inconsistent phoneme-grapheme conversion structure. This is because each phoneme can be represented by different graphemes and one grapheme can stand for many phonemes (Smythe et al. 2008). For instance, the grapheme 'ou' has several pronunciations as cousin, cough,

soul, would, wound (Geudens 2006, p. 33). Ziegler and Goswami (2005) emphasized that the differences in spelling-to-sound consistency across orthographies cause different reading ability levels. The more consistent the language is, the easier it is to map between phonemes and graphemes and consequently to read. Similarly, the more inconsistent the language is, the more difficult it is for children to map between phonemes and graphemes and read. Consequently, different orthographies reveal different developmental reading processes (Katz and Frost 1992; Ziegler and Goswami 2005).

The third reason is granularity (grain size) and this is associated with a language's consistency of orthographic and phonological representation (Ziegler and Goswami 2005). To be more precise, Goswami argued that students who use consistent orthography in early reading stages can follow the grapheme-phoneme correspondences and will be able to use a small unit strategy for successful reading. This is because the language script contains small verbal units and the phonological decoding is close to a one-to-one (graphemes/phonemes) relationship (Goswami et al. 2005; Joshi and Aaron 2006). However, this is not necessarily true for English orthography. For example, reading some words in English, such as (thief), children should be able to segment multi-letters to reach the sound and recognise the word (thief - /th/ /ie/ /f/) instead of the use of the simple letter / sound correspondences (Joshi and Aaron 2006).

Nevertheless, when children read an orthographically inconsistent language, such as English, the small grain size will not be easily used because of the inconsistent grapheme-phoneme conversion process (Goswami et al. 2005; Ziegler and Goswami 2005). This is because the “inconsistency is much higher for smaller grapheme units than for larger units” (Ibrahim 2013). However, those readers may learn recoding strategies for both small grain size units such as phonemes, and the larger orthographical units such as syllables, rimes or whole words, in parallel (Ibrahim 2013; Ziegler and Goswami 2005). Therefore, children with inconsistent language show stronger switching ability, whilst the use of one grain size only, as in consistent Arabic, can make the phonological decoding process difficult for some written words (Ibrahim 2013).

Goswami assumed that the awareness of larger grains emerges before the smaller grains in words. She stressed that this progression of the awareness from the large to the smaller grains is universal across different languages. However, the speed at which it develops can be varied (Ziegler and Goswami 2005; McDougall et al. 2010).

On other hand, Lynne Duncan (2010) has a different approach. She argues that the nature of children's native language and the background of their literacy acquisition influence their phonological development to different paths. Duncan (2010) reported that many studies (Carvolas and Bruck 1993; Durgunoglu and Oney 1999; Cossu et al. 1988; Duncan et al. 2004) showed that speakers of different languages take very different grain size routes. Therefore, there is no universal approach for phonological grain unit and reading. The decoding of the phonological grain size depends on the complexity of languages and the teaching systems in different contexts (McDougall et al. 2010). For example, in mainstream Kuwaiti schools, while the Arabic language is considered as a highly consistent orthography at the early reading stage, the oral and written syllabification are used to help children process the multisyllabic structure of Arabic words, and do not involve any systematic instruction in phonemic awareness. Conversely in British education, teaching methods emphasise the awareness of rhymes by singing songs that involve the detection of smaller grain units and usually single consonants (Brunswick et al. 2012).

In fact, both of the pathways regarding the grain unit and reading, Goswami's and Duncan's, have strong viewpoints regarding phonological awareness across languages and its relation to reading development. Smythe et al. (2008) stressed that although phonological awareness represents a common predictor factor of reading ability across different languages, the level of this prediction can be different according to orthography. This emphasises the need for additional studies in general, and longitudinal development studies in particular, investigating reading and its relationship to phonological awareness in different languages to achieve a clearer picture of this relationship (McDougall et al. 2010).

Also, investigation of other factors that may also be related to reading (Bus and van IJzendoorn 1999; Rego and Bryant 1993), such as short term memory including both phonological short term memory and visual short term memory, can be crucial. These

skills are associated with a wide range of complex cognitive activities such as reading (Baddeley 2003; Gathercole et al. 1991; Torgesen 1978; Wagner et al. 1994).

1.5.4 Children's reading ability and phonological short term memory

Phonological short term memory represents the storage of different phonemes, which are produced by grapheme–phoneme decoding, and this allows children to read unfamiliar words. In addition, it facilitates the process of building up a sight vocabulary of familiar written words in beginner readers (Brunswick et al. 2012; Gathercole 1999; Passenger et al. 2000). Phonological short term memory is considered as an important component for the development of children's phonological awareness and their reading ability (Passenger et al. 2000; Rapala and Brady 1990). Mann and Liberman (1984) stressed that both phonological awareness and phonological short term memory contribute strongly toward reading ability specifically during the kindergarten level.

Some researchers suggested that there is not a direct influence of phonological short term memory on reading but its function represents part of a general phonological processing concept that is important for successful reading development (Alloway 2006; Hansen and Bowey 1994; Wagner et al. 1997). For example, Brady (1986) demonstrated that there is a close association between children's phonological awareness efficiency and the available storage capacity in phonological short term memory. She said that children with reading difficulties have problems with phonetic processes which "correspond with their reduced memory space" (p. 153). Consequently, phonological short term memory cannot be studied independently from other cognitive processing (Torgesen 1978).

Children's learning acquisition can be maintained by good phonological short term memory and a weakness in processing language sound can lead to learning delays during early school years (Alloway 2006; Alloway et al. 2005). Phonological short term memory plays key roles in children's vocabulary knowledge (Gathercole and Baddeley 1989; Gathercole and Baddeley 1993; Gathercole et al. 1997; Gathercole et al. 1992; Gathercole et al. 1999), as well as in children's early reading ability (Gathercole and Baddeley 1993). For instance, Mann and Liberman (1984) investigated the link between kindergartners' phonological short term memory and their later reading abilities as first

graders. They used two short term memory measures: a word string memory test, in which each child was required to repeat a string of words presented verbally by the researcher in the same order. The researchers then repeated the same procedures in the following year with the participants as first graders with an additional reading test. The results revealed that phonological short term memory was positively correlated with initial reading capability and predicted future reading achievement for primary school children.

Moreover, Brunswick et al. (2012) administered a digit span test and reading skills test on children from kindergarten through to the middle of grade 2 primary school. Results showed that phonological short term memory was strongly correlated with reading ability at different ages and was crucial for initial reading acquisition.

Another example to be considered is the investigation by Rohl and Pratt (1995). They applied phonological short term memory tests, such as memory for letter and memory for words, in which participants were asked to listen to a set of letters and words presented vocally by the researcher and repeat them. These tests were applied to measure the children's ability with the articulatory loop component of phonological short term memory. Another test applied in the study was the backwards repetition test, by which the control processing and storage in the central executive can be measured. This is because during the backwards repetition, it is important for children to store letter names or words "while they processed them by reordering" (Rohl and Pratt 1995). Another memory test was applied, the memory sentences test, in which children were required to listen to a sentence and repeat it accurately, to examine children's capability to remember different information. Participants were also administered with reading and spelling tests: the Neale Analysis of Reading Ability, a real word and pseudo-word decoding test, a real word and pseudo-word spelling test. The multiple regression analysis showed that phonological short term memory did not contribute to second graders' literacy skills independently of end of grade one phonological skills. However, phonological short term memory as assessed during grade one was found to contribute to later literacy skills when phonological variables of the investigation were all controlled. This is because during the initial stage of reading acquisition, both phonological awareness and phonological short term memory are extremely related but

“this relationship becomes gradually differentiated overtime” (Rohl and Pratt 1995, p. 355).

Studies of children with reading disabilities also show a deficit in their phonological short term memory. These studies found that children with reading disabilities were slower than their peers with normal reading ability at accessing the verbal information measured by different types of phonological short term memory tasks (Gathercole et al. 2006 Torgesen et al. 1994; Talcott et al. 2002). This is because skilled readers are better at briefly storing the encoded verbal materials compared to the less skilled readers (Gathercole and Baddeley 1990).

Evidently, the process of either reading or writing any language would require an ability to store verbal material efficiently in phonological short term memory (Mann and Liberman 1984). Learning to read and write new words in general, and in particular those that do not exist within children’s everyday spoken language, require the phonological short term memory retention of words’ meaning and their sound structures. In some situations such as diglossia, where children are introduced to MSA as a formal language when they first go to school, their abilities to make this connection between MSA word sound structures and their graphical components might be difficult, inefficient and require an extra load on phonological short term memory (Ammar and Ben Maad 2013; Ibrahim 2010; Ibrahim 2011), which can lead to difficulties in children’s MSA literacy acquisition. The Arabic studies that have been conducted in relation to this issue were consistent with the literature based on tests of English-speaking children in showing how important this skill is for children’s reading ability (Abu-Rabia and Siegel 2002; Al-Mannai and Everatt 2005).

1.5.5 Children’s reading ability and phonological short term memory in Arabic diglossia

A few studies have investigated the link between reading and phonological short term memory, and have sought to establish whether phonological short term memory correlates with reading and plays a role as a predictor of literacy skills amongst Arabic children. Zayed et al (2013) found that there was a strong relationship between Egyptian children’s phonological awareness and phonological short term memory and both

influence subsequent reading ability. Saiegh-Haddad (2005, p. 560) claimed that in order to achieve successful reading in Arabic,

“children must be able to retain the phonological representation of orthographic units in phonological short term memory until phonological assembly and lexical access is achieved”.

This can make phonological short term memory another factor that is important for reading in Arabic because phonological short term memory capacity can play a role in children’s acquisition of new vocabulary. Ibrahim (2010) found that phonological short term memory was associated with and affected children’s phonological awareness throughout grades 1 – 12, which consequently affected children’s reading ability. He found that children with good reading ability perform better than weak readers in phonological short term memory tasks. Also, studies by Saiegh-Haddad (2005) and Al-Mannai and Everatt (2005), have shown that phonological short term memory had a moderate to high correlation with reading fluency.

However, an investigation by Taibah and Haynes (2011) was conducted on 237 Arabic speaking children from grade three to assess the influences of phonological short term memory using non-word repetition and Digit Span measures on reading performance. Reading performance was tested by several tasks: word decoding, oral passage reading fluency, non-word reading fluency, and retell fluency. Within-grade analyses showed that there was almost no relationship between reading and phonological short term memory performance.

Other Arabic studies have been conducted to distinguish the importance of phonological short term memory for children with reading difficulties but these did not take account of the diglossic context (Abu-Rabia and Siegel 2002; Abu-Rabia et al. 2003; Elbeheri and Everatt 2007; Elbeheri et al. 2011). For instance, Abu-Rabia (1995), found that reading abilities of skilled readers and poor readers, aged 8-11, were correlated with their phonological short term memory. This was established by applying tests for reading and spelling real words, reading non-words and for phonological short term memory, in which children have to supply a missing word in a set of sentences presented verbally by the researcher, then repeat all the missing words from the set. They demonstrated that although poor readers performed significantly less well than

normally achieving readers, in both groups participants' reading skills were highly correlated with their phonological short term memory skills.

A large number of English and some Arabic studies have tested children's abilities in articulating phonemes independently of some of the other perceptual and linguistic skills which do not include phonological processing, for instance visual short term memory, which can be an additional factor significantly important for reading development in preschool children.

1.5.6 Children's reading ability and visual short term memory

Ellis and Large (1988) stressed that the best method of investigating the development of reading is to investigate the cognitive skills that are associated with it, such as phonological awareness, phonological short term memory and visual short term memory, in longitudinal bases. Baddeley (1986) found that the process of the visual short term memory is to

“visually encode printed letters and words while maintaining a visuo-spatial frame of reference that allows the readers to backtrack and keep their place in the text.” (p. 200).

Gathercole and Baddeley (1993) argued that there is evidence that visual short term memory plays a role in language processing, and researchers have suggested that children rely on visual short term memory in order to achieve the whole reading process (Baddeley 1986; Stanovich and West 1989). Ellis (1990) demonstrated that although preliterate children depend on phonological short term memory as well as phonological awareness for letter knowledge, once children begin to read, reading promotes development of these two cognitive skills, phonological awareness and phonological short term memory, which leads to the development of visual short term memory.

Studies of the relationship between reading ability and visual short term memory in children have demonstrated a close positive relationship between these two skills (Ellis 1990; Stanovich and West 1989). Several studies have shown that good readers performed significantly better on visual short term memory measures than poor readers (Baker 1976; Carroll 1972; LeFever 1982; Wesson 1993). It was argued that although phonological awareness and phonological short term memory are essential for reading development in

early reading stages, children were primarily recognising words depending on their shapes rather than their phonological representation (Brunswick et al. 2012; Ehri and Wilce 1985; Ellis and Large 1988), as “the early stage of reading is essentially visual in nature” (Ellis and Large 1988, p. 52). A few studies have demonstrated the importance of visual short term memory in beginner readers and its contribution to their reading acquisition. For example, Solan et al. (1985) demonstrated that in children from kindergarten, first and second grades, visual memory was strongly correlated with reading when their visual short term memory was measured by tachistoscope. This device can introduce images to participants for a specific amount of time, then they are asked about the images which they remembered.

In another case, a longitudinal study by Ellis and Large (1988) investigated the relationship between reading and visual short term memory, measured by a visual digit span test, as well as phonological awareness and phonological short term memory, where the full WISC IQ was controlled for. The study was carried out on 40 children aged 5-8 years old. All tasks were administered four times, first when children were 5 years old, and then every 12 months. According to participants’ age, Ellis and Large found that the nature of reading ability changed rapidly during the first three years of acquisition. They concluded that during the first stage of reading in preliterate children aged around five years old, phonological awareness and visual short term memory predicted their later reading ability. Also, in stage two, they mostly depended on their visual short term memory. However, children’s reading ability developed considerably through both phonological awareness and phonological short term memory in the following stage. In the fourth stage, children’s reading ability was significantly associated with phonological awareness as well as visual short term memory. Ellis and Large (1988, p. 71) claimed that during the last stage “reading involves orthographic strategies where the words are instantly analyzed into orthographic units without phonological conversion.”

Visual short term memory was also found to predict below-average academic achievement including reading decoding. Kulp et al. (2002) studied visual memory ability, which was assessed with the Test of Visual Perceptual Skills (TVPS), a visual memory subtest. This test is commonly used as a norm reference, motor-free test in which the child is required to look at a simple shape, for example square, circle or rectangle, and remember the shape. Then they try to find the matching shape on another page among other different shapes.

The experiment was conducted on 155 second through fourth grade children whose verbal ability was controlled in all regression analyses. Results showed that the visual memory score was significantly predictive of below-average word decoding and showed a positive trend in predicting reading comprehension.

Recently, Brunswick et al. (2012) aimed to explore preliterate children's ability to process non-alphanumeric stimuli to determine the contribution that visual short term memory makes to early reading development and to see how long this effect endures once reading commences. The study was a longitudinal study conducted over five time points, the first three months of kindergarten, the end of kindergarten, the start of primary school, the end of grade one and finally the first term of grade two. They administered a Block design test and a matching letter-like forms task, which provides a measure of the development of visual discrimination skills, as well as a single word-reading task. They re-administered all measures in all stages. Results revealed that performance on the block design task at stages two and three correlated with reading skills at stages three and four, and performance on the matching letter-like forms task correlated significantly with subsequent reading ability across all stages. Thus, it would appear that the ability to analyse visual forms is important for the early acquisition of reading and that early visual analysis skills, particularly the ability to distinguish between letter-like shapes, may enhance the efficacy of elementary reading instruction (Badian, 2001; Feagans and Merriwether 1990). Previous literature has shown there is a strong relationship between reading ability and visual short term memory in early reading stages and that this is reduced in later reading stages (Brunswick et al. 2012).

However, Schatschneider et al. (2004) found that visual short term memory was less correlated with reading development than phonological awareness. In addition, visual short term memory was not a strong predictor of reading, whereas phonological awareness was a very strong predictor of reading ability. They applied the VMI Beery visual motor integration task which involves 24 geometric line drawings of increasing complexity. This task measured the visual short term memory ability of 945 children from kindergarten to grade two. They also administered phonological awareness tasks such as onset, rime, phoneme blending, phoneme deletion and segmentation, and the contribution of reading outcome was assessed by a single word reading speed test.

Also, Vellutino et al. (2007) conducted a cross-sectional study of reading development in children from grades two and three, and from grades six and seven, where children were also asked to reproduce visual patterns from memory. They found only weak relationships between visual abilities and reading, and these disappeared completely in the older children following bootstrap analyses.

Overall, there is some disagreement in the above studies, conducted in relation to English orthography, over the importance of visual short term memory in children's reading ability. Arabic, on the other hand, has different orthographic features, which could show a different role for visual short term memory in reading ability. This is because Arabic orthography is considered unique and arguably has a more precise linguistic nature during the early reading stage.

1.5.7 Children's reading ability and visual short term memory in Arabic diglossia

As explained earlier in Chapter one, the Arabic language has a very complex orthography especially at the early stage of reading acquisition. This complexity is apparent in the different shapes of specific letters according to their position, different numbers of letter dots and their positions, and different positions of diacritics (vowels) according to their type. This level of difficulty in the initial steps of reading can negatively impact on children's visual word recognition (Ibrahim et al. 2002; Taha et al. 2012). Therefore, children depend more on visual processes, besides phonological processing, to recognize the words and improve their reading ability (Taha 2013). In fact, according to behavioural measures of the right hemisphere activities during reading performance, it has been distinguished that Arabic orthography, cognitively, is more demanding than other languages' orthographies, such as Hebrew and English, during the early stages of reading development (Eviatar and Ibrahim 2000). For example, Levin et al. (2008) demonstrated that young participants have difficulties identifying letters in Arabic orthography because they are visually similar. Also, Taha et al. (2011) conducted a study in Egypt on children (mean age 70 months) who were introduced to both Arabic and English during their early literacy. The purpose was to determine if their visual processing ability differed across orthographies. The results showed that children did better in the English orthographic task

than the Arabic task. The researchers claimed that the visual confusion of the Arabic orthography influences children's performances.

Unfortunately, no studies in Arabic diglossia have considered the importance of visual short term memory in children's reading development. However, a small number of studies have investigated the relationship between reading and orthographic discrimination abilities. Taha (2008) investigated the contribution of phonological and visual processing tasks to the accuracy of reading single vowelized words among 67 sixth grade (12 year-old) native Arabic readers in Israel. 32 of the participants were known to have reading difficulties. The phonological task used was the digit span. The visual processing tasks included the Bieri Visual perception test (Beery, 1997), which presents the participants with 27 different target shapes and they are required to find the shape that exactly matches the shape of the target, and also a visual search test. The latter includes shapes and series of digits in pages featuring numerous distractions, and participants were asked to find the target shape or series of digits. The reading measure included a list of 22 non-words and a list of 56 fully vowelised familiar words. A hierarchical multiple regression showed that the visual processing skills significantly predicted single vowelized reading words beyond the significant contribution of phonological processing skills.

Another example to be considered is a study by Elbeheri and Everatt (2007). They introduced two Egyptian groups of children, normal and non-normal readers, to two measures. A reading ability measure involved four different tests: word recognition from a picture, in which participants were required to mark the correct word from four written words that described a picture, sentence recognition from a picture, in which participants were required to chose the correct picture from six provided pictures that described a sentence, sentence completion, in which participants were required to complete an in-completed sentences by one correct word presented within four words and passage comprehension, in which participants were required to read silently different short passages varied in difficulty and length then answer a few comprehension and multiple-choice questions according to the passage content. The other measure was a grapheme discrimination measure. In this measure children were administered with different Arabic words, two side-by-side written words, and were required to decide if the words were same or different. Pearson correlation coefficients showed that there was a correlation between measures of children's orthographic task and reading ability in both groups.

Another similar study was conducted in Kuwait on two groups of Kuwaiti normal readers (grades 2–5) and readers with learning disabilities (grades 3–5) by Elbeheri et al. (2011). The researcher administered several tasks including reading comprehension fluency and visual memory tasks. The visual memory task consisted of 20 trials. In each trial, three different shapes such as circles, triangles, stars and arrows, were introduced to each participant for five seconds. Then, two similar shapes were presented, with the third replaced by a different shape. The child should indicate the replacement shape. The results indicated that there was a relationship between the visual short term memory and the Arabic reading comprehension measure in 4th and 5th grades only for both groups. The regression analysis showed that the orthographic task was predictive over and above the level of prediction provided by other tasks involving a range of phonological and memory processes, such as phonological deletion and digit span in grades four and five for both groups of children as well (Elbeheri et al. 2011). These researchers argued that the reason why orthographic discrimination is the best predictor in this study is the nature of written Arabic and the importance of this skill for successful reading.

Ultimately, there is a lack of research focused on the effects of visual short term memory on Arabic children's MSA reading skills as an integral part of successful reading. Given that comparatively little is known about visual short term memory in pre-readers or about the role it plays in early reading development, there is clearly a need for more research to explore this relationship within the Arabic language.

1.6 The present study

Phonological awareness, phonological short term memory and visual short term memory are essential for reading acquisition (Brunswick et al. 2012; Ellis and Large 1988). There is a considerable focus in English literature on screening children's reading ability and its relationship to phonological awareness, which is one of the best predictors of subsequent reading development (Adams 1990; Ellis 1990; Goswami and Bryant 1990; Rego and Bryant 1993; Rohl and Pratt 1995; Targeson et al. 1994; Perfetti et al. 1987). Alongside it, phonological short term memory has been identified as a key component that is necessary for reading development (Alloway et al. 2005; Brunswick et al. 2012; Mann and Liberman 1984; Wagner et al. 1997). Additionally, although a small number of studies investigated

the role played by visual short term memory and its relationship to reading acquisition in normal primary school children in English orthography, it is clear that this skill also affects reading ability in some stages (Baddeley 1986; Gathercole and Baddeley 1993; Ellis and Large 1988).

Evidently, regarding English orthography, ample evidence in English literature has emphasized that phonological awareness, phonological short term memory and visual short term memory are important skills for successful reading acquisition (Brunswick et al. 2012; Ellis and Large 1988). However, children's reading ability across languages is under considerable debate (Harely 2008). This is because different languages vary in the complexity of their orthographic and linguistic structure (Taha 2013). Also, current reading theories are based on the conclusions of studies conducted in Latin orthography (Abu-Rabia 1997; Taha 2013). Therefore, it is challenging to conceive that the nature of reading ability and its relation to any cognitive skill involved with reading is universal, and includes various languages, such as Arabic and English (Saiegh-Haddad et al. 2011; Mahfoudhi et al. 2011). This, as discussed earlier, can be related to different factors, such as the degree of variation in the availability, consistency and granularity of symbol-to-sound mappings; grain size theory, as well as teaching and learning techniques for reading acquisition (Duncan 2010; Ziegler and Goswami 2005). Hence, it was important to conduct research in Arabic orthography on Arabic children to investigate the reading process in Arabic and to achieve a clearer picture of Arabic reading development. Only a small number of studies of Arabic speaking children have investigated this important area. In fact, there are some critical gaps in our knowledge concerning Arabic language and the early development of phonological awareness, phonological short term memory and visual short term memory, and their influence on children's reading ability in the Arabic countries in general, and on normal primary school children in Kuwait in particular.

Although some Arabic studies have investigated reading ability and its relationship to the different cognitive skills, phonological awareness, phonological short term memory and visual short term memory, they produced mixed results. For instance, some studies found that phonological awareness is the best predictor for early reading (Al-Mannai and Everatt 2005), while others established that phonological awareness might not support a successful reading process in Arabic as much as it does in other orthographies,

such as English (Siegh-Haddad 2005). Also, some researchers found that the visual processing skills significantly predicted reading ability beyond the significant contribution of phonological processing skills (Taha 2008; Elbeheri et al. 2011). Moreover, results obtained from some Arabic studies established that phonological short term memory had a moderate to high correlation with reading fluency (Ibrahim 2010; Al-Mannai and Everatt 2005; Saiegh-Haddad 2005) while others demonstrated that there was almost no relationship between reading and phonological short term memory (Taibah and Haynes 2011). This can be related to several reasons such as the time when the studies were conducted (the beginning, middle or end of school year), the age of participants (preliterate or in later stages) as well as the curriculum and teaching system across Arabic countries. So, it was very important to continue study in this area.

Additionally, the Arabic investigations into reading ability have been carried out by a small number of investigators on children who were almost all from the same country with the same Arabic dialect: the Palestinian dialect (Al-Mannai and Everat 2005, Siegh-Hadad 2005, 2007; Siegh-Hadad et al. 2011), which is different from the Kuwaiti dialect. As explained earlier in this chapter, there is a great discrepancy between dialects across Arabic countries. For example, the Palestinian dialect and Kuwaiti dialect vary at the phonological, semantic and syntactical levels (Chapter One). Also, they have an Arabic teaching system that differs from the system available in Kuwaiti schools. Therefore, there was a need for the current study, which was conducted in Kuwaiti schools on Kuwaiti children and includes tasks that are suitable for the Kuwaiti dialect.

Moreover, all the previous research included only MSA and LD in their phonological awareness measures, and only MSA real words in reading ability measures. None of the previous studies have investigated both types in both measures. Further, none of the previous studies have investigated the effect of the third type, the Shared Words (ShW). These words are exactly the same in both Arabic variations, MSA and LD, and used by students in schools and their everyday life communication. Thus, the current study is the first to include all the variations of Arabic word types used by Kuwaiti children, which are MSAW, KLDW KShW. This is to assess the level of their reading ability and phonological sensitivity to each type. It further investigates how phonological awareness relates to their reading ability including these various forms of Arabic.

In addition, there are problems with methodology in studying visual short term memory. Some of these studies applied visual short term memory tasks involving verbal responses (Ellis and Large 1988), which can make the task hard for children and involve extra cognitive skills such as phonological skills that create difficulties for children (Vellutino et al. 2007). Other studies did use visual discrimination tasks that did not involve any other skills, such as motor or phonological skills (Brunswick et al. 2012; Elbeheri et al. 2011; Kulp et al. 2002). However, reading is not just about visual recognition; children mostly depend on copying words and letters which involve visual motor coordination to read. Efficient reading can be achieved by the ability to process visually a “graphic shape that has specific configuration and orientations”, into a linguistic form (Longcamp et al. 2008). This process is crucial for reading and can be achieved by practice, such as copying.

Arabic is a complex visual orthography for children to acquire (Mahfoudhi et al. 2011; Siegh-Haddad 2005) because of the different shapes of different letters, dots and the vowelization marks (Taha 2013). This makes visual short term memory as important as phonological awareness and phonological short term memory for readers to read appropriately (Taha 2013). Therefore, this study is the first to use a highly sensitive recording technique to investigate children’s visual short term memory ability and its relation to reading ability in Kuwaiti children in particular and Arabic children in general.

The research is designed to help fill the gaps in research related to children’s reading ability within the Arabic diglossia phenomenon on normal readers. Two studies, a cross-sectional study and longitudinal study, were conducted to investigate the relationship between reading ability and the associated skills of phonological awareness, phonological short term memory and visual short term memory, in Kuwaiti primary school children. Additionally, these experimental studies measure the effect of phonological awareness, phonological short term memory and visual short term memory on reading development, and demonstrate the nature of this relationship in Arabic speaking children taught in Arabic compared to English children taught in English, in relation to the literature. These studies can also have impact on educational practice and lead us to understand Arabic children’s needs in acquiring successful Arabic reading skills.

Chapter Two

Pilot study

At the time of the pilot study, this was the first time that this kind of research was conducted in Kuwait investigating the reading ability and phonological awareness of normal developing Kuwaiti readers. The pilot study was conducted in order to construct and validate the reading ability and phonological awareness materials that would be used in the experimental study by eliminating any mistakes or ambiguities in the design, also to ensure its reliability and sensitivity to individual differences across the age range that would be included.

Only the reading ability and phonological awareness tasks were piloted. This is because they were developed specifically for the study, while the other tasks measuring children's phonological short term memory (Arabic version adapted from The visual aural digit span test by Koppitz, 1977 by the Center for Child Evaluation and Teaching, Kuwait, 1995) and Verbal IQ (Kuwaiti version of WPPSI-R III 1989) needed no piloting before the real experiments since they are already standardized tests. Regarding the task to measure children's visual short term memory, this was adapted from a study conducted on English adults and it was considered to be a successful task for measuring visual short term memory ability (Gonzales et al. 2011). This task will be explained in detail in the following chapter.

2.1 Participants

Participants were randomly selected from three different single sex schools in Kuwait and all volunteered to participate in the research during December 2010; this was the middle of the first semester in the Kuwaiti primary school year. The pilot study was administered to 10 children, with an age range of 69.11 – 80.2 months, (six boys and four girls in the first year primary school) who had almost gained the requirements of basic reading skills. Participants had been introduced formally to MSA for four months, two lessons a day, taught almost half of the Arabic letters, and practised reading, writing

and listening. So they were closest in age to the first graders of the cross sectional study and to the participants in phase one of the longitudinal study.

2.2 Measures

Although there are some reliable Arabic tasks studying different levels of phonological awareness and reading ability in the previous literature, it was considered necessary to develop new tasks specifically for this study. This is because of the phonological variation between different Arabic settings with different Arabic dialects. In addition, this is the first study classifying three word types (MSAW, KLDW and KShW) and there was a need for new tasks that meet the aim of the study.

For the pilot study, there were two lists of words in each task, including MSAW and KShW but not including KLDW. This was because the aim of the pilot was to develop the task using standard words found in schoolbooks, and the KLDW were not included in children's schoolbooks (Chapter One). Then, depending on the pilot study observations, a decision could be made about including the KLDW in the actual study. Each task, reading ability and phonological awareness, included 20 words. 10 words were constructed from the first grade primary government schoolbooks and 10 words were not. Children's age and stage of literacy learning were considered in selecting the words for the tasks (Bird et al. 2001). Therefore, all words were fully vowelized, which required an acceptable level of reading ability for children of the age range included in the study. The cultural and Kuwaiti family background were also considered, especially when choosing the KShW. Only KShW that are easy to understand and used by children during this stage on a daily basis were included.

The words in each task were checked to make sure that no word was repeated twice in the task. To minimise variation between the lists, the average number of syllables in each list was checked (total number of syllables in each list was between 20 - 22 syllables). Further, the words in each list consisted of mono-syllabic, di-syllabic and tri-syllabic words. This was to make sure that each list had a comparable syllable structure within the words. In addition, the average number of grapheme strings of the words in

each list was checked (the grapheme strings range between 2 -5 graphemes per word in each list) to make sure that each list included words with no more than five graphemes. The phonological awareness and reading ability tasks were designed in Arabic by the researcher, and then translated from Arabic into English to be checked by the supervisors. Finally, all words were double checked by another Arabic speaker with relevant teaching experience and educational linguistics qualifications. Finally, to confirm the difficulty level of words, an Arabic subject teacher evaluated all the words and found them within an acceptable range of length and difficulty and written in an accurate vowelised Arabic. The teacher even helped in grading the words in terms of level of difficulty according to their meaning, familiarity, length and pronunciation level; starting from the shortest and easiest words through to the most difficult words.

Reading ability task: Children's reading ability was measured by having children read aloud single fully vowelized words: 20 MSAW and 20 KShW. MSAW and KShW were added together in a single list, then, the researcher administered a word from each list at a time, presenting an MSAW followed by a KShW. The researcher continued the test to the end if children had correctly completed the first successive three words correctly, which are the easiest three words in the task. On the other hand, the researcher stopped the task if children failed on the first three successive words. Children were administered individually with each word presented in a black colour on a laptop screen using a PowerPoint program. Each participant was asked to read out loud and clearly each word one at a time so it could be heard clearly by the researcher (Appendix 1).

Phonological awareness task: This task was conducted to assess the phonological awareness of children and their ability to manipulate the different sound structures of words. There were 20 words in the task list, 20 MSAW and 20 KShW. Words were presented in the same order as in the reading ability task: MSAW and KShW were added together in a single list in the following order: MSAW followed by KShW. Each word in the task was introduced verbally one at a time to participants. Each child was asked to listen to each word carefully and to repeat the required word without the first sound. For example, the word 'hadeyah (gift) should be 'adeyah' after deletion of the first sound 'h'. The word lists were administered in the same order as in the previous task (Appendix 2).

Two practice sessions for each task were conducted for each participant, including MSAW and KShW words. Those words were not included in the actual lists. Throughout the practice sessions, the examiner explained the process of each task to each child individually, helped and even corrected the participants' answers when appropriate and needed. All the instructions were giving in KLD as essential to ensure children's understanding (Elbeheri et al. 2011).

2.3 Scoring

A score of one was given if the participant isolated the phonemes successfully and a zero score for failing to do so; the same scoring applied to the reading tests: one score for the correct reading of each word and zero for incorrect. No partial scores were given.

2.4 Ethical issues

The researcher followed the approved protocol from the University of Leeds Research Ethical Committee, UK. In Kuwait, where the educational system is centrally controlled by the Ministry of Education, the permission from the Educational Research and Development Administration of the Ministry of Education Kuwait was obtained first, then, that of the managements of different Educational areas, followed by the head teachers of the schools participating in the study. This was delivered by hand as it ensured speedy access to participants.

2.5 Procedure

Both tasks were administered to children individually in a quiet room inside their schools and lasted for approximately 15-25 minutes. The phonological awareness task was administered first, then the reading ability task. The exact procedure for administering the reading ability and phonological awareness tasks were described in sections 2.3.1 and 2.3.2.

2.6 The pilot study results

Table 5: Mean and Std. Deviation for participants' scores in the reading ability task across word types

Task	Word types	M (20)	SD
Reading ability	MSAW	6.9	5.49
	KShW	8.6	5.9

Table 6: Mean and Std. Deviation for participants' scores in the phonological awareness task across word types

Task	Word types	M (20)	SD
Phonological awareness (Phoneme deletion)	MSAW	4.5	6.32
	KShW	4.9	6.85

2.7 The pilot study observations

The data collected from the pilot study enabled us to validate the tasks and to make several interesting observations which informed our subsequent decisions. The study observations revealed some important points for developing the tasks to an acceptable level to be introduced to children in future studies. Accordingly, some changes to the tasks were applied as follows:

- 1- There were only two practice words in both tasks. Because most of the children found it difficult to understand the meaning of the first initial deletion sound in the phonological awareness task, the practice sessions were extended to include three words instead of two. That applied for the reading task as well.
- 2- During the phoneme awareness tasks, generally, the majority of the children faced difficulties deleting the first phonemes in all the phoneme deletion tasks and they mostly deleted the first syllable or the first consonant + vowel unit of words instead. Accordingly, the scoring process was changed and will be explained in the following experimental chapter (Chapter Three).

3- Each task included 20 words, which was too long for children to complete. Therefore, 12 words from each original word list were dropped and the total of each word list became 8 words. This made the tasks shorter and of an acceptable level for children to complete. It is worth mentioning that 8 is considered a sufficient number of words in each list should it be necessary to eliminate any more words from the task for future studies. This is in case the reliability of the task does not reach an acceptable Cronbach Alpha value. The 12 words were dropped according to the following reasons:

a. In the reading ability task, words that caused confusion for participants were excluded. For example, similar graphemes within the same words; /S/ and /Sh/ in the word “shams” (sun). Also, words including the consonant /a/ in the middle of the word, such as ‘Faarah’, were excluded. This is because children were confused between the consonant /a/ and the long vowel ‘a’, which influenced their reading ability specifically because they are part of their initial reading acquisition. In addition, shared words that could be read in the Kuwaiti dialect way by adding vowels or changing the vowels lengths were excluded. For example, most of the students added the sound /e/ and read the word ‘kitāb’ /كتاب/ (book) as ‘ektāb’ /إكتاب/ in KLD (see page 13).

b. In the phonological awareness task, the most difficult words to pronounce and phonologically manipulate were dropped.

4- Most importantly, after the pilot study was conducted and all the observations were taken into account, the KLDW type list was developed to be included in the future experiments. This is because the KLD is the main speaking language for Kuwaiti children and it is an integral part of the Arabic Diglossia (for more discussion see 12-13). According to the KLD characteristics, several criteria were taken into account. Words that included phonemes that are not accessible in all the variations, MSA, KLD and KSh, were excluded from both tasks. Therefore, all words in both tasks included phonemes that can be used in all the varieties, which are mostly from MSA. This was conducted to limit the variations between the lists in both tasks. For example:

- a) A phoneme that is only available in MSA and not accessible in KSh or KLD, for example ‘ḍ’ was not included in the task word lists. This is to avoid confounding of phonemes with articulation difficulties (Saiegh Haddad 2007).
- b) Although the use of KLD phonemes can be acceptable for the phonological awareness task, however, it is not for the reading ability task. This is because there is no written form for the KLD phonemes. Therefore, the relation between reading ability and KLD words cannot be discovered and the comparison between reading ability and phonological awareness across word types cannot be acceptable.

After piloting the reading ability and phonological awareness measures, observations were considered, and revisions were made. Then the reading ability and phonological awareness tasks were fully developed including all the Arabic variations in the diglossic situation in Kuwait. Subsequently both tasks were translated from Arabic into English to be confirmed by the supervisors. Finally the main study was considered.

Although the children faced difficulties completing the task during the pilot study, it was thought that this task should be applied in an actual experiment with a larger sample size. This would provide a wider understanding of Kuwaiti children’s phonological awareness in general and their phonemic awareness in particular. In addition, although some previous studies considered other phonological awareness tasks that can be applied, it was thought that further investigation using the phoneme awareness task would be worthwhile to confirm the findings.

Chapter Three

Cross-sectional study

3.1 The aim of the current study

The research was conducted to provide a snapshot of the relationship between Kuwaiti children's reading ability and their phonological awareness, phonological short term memory and visual short term memory. In addition, it was performed to investigate whether phonological awareness, phonological short term memory and visual short term memory are independent predictors of children's reading ability during their early primary school years. Also, it was interesting to assess the level of children's reading ability and phonological sensitivity to each type of Arabic: Modern standard Arabic (MSA), Kuwaiti Local Dialect (KLD) and Kuwaiti Shared (KSh) forms. It was further considered that verbal intelligence could play a role in this whole cognitive process (Deacon and Kirby 2004; Smith 2004), so it was decided to control for the verbal intelligence as well as age.

It is hoped that the research findings will shed more light on the nature of Arabic children's reading development in primary school, and what difficulties they may face during their academic life due to the diglossia phenomenon. It is our responsibility to understand and be aware of Arabic children's needs and complications in acquiring a successful Arabic reading process, and the findings of studies such as this one may provide useful feedback to the education policy makers in Kuwait.

3.2 Methodology

3.2.1 Measures

This study included the application of five specific tasks. Two tasks, which were piloted and developed, are the reading ability and phonological awareness task. The reading ability task was used to measure children's reading abilities while the phonological awareness task was used to assess children's awareness of the different sound structures

of words. One task, adapted from a study conducted on English adults, was considered to be a successful task for measuring visual short term memory ability (Gonzalez et al. 2011). This task was further developed specifically for the present study, where it was used for Arabic participants for the first time. It was applied to measure children's visual short term memory through their copying performance. This is appropriate because of the unique formation of Arabic orthography, where copying is an essential skill for successful reading; it requires the visual analysis of parts of words, remembering and understanding the connection between these parts and application (Kirk 1980). Two other standardised tasks were applied that had previously been used in various studies and proved to be effective measures for studying children's reading development: the Digit Span (Koppitz, 1977, Child Evaluation and Teaching, Kuwait 1995) measuring children's phonological short term memory capacity, and Verbal IQ (Kuwaiti version of WPPSI-R III 1989) which measures children's verbal intelligence.

Reading ability task: reading ability was assessed by having children read aloud single fully vowelized words. There were three single word reading lists in MSAW, KLDW and KShW. Hence each type has its linguistics characteristics and different challenge levels in terms of reading ability for children (see page 10-13 for more discussion). Each list consisted of a set of 8 words (Appendix 3). In addition, all words in the reading task included only MSA phonemes that are present in both MSAW and KLDW. This is because KLD phonemes, which are not applicable in MSA, cannot be translated into an Arabic standard form that is possible for first grade primary school children to read (see page 13-14). Every word was introduced clearly in a black colour on a laptop screen using a PowerPoint program, and presented to each child individually. Each participant was asked to read out loud each word one at a time so it could be heard clearly by the researcher. All the words from the three lists were mixed together in one list, then the researcher administered a word from each list at a time in the following order: MSAW followed by KLDW, then KShW.

Phonological awareness task: The phonological awareness task measured children's ability to understand and manipulate the different sound structures of words. This task consisted of three word lists: MSAW, KLDW, and KShW. Each list comprised 8 words all of which were different from those included in the reading task (Appendix 4). Each word was verbally introduced one at a time to participants to test their phoneme awareness

levels in the different word profiles. Each child was asked to listen to each word carefully and to repeat the required word without the first sound. For example, the word 'darasa' (studied), in MSA, should be 'arasa' after deletion of the first sound 'd'. The words were presented in the same order of word as for the reading ability task.

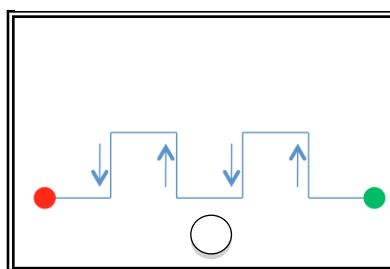
During the phonological awareness and reading ability measures, children completed six practice sessions, three for each task including three types of words, MSAW, KLDW and KShW. Those words were not included in the actual test list. Throughout the practice trials, the examiner explained the process of each task to each child individually, helped and even corrected the participants' answers when appropriate and needed. All the instructions were giving in KLD as essential to ensure children's understanding (Elbeheri et al. 2011). The researcher started with three practice sessions involving the three different types of words in the following order: MSAW, KLDW and KShW. Then, all the words from the three lists were put together in one list and administered to children in the following order: MSAW followed by KLDW then KShW. The three types of words were mixed to prevent children predicting that there were different types of words to read. If children failed on the first three successive words, the researcher stopped the task. If children were able to complete the first three successive words correctly, the test continued until children had completed the whole task.

Phonological short term memory task: Children's phonological short term memory capacity was measured by the Digit Span test. The test is a common measure adapted from "The visual aural digit span test" by Koppitz, 1977, to test children's phonological short term memory capacity. The task is translated into Arabic, standardized and codified for Kuwaiti children to include the ages 5-16, by the Center for Child Evaluation and Teaching, Kuwait (1995). The test was administered to children according to the manual provided. There are a total of 27 digits distributed in 6 sequences, starting with a sequence of two digits, and ending with seven digits. The researcher verbally presented the sequences of digits and then asked the participants to repeat them in the same order. The researcher increased one digit at a time when the child repeated all the digits in the sequence correctly. When the child made an error, the researcher gave a second chance using different digits with the same sequence. If the child made two errors in a given sequence, then the assessment stopped.

Visual short term memory task: To measure children’s visual short term memory capacity, a visual motor memory task was adapted from a study conducted on English adults (Gonzalez et al 2010), then developed to be suitable for Arabic children. Participants were seated comfortably in front of the tablet laptop screen. The laptop ran specialised software to present stimuli and record kinematic measures (Culmer et al. 2009). The tablet laptop screen was rotated and folded to provide a horizontal surface to be used as the writing surface for the tasks with the digitising stylus as the input device (Toshiba Portege M700-13P, Screen: 260 x 163 mm, 1280 x 800 pixels, 32 bit colour and a 60 Hz refresh rate).

Participants were asked to use their preferred hands and deal with tablet and stylus as electronic pen and paper. The writing surface contained integrated sensors that measured the planar position of the pen-shaped input stylus at 120 Hz. Participants were asked to look at a shape for 5 seconds. There were 18 square waves which varied in height and width, including three practice trials (Appendix 5). Then, the child had to remember and copy the shape from right to left as fast and accurately as possible (the copying direction in the original task was from left to right (Gonzalez et al 2010), The researcher asked each participant to put the stylus on the start point (white circle for the copying tasks) when they were ready to start the trial. While participants placed the stylus on the center of the start button for 500 ms, the pattern appeared on the screen with the finish button (always red) as an indication for the participants to begin to copy the pattern presented (Figure 1). The next trial commenced once the participants reached the finish button.

Figure 1: The Basic layout of the copying task



Control variable: Verbal Intelligence Scale (Verbal IQ): Children’s Verbal IQ was assessed to control when looking for the relationship between reading ability and the other cognitive skills (Al-Mannai and Everatt 2005; Elbeheri et al. 2006; Mann and Liberman 1984). Participants’ Verbal IQ was measured using the Arabic version of the

Verbal subtest from the Wechsler Preschool and Primary Scale of Intelligence Revised (Kuwaiti version of WPPSI-R III 1989). This scale has been standardized for a Kuwaiti population (Ministry of Education, Kuwait, 1988). The Verbal IQ test was conducted including five core verbal subtests:

1. The information subtest: test children's general knowledge, including questions about geography and literature.
2. The vocabulary subtests: measures of the child's vocabulary skills.
3. The arithmetic subtests: measures of the child's vocabulary and arithmetic skills.
4. The comprehension subtest: asks the child to solve practical problems and explain the meaning of simple proverbs.
5. The similarities subtest: asks the child to describe the similarities between pairs of items, for example that apples and oranges are both fruits.

The researcher followed the Methods defined in the WISC manual to test children.

3.2.2 Participants

A total of 56 first grade primary school children participated from 12 mainstream government single-sex schools: 7 girls' schools and 5 boys' schools located in four different educational districts in Kuwait (Al-a^ḥsimah, Al-aḥmadi, Al-farwaniyyah, and Mubāarak Al-kabir). Seven children failed to do the complete testing as follows: three failed to complete the visual short term memory task, two refused to do the phonological awareness and phonological short term memory tasks, and two came from private English schools. Therefore, these children did not complete the Verbal IQ test. Participants who failed to complete all the tests were excluded from the study as well as those known to have learning difficulties. Additionally, children who came from private English schools were excluded since they were taught English and Arabic a year earlier than the rest of the participants. This can produce some differences in children's responses to the tasks.

The complete data set was obtained from forty-nine children (23 girls and 26 boys). The mean age for participants was 79.88 months (SD= 3.56) with a range of 6 years to 7 years and 2 months at the start of the study. Students who took part in the study were native speakers of a similar KLD. Also, with regard to the primary school participants,

they receive their school instruction in Arabic and are only introduced to MSA as a school subject at the beginning of their first year. Demographic details for the 49 participants are shown in Table 7. Forty-nine participants was considered to be an acceptable sample size as there is only a need for 15 cases per predictor variable to achieve a reliable equation in social sciences (Stevens 2009).

Table 7: Demographic details for the participants

Educational districts	No. of schools	Participants	Gender
Al-āsimah	4	4	1M-3F
Al-aḥmadi	4	32	13M-19F
Al-farwaniyyah	2	2	1M-1F
Mubārak Al-kabir	2	11	11M

3.2.3 Ethical issues

All potential ethical issues involved with conducting such research were taken into account. First, the approved protocol obtained from the University of Leeds Research Ethical Committee, UK was followed. Second, the permission of the Educational Research and Development Administration of the Ministry of Education Kuwait was obtained. Third, the permissions of the managements of different Educational areas and the head teachers of the schools participating in the study were obtained. Finally, parental / guardian consent forms were delivered by hand by the researcher to first grade primary school children.

3.2.4 Procedure

The data collection was conducted once starting from April 2011, which is two months before the end of the school year in Kuwait and lasted for approximately 6 weeks. It was thought that the end of the first grade primary school year was the best time for the study to be conducted because children had been introduced to almost all Arabic letters and gained the requirements for learning the basic reading skills during the same year, so they were neither preliterate nor skilled readers. This should enable the collection of comprehensible data to evaluate the tasks more and plan for future research. The

researcher carried out the experiment on 49 first grade primary school pupils. All tasks were administered to participants by the researcher, including phonological awareness, reading ability, phonological short term memory, visual short term memory tasks and the Verbal IQ tasks.

All tasks were individually administered to children in a quiet room inside their schools. Each child completed the series of tasks without time pressure, in two sessions, to reduce problems of boredom and fatigue which may affect children's performance. Before the actual experiment, the test items, tape recorder, tablet laptop (used to administer the visual short term memory task) and a laptop (used to administer the reading ability task) were introduced to each child prior to the actual experiment. All tasks were administered in a balanced order in two sessions, each session lasting approximately 45 minutes. In session one, 4 tasks were always applied as follows: visual short term memory, phonological awareness, reading ability then phonological short term memory tasks. In session two, only the Verbal IQ task was applied.

3.2.5 Scoring

Reading ability task: For the reading ability task, a score of one was given for each word correctly read and zero for incorrect reading or missing a word.

Phonological awareness task: During the phonological awareness task, each response was scored according to the following three criteria:

- 1- A score was given if the students gave the correct remainder of the word after they had deleted the Initial Phoneme (IPD), such as, C / CV or C / CVC.

- 2- A score was given if participants gave the correct remainder of the word and had deleted the Initial larger Unit (IUD). IUD includes either the first syllable in a word or the first unit that is larger than a phoneme and smaller than a syllable, such as CV / CVC.

- 3- Zero for children who gave a wrong remainder in the case of IPD or IUD, as well as those who failed to respond.

Because so few children were able to delete at the level of the phoneme (see page 61-62), we were unable to analyse this data statistically. We therefore produced a combined score of phonological awareness which included both IPD and IUD. This then represented those children who were able to do the task to a greater or lesser extent. Therefore, children's phonological awareness in MSAW, KLDW and KShW is represented by the combined scores of both IPD and IUD in MSAW, KLDW and KShW respectively throughout the analysis.

Visual short term memory task: Participants were asked to look at a shape, and then remember and reproduce the shape by drawing it from right to left as fast and accurately as possible. This was conducted using a digitised stylus on a tablet laptop. Scoring for this test involved a measure of shape reproduction, and the score represented the error from the ideal reference path. In order to calculate the qualitative reproduction of the shapes relative to an ideal reference path, an algorithm was used to analyse the movement data between the start and finish locations. Further, to characterise the quality of shape reproduction, an iterative 'point-set registration' algorithm was applied. The input to the algorithm was the recorded stylus movement between the start and finish dots. For each participant's individual test, the input data was subjected to iterative applications of rigid transformation, rotation and isotropic scaling (Myronenko and Song 2010; Gonzales et al. 2010) so that the input data could best match an idealised reference path of the desired input. The key useful feature in this test was the point-matching capability of the algorithm, whereby the path lengths of the input and reference path were divided to a resolution of 1mm, and the 2D distance between the corresponding points along the paths could be calculated. The score was provided by calculating the Root Mean Square of this error (RMSe) in mm, which represented a measure of shape reproduction.

Control variable: Verbal IQ: The researcher followed the Methods defined in the WISC manual to score children's responses which were derived from scores on evif core of the subtests: information, similarities, arithmetic, vocabulary and comprehension. The raw scores were added together as a Verbal IQ score and used for the analysis. Because the Verbal IQ task testing took 45 minutes, it was decided not to include any more tests.

3.3 Results and analysis

The reliability and validity of the measures were scrutinized using Cronbach's alpha coefficient, which should be above 0.7. This is to evaluate the internal consistency of the tasks and to demonstrate whether the task items relate to the same underlying construct of the assessment (Pallant 2005).

The data were analysed using one-way ANOVA to test the effect of word types on children's phonological and reading abilities. In addition, a Pearson correlation was computed to assess the level of relationship between the variables reading ability and phonological awareness, phonological short term memory, visual short term memory and Verbal IQ. Also, a hierarchical multiple regression was used to investigate the contribution of the predicted measures phonological awareness, phonological short term memory, visual short term memory to reading ability.

3.3.1 Descriptive Data

Prior to processing the data for analytic purposes, the outliers and normality of the data were assessed by applying several approaches, such as boxplot, histograms and skewness. The data were not normally distributed according to the Shapiro test and several transformation techniques were applied such as square roots and logarithms, but did not alter this. However, the values of skewness of between +2 and -2 indicate a reasonable normal distribution (Rubin 2010; Bachman 2004; Lewis-Beck et al. 2004). Consequently, the present study data is assumed to be normally distributed to an acceptable level. From now and throughout the thesis data were taken to be normally distributed if the skewness and kurtosis were within +2 and -2. Therefore, the data were kept raw without transformation throughout the study¹.

Reading ability task: The measure was found to be highly reliable, ($\alpha = 0.92$). The reading ability measure is descriptively reported in terms of the means and standard deviations in Table 8. The data were treated as normally distributed according to skewness and kurtosis being between +2 and -2.

¹ The analyses of the transformed data were carried out and it was the same as the analyses of the untransformed data, so it was decided to use the raw data.

A total of 6 children failed to do the task as they scored zero across all the word type lists. Forty-three remaining children were able to do the task and one of them only was able to read all the words across the three word type lists (see Table 9).

Table 8: Mean and Std. Deviation for 49 participants' scores in the reading ability task across word types

Task	Word types	M (8)	SD
Reading ability	MSAW	3.22	2.6
	KLDW	1.63	2.1
	KShW	2.69	2.58
²Total reading ability / 24		7.55	6.71

Table 9: Responses of the 43 participants who were able to read across word types

Word types	N	Correct responses	Responses %
MSAW	39	158	13.43%
KLDW	28	80	6.8%
KShW	38	132	11.23%
Responses of 49 participants / 1176		370	31.45%

Phonological awareness task: On examining the internal reliabilities of the phonological awareness measure, a high Cronbach's alpha was found to be 0.94. The phonological awareness measure is descriptively reported in terms of the means and standard deviations in Table 10. The data were considered normally distributed because the skewness and kurtosis were between +2 and -2.

A total of 11 children failed to do the whole task; they scored zero across the three words lists. Of the remaining, 38 were able to do the task; they either deleted the initial phoneme for some words, or the initial larger unit for the others (Table 11).

² The total score of reading ability is the total responses across all word types

Table 10: Mean and Std. Deviation for 49 participants' scores in the phonological awareness task across words types

Deletion ability	Word Types	M (8)	SD
IPD	MSAW	.45	1.12
	KLDW	.39	.7
	KShW	1.35	1.35
IUD	MSAW	3	2.9
	KLDW	2.82	.27
	KShW	3.04	.26
³ Combined phonological awareness	MSAW	3.45	3.1
	KLDW	3.2	2.83
	KShW	3.6	3.24
⁴ Total phonological awareness / 48		10.27	8.71

Table 11: Responses of the 38 participants in the level of IPD and IUD in the phonological awareness task across word types

Word types	IPD			IUD		
	responses	Percentage	N	responses	Percentage	N
MSAW	22	1.87%	13	147	12.5%	33
KLDW	19	1.62%	14	138	11.73%	32
KShW	28	2.38%	12	149	12.67%	28
Total responses / 1176	69	5.87%		434	36.9%	

Phonological short term memory tasks: The participants' phonological short term memory mean span score was 3.78, which is out of the longest span 7 digits (SD = .896, range 2-6). Phonological short term memory data were treated normally distributed.

Visual short term memory task: The participants' performance scores in visual short term memory task are based on error scores. The error scores reflect how much children's drawings were distorted from the actual shape (see page 55). The visual short term memory mean is 8.18 and SD is 3.18. The visual short term memory skewness and kurtosis were between +2 and -2 so the data were treated normally distributed.

³ The combined phonological awareness included both IPD and IUD

⁴ The Total phonological awareness is the total scores of the combined phonological awareness scores across words.

Control variable: Verbal IQ: The current study sample attained a mean score of 43.18, which almost reflects the mean value found in the test's manual for 6-7 year olds, which is 47 - 50. The Verbal IQ data were normally distributed

3.3.2 Data analysis

3.3.2.1 ANOVA:

Reading ability task:⁵ A one-way ANOVA was conducted to compare the effect of the word types (MSAW, KLDW and KShW) on reading ability. There was a statistically significant effect of word types on reading ability ($F(2, 96) = 24.86$, $MSe = 1.3$, $p < 0.001$), (Table 8). The results of the Post-Hoc analysis showed that all the word type lists differed highly significantly from each other (MSAW / KLDW $p < 0.001$, MSAW / KShW $p < 0.05$ and KShW / KLDW $p < 0.001$). The indication is that children found it easier to read both MSAW and KShW than KLDW.

Phonological awareness task: Because of the small number of children who were able to delete the initial phonemes throughout the three words lists, it was not possible to analyse it statistically as there is no meaningful variability to analyse these results further (Table 10). Therefore, a combined score was used (see page 59).

⁶A one-way ANOVA was conducted to compare the effect of the word types (MSAW, KLDW and KShW) on children's phonological awareness. There was not a statistically significant effect of word types on phonological awareness ($F(2, 96) = 1.45$, $MSe = 1.43$, $p > 0.05$). Taken together, these results suggest that children performed almost the same across all three-word lists (Table 10).

3.3.2.2 Correlation

A Pearson correlation was computed to assess the relationship between children's reading ability and their phonological awareness, phonological short term memory and visual short term memory. The correlation analysis (as well as the following regression analysis) was conducted using the total scores of the reading ability task, the total scores of phonological

⁵ The same analysis was conducted after excluding children who failed to complete the reading ability task and the same results were obtained.

⁶ The same analysis was conducted after excluding children who failed to complete the phonological awareness task and the same results were obtained

awareness, phonological short term memory and visual short term memory while controlling for age and Verbal IQ.

The correlation matrix displayed in Table 12, shows that the reading ability revealed positive and significant correlation with phonological awareness at $p < 0.001$ level. A significant correlation also exists between the reading ability and children's phonological short term memory at $p < 0.01$ level. The visual short term memory correlates negatively with reading ability at $p < 0.01$ level. The scoring process explains this correlation because low scores in the reading ability, phonological awareness and phonological short term memory tasks indicate low performance, while higher scores in visual short term memory task mean larger error because this task measured error. Verbal IQ was also correlated with phonological awareness, phonological short term memory, visual short term memory and reading ability tasks. That is, reading ability correlated with all the variables.

Table 12: Pearson correlations between the variables measures of 49 children

Tasks	1	2	3	4	5
1. Reading ability	—				
2. Phonological awareness	.54***	—			
3. Phonological short term memory	.39**	.38**	—		
4. Visual short term memory	-.38**	-.35*	-.1	—	
5. Verbal IQ	.43**	.42**	.32*	-.35*	—

Statistical significance: * $p < .05$; ** $p < .01$; *** $p < .001$

3.3.2.3 Regression

In order to investigate which of the measures, phonological awareness, phonological short term memory and visual short term memory, can predict reading ability in children amongst first grade primary school Kuwaiti children, a series of hierarchical multiple regression analyses were employed, treating the reading ability task as the predicted variable, phonological awareness, phonological short term memory and visual short term memory tasks as the predictor variables and the Verbal IQ test and age as control variables. The hierarchical multiple regression revealed that at stage one, Verbal IQ and age contributed significantly to the regression model, $F(2, 46) = 5.43, p < 0.01$ and accounted for 19.1% of the variation in reading ability. The model at stage two was also significant, $F(5, 43) = 5.76, p < 0.001$, and explained 40.1% of variation in reading ability. Therefore ΔR

was 21%. However, the only significant predictor of reading ability was phonological awareness. The β coefficient associated with phonological awareness (0.37) is positive, indicating a direct relationship in which higher numeric values for phonological awareness are associated with higher numeric values for reading ability (Table 13).

Because phonological awareness is such a strong predictor, other variables would show some contribution to the model if phonological awareness was not included. Therefore, the same hierarchical multiple regression steps were conducted excluding the phonological awareness as one of the predictor variables. At stage one, Verbal IQ and age contributed significantly to the regression model, $F(2, 46) = 5.61, p < 0.01$) and accounted for 19.6% of the variation in reading ability. The model at stage two was also significant, $F(4, 44) = 5.2, p < 0.01$), and explained 32% of variation in reading ability. Therefore ΔR was 12.4%. However, the only significant predictor of reading ability was phonological short term memory. The β coefficient associated with phonological short term memory (0.29) is positive, indicating a direct relationship in which higher numeric values for phonological short term memory are associated with higher numeric values for reading ability (Table 14).

Table 13: Hierarchical multiple linear regression analysis when including all the variables

Tasks	R	R2	R2 change	B	SE	β
Step 1	.44	.191				
Verbal IQ				.3	.1	.44**
Age				.17	.25	.1
Step 2	.63	.401	.21**			
Verbal IQ				.1	.1	.13
Age				-.19	.25	-.1
Phonological awareness				.28	.12	.37*
Phonological short term memory				1.5	1	.2
Visual short term memory				-.41	.28	-.1

Statistical significance: * $p < .05$; ** $p < .01$; *** $p < .001$

Table 14: *Hierarchical multiple linear regression analysis when excluding phonological awareness*

Tasks	R	R2	R2 change	B	SE	β
Step 1	.44	.191				
Verbal IQ				.3	.1	.44**
Age				.2	.25	.1
Step 2	.57	.32	.13**			
Verbal IQ				.17	.1	.25
Age				.17	.1	.25
Phonological short term memory				2.17	1	.29*
Visual short term memory				-.56	.28	-.27

Statistical significance: * $p < .05$; ** $p < .01$; *** $p < .001$

3.4 Summary of the cross-sectional data

Five measures were applied to investigate Arabic reading ability of Kuwaiti children and the reading ability related skills; phonological awareness, phonological short term memory and visual short term memory, and to explore the relationship between their reading ability and phonological awareness, phonological short term memory and visual short term memory during their second grade primary school period.

Results of the reading ability task showed that the majority of the participants were able to read to some extent, although only one child completed the whole task correctly. Participants' reading ability measures across the three word type lists were statistically different. The easiest word type list was the MSAW and the most difficult was the KLDW.

For the phonological awareness task results, one quarter of the participants failed to do the task and only two of the participants were able to complete the entire task (either deleting the initial phoneme or the larger unit). Data analysis showed that children found it easier to delete the initial larger unit than the initial phonemes across the word type lists. The word type did not have any influence on children's phonological ability.

Although correlational analysis indicated a high relationship between all the predictor

measures: phonological awareness, phonological short term memory and visual short term memory, and the predicted measure reading ability, the regression showed that only phonological awareness is a significant strong predictor of reading ability when including all the variables in the regression model. However when phonological awareness was excluded, phonological short term memory became a significant predictor of reading ability.

3.5 Discussion

This cross-sectional study provided an initial assessment of the level of Kuwaiti children's reading ability and phonological awareness for each of the three types of written Arabic to which they had been exposed: MSAW, KLDW and KShW. It also provided insights into the relationship between the children's reading ability and their phonological awareness, phonological short term memory and visual short term memory.

3.5.1 Children's reading ability across word types

The study investigated children's reading ability across three word type lists, MSAW, KLDW and KShW. This was the first study considering these three word type lists in a reading measure. This study assessed the level of children's reading ability for each type, then correlated the total scores for children's reading ability across these word type lists with scores for all the other skills, phonological awareness, phonological short term memory and visual short term memory. By applying this assessment, clearer pictures of children's reading ability could be achieved, taking into account all the variations of the children's diglossic context.

Although only MSA consonants were involved in all the lists for the reading ability task, children found it difficult to read KLDW compared to the other word type lists. Even though KLD and KSh are perceived as the native Arabic form for Kuwaiti children, children read KShW much more easily than KLDW. This is because KLDW are not seen in a written form, especially at the early reading stage, compared to KShW,

which can be seen in schoolbooks or media and newspapers. Also, KLDW are phonologically familiar for children to speak but they are not orthographically familiar to read (Bentin and Ibrahim 1996; Torgesen et al. 1999). Thus, it would appear that children read KLDW in the same way that English children read pseudohomophones, which can be more difficult and take longer to read than real words (Goswami et al. 2001; Torgesen et al. 1999). On the other hand, children use KShW in their daily communications and apply them during their school literacy activities as well. Additionally, Arabic children learning KShW are like those learning to read in a language that is not characterized by diglossia, using the same form of language, written and spoken. According to the Grain size theory, a psycholinguistics theory formulated by Goswami, when the availability of symbols and sounds are accessible in children's spoken language, as in KShW, this facilitates learning to read. Therefore children in this study can read KShW better than KLDW, because mapping between phonemes and graphemes is accessible in this situation (Ziegler and Goswami 2005).

Regarding the ability to read MSAW, the children had only been exposed to this type of Arabic during their first primary school year, starting less than a year earlier than the current study was conducted. The participants found it easier to read MSAW than KLDW. One possible explanation for this finding might be related to the common key challenge usually imposed on the readers in diglossic contexts. Terry (2012) asserted that the frequent mismatch mapping between speech and orthographic representations in a dialectic variety plays a role in the reading abilities of the learners. The children participating in this study, having received reading lessons in MSA for seven months, may have found it easier to match between the new learnt form of Arabic and its orthographic strings than to match between their spoken dialect and the printed MSAW. The matching processes in the latter case are infrequent, inconsistent or inapplicable.

3.5.2 Children's phonological awareness across word types

Although the current study applied a small grain size measure, initial phoneme deletion, participants showed sensitivity to larger phonological units rather than small ones across all of the three word types, MSAW, KLDW and KShW. There are three possible reasons for this result.

This first reason can be related to Goswami's Grain size theory. Goswami suggests that during the early stage of literacy children develop their awareness of larger grain units before the smaller ones (Ziegler and Goswami 2005). And in the current study, children were at the end of their first primary school year; having acquired MSA a year or so before this study was conducted. This result is consistent with a study relating to Arabic orthography (Saiegh-Haddad 2007) as well as studies relating to English orthography (Bradley 1983; Bradley 1980; Goswami 1986).

The second reason can be teaching methods, which can explicitly and directly play a role in children's phonological development (Ziegler and Goswami 2005). For example, although Arabic contains small phonological units which require a one to one grapheme / phoneme relationship (Goswami and Brayant 2005), Arabic reading instructional practices in classrooms can influence beginner readers' phonological awareness (Saiegh-Haddad 2007). In mainstream Kuwaiti schools, syllabification teaching approaches are applied to help children acquire the multisyllabic structure of Arabic words and the teaching does not involve any systematic instruction in the smaller verbal sounds: phonemic awareness. Therefore, segmenting a small verbal unit can be more challenging than a larger phonological unit for children. And children in the classroom are regularly becoming used to segmenting words according to larger units and are not taught about phonemes.

The third reason can be explained by the nature of Arabic orthography. Almusawi (2014) stressed that the nature of Arabic orthography, in which the pronounceable units mostly represent syllabic combinations of consonant–vowel structures rather than a single phonemic segment, can be responsible for the apparent predictive relationship between large grain size and reading skills. Additionally, Saiegh-Haddad (2003, 2005, 2007) consistently reported empirical findings regarding the difficulties children face in isolating phonemes from their attached vowels. Saiegh-Haddad (2003) emphasised that there is a consistent relationship between consonants and their subsequent vowels in the Arabic language and she characterized this relationship as 'coherent'. Saiegh-Haddad studies are the only Arabic studies available that have investigated children's phonological sensitivity level in a diglossic context. However, her research was conducted using the Palestinian dialect in particular, and the discrepancies between the Palestinian dialect and MSA are not the same as between the Kuwaiti dialect and MSA.

Therefore, children's ability to delete and manipulate the phonological units of words may differ across countries with different dialects. The discrepancies between MSA and the particular LD could produce different results as shown in the current study and other Arabic studies related to children's phonological awareness across words types (Saiegh-Haddad 2003; Ibrahim 2010).

In addition, it was thought that because of the children's greater oral experience with KLDW as well as KShW, they would find the phonological units within these words easier to manipulate than in MSAW. However, the current study showed that children's phonological awareness across word types was almost the same. A possible reason for this result can be related to the phonological identity of the target phonemes (KLD phonemes vs MSA phonemes) rather than the words' identity (MSA phonemes in KLDW vs MSA phonemes in MSAW). To be more precise, all the words in the phonological awareness task, MSAW, KLDW and KShW, were composed of MSA phonemes only. Children were asked to delete MSA phonemes within different types of words rather than deleting KLD phonemes from the KLDW and MSA phonemes from the MSAW and KShW. Different results might be achieved if different phonemes were used in each word type list.

The present results were not in line with the results of previous studies (Saiegh-Haddad 2003; Ibrahim 2010), which were themselves contradictory. Some studies found that Palestinian phonemes were less difficult to isolate than MSA phonemes due to the greater experience and practice of the spoken language phonemes compared to the standard phonemes (Saiegh-Haddad 2003, 2007 and 2011). Other studies found that participants performed better on deleting MSA phonemes than deleting Palestinian phonemes because of literacy acquisition (Ibrahim 2010). But, in the current study, there was no difference in children's ability to delete phonemes across the different word types. This could be because of the specific criteria used to measure children's phonological awareness in each study; different types of phonemes and different types of words could contribute to the participants' performance. Also, each study was conducted in a different diglossic context with a different dialect. There are great discrepancies between dialects across Arabic countries and different levels of discrepancies between these dialects and standard Arabic, which consequently can produce different phoneme sensitivity levels.

3.5.3 The relationship between children's reading ability and phonological, phonological short term memory and visual short term memory.

The most prominent finding in this study is a significant correlation between children's reading ability and their phonological awareness. This study was the first to include three types of words; MSAW, KLDW and KShW, in the reading ability and phonological awareness measures to investigate their relationship and the predictor role on children's reading ability. It appears that, under a variety of research designs, and regardless of the phonological awareness task sensitivity level, orthographical complexity or sample size and participants' age, children's phonological awareness is linked to their reading ability in both English orthography (Mann and Liberman 1984; Rego and Bryant 1993) and Arabic orthography (Abu-Rabia 1995; Al-Mannai and Everatt 2005; Taibah and Haynes 2011).

Also, the regression analysis of the current study data showed that phonological awareness was the only predictor of children's reading ability, independent of the variables of age and Verbal IQ. Numerous English studies have found that phonological awareness predicted reading (Adams 1990; Ellis 1990; Goswami and Bryant 1990; Mann and Liberman 1984; Rego and Bryant 1993; Rohl and Pratt 1995; Targeson et al. 1994; Perfetti et al. 1987; Whitehurst and Lonigan 1998), but very few studies have investigated this in an Arabic context (Saiegh-Haddad 2005; Al-Mannai and Everatt 2005). This study has shown that although the majority of children were deleting large grain units in a phonemic deletion measure more easily than small grain units, their phonological awareness, represented by the total scores of their ability to delete both phonemes and large units, still predicted reading ability in Arabic. This is because the awareness of sounds represents the foundation skill for using any alphabetic concept. In fact, Arabic children use the Arabic alphabetic system in which the letters and vowels, in combination, represent single speech sounds (Saiegh-Haddad 2003). Segmenting a word into its sounds components, recognizing their identity and blending these components together again is a key role for children to be able to start to read a word (Shaywitz 1998). Therefore, without phonological awareness, students may be confused by the print structure and how it represents the spoken word (Moats and Tolman 2009). This process is very important for children's reading, thus phonological awareness significantly correlates with and predicts reading ability.

There was a relationship between reading ability and phonological short term memory. The current study therefore achieved results which are consistent with the previously reviewed studies in English orthography (Brunswick et al. 2012; Gathercole and Baddeley 1993; Mann and Liberman 1984; Rohl and Pratt 1995). A small number of Arabic studies found that there is a relationship between reading ability and phonological short term memory (Abu-Rabia 1995; Abu-Rabia and Sieghel 2002; Abu-Rabia et al. 2003; Elbeheri and Everatt 2007; Elbeheri et al. 2011; Zayed 2013). However, they did not take into account the diglossia context. They focused on this relationship by measuring children's reading ability in literary Arabic only.

The current study, on the other hand, did take into account the diglossia context and also found that this relationship exists. A possible explanation of why these findings are consistent is that in order to read, children should be able to place information about words into their memories, retain it for a short period of time, select the relevant information and retrieve it. In addition, the significant correlation between phonological short term memory and reading ability can be explained by the strong correlation found between phonological awareness and phonological short term memory (Brady 1986; Brunswick et al. 2012; Passenger et al. 2000; Rohl and Pratt 1995). This is because phonological short term memory characterizes a function of general phonological processing perception that is essential for successful reading development (Alloway 2006; Brunswick et al. 2012; Hansen and Bowey 1994; Wagner et al. 1997). Therefore, in a diglossic context where there are different forms of the same language, phonological short term memory plays a role in learning new vocabularies as well as new phonemes in children's literary form that are not accessible in their spoken form. Because phonological short term memory is considered as the storage of different phonemes, which are produced by grapheme-phoneme decoding, it helps children to learn the phonological structure of new words and read unfamiliar words.

Although there were significant correlations between phonological short term memory and reading ability, the results of the regression analysis did not support the view that phonological short term memory is a predictor of reading ability. However when the phonological awareness was excluded, the phonological short term memory became a significant strong predictor of reading ability (Mann and Liberman 1984). This can be related to the significant contribution of phonological awareness on children's reading

ability in the early reading acquisition period, which is stronger than the effect of phonological short term memory ability on reading development.

The present study is the first study investigating children's visual short term memory and its relation to reading ability in diglossic context by applying an electronic device with a highly sensitive recording technique. The results showed that visual short term memory significantly correlates with children's reading ability. This is because children rely on their visual memory to read a word depending on its shape in addition to using their phonological awareness and phonological short term memory (Brunswick et al. 2012; Ehri and Wilce 1985; Ellis and Large 1988), and it particularly affects the ability to discriminate between letter-like shapes (Badian 2001; Feagans and Merriwether 1990; Taha 2013). Similar findings have been reported by English studies (Baker 1976; Brunswick et al. 2012; Carroll 1972; Ellis 1990; Ellis and Large 1988; Kulp et al. 2002; LeFever 1982; Schatscheider et al. 2004; Salon et al. 1985; Vellutino et al. 2007; Wesson 1993) as well as Arabic studies (Elbeheri and Everatt 2007; Elbeheri et al. 2011; Taha 2008; Taha 2013) regardless of the research methods and sample criteria.

Although there were significant correlations between visual short term memory and reading ability, the results of the regression analysis, surprisingly, did not support the view that visual short term memory is a predictor of reading ability (Kulp et al. 2002) or at least not a strong predictor of reading ability in Arabic orthography, as had been expected. This may be explained by the procedure that was used during the visual short term memory measurement, which was the same as the procedure used by previous research (Gonzalez and Johnson 2011). To be more precise, during the task there was a white circle (a start point) in the center of the start button for each copying shape trail. Each participant was asked to place the stylus on this white circle when waiting for the next trail for 500 ms. It was noticed that the majority of children paid more attention to trying to keep their stylus on the circle rather than looking at the shape. Also, most of shapes used in the task were quite similar. It was noticed that some of the children appeared to try and predict the shapes rather than focus and try to remember the shapes. Moreover, there were 18 shapes introduced to children via the visual short term memory task. Problems of boredom and fatigue were detected during the task. Therefore, it is possible that these methodological issues reduced children's performance on the task.

3.6 The significance of the study

This cross-sectional study provided an initial assessment of the level of children's reading ability and phonological awareness for the three Arabic word types to which Kuwaiti children had been exposed: MSAW, KLDW and KShW. Using three word types including KShW in both reading ability and phonological awareness tasks was a completely novel method that assessed the whole linguistic context of the participants.

The findings of the current study showed a clearer picture of children's reading ability taking into account all the variations of children's diglossic context. Children found it difficult to read KLDW compared to the other word types. The results showed how different factors could contribute to children's reading performance. These factors include the visual familiarity of words, the availability of symbol, and sounds; the accessibility of mapping between phonemes and graphemes.

Interestingly, children showed phonological sensitivity to a larger grain size rather than a small grain size. This, as discussed earlier, relates to the nature of the pronounceable units in Arabic, which represent syllabic combinations of consonant–vowel structures rather than a single phonemic segment. Teaching systems in classrooms can also emphasise the syllabification approach rather than the smaller verbal sounds: phonemic awareness. Moreover, participants' phonological awareness across word types was almost the same. This might be because all the words in this task were composed of MSA phonemes only that are accessible in all the Arabic variations in Kuwait.

The most prominent finding of the current study was that although there are relationships between Kuwaiti children's reading ability and their phonological awareness, phonological short term memory and visual short term memory, phonological awareness was the only predictor of children's reading ability independent of the variables of age and Verbal IQ. Surprisingly, the visual short term memory measure did not predict reading ability. This result may be related to the method of the measure applied in the study to assess children's visual short term memory, which will be reviewed for future studies.

Although children's reading ability and its relationship with their phonological awareness, phonological short term memory and visual short term memory was

investigated by this cross-sectional study, a longitudinal study is needed, studying a large group of preliterate students, to investigate the developmental changes in each of these cognitive skills and their association with reading. The greater the number of participants in a study, the greater the statistical power will be (Werner and DeSimone 2012). Moreover, including preliterate children can be more effective because children with initial reading ability may influence their phonological awareness and produce unreliable findings.

Chapter Four

Longitudinal study

The present study was designed to further examine the relationship between the development of phonological awareness, phonological short term memory, visual short term memory and reading abilities. It will extend what has been found by the previous cross-sectional study. Also, it will add more information about the unique contribution of these different cognitive skills towards the ability to read an Arabic orthography in a diglossic setting.

In fact, although we have conducted a cross-sectional study for the same purpose, there is still a gap in our knowledge regarding MSA reading development and other cognitive skills, phonological awareness, phonological short term memory and visual short term memory, particularly with normal beginning readers. The present longitudinal study represents the only effective way to study the developmental changes of each cognitive skill associated with reading. This is because we are testing the same group of participants over an extended period of time, on three occasions (Wagner and Torgesen's 1987).

In addition, the testing period of this type of study is critical. To examine the emerging relationship between reading and other cognitive skills, it is necessary to start by including preliterate participants and measure all variables of interest at every stage (Burgess and Lonigan 1998; Torgesen et al. 1994), and to control for the Verbal IQ and age at all stages (Brunswick et al. 2012; Rego and Bryant 1993; Rahl and Pratt 1995; Torgesen et al. 1994). It is important to exclude all children who already have some reading skill at the initial stage of the study. This is because in children with initial reading ability this may influence their phonological awareness and make them likely to perform better on phonological awareness measures compared to children who have not yet developed reading skills (Tunmer 1991). In the present study, a longitudinal design was applied to measure each cognitive skill and to relate this measure to reading ability across the first two primary school years, generally at the start of the formal school year toward the end of the first school year and the beginning of the second school year (age

range between 63 and 93 months). This ensures that we do not miss this crucial period of development and clearly separates cause and effect between the skills (Brunswick et al. 2012; Rohl and Pratt 1995).

The present study comprised a large group of children tested before they could read, at a stage of early reading acquisition, and when reading skills had been acquired. So the sample was followed from the start of the formal education through the second year at school.

4.1 The aim of the study

This study is novel in a number of ways. Firstly, it is the first longitudinal study in Kuwait focused on the relationship between reading ability of Kuwaiti normal readers and their abilities in phonological awareness, phonological short term memory and visual short term memory. This study will reveal the factors which are crucial for a successful reading process in MSA for Arabic pre-reader children in general, and Kuwaiti pre-readers in particular. Secondly, it is the first longitudinal study conducted to investigate children's reading ability and phonological awareness and their relationship across the three word types, which are MSAW, KLDW and KShW. Thirdly, this study aimed to investigate the predicted roles played by phonological awareness, phonological short term memory and visual short term memory in children's reading ability in this diglossic setting. Finally, it was interesting to investigate the effect of the different word types on children's reading ability and phonological awareness across three time points.

We need to understand how these skills develop and affect subsequent reading ability in early reading acquisition. It is important to understand the nature of these cognitive skills, their relationship and how they are different in other orthographies, such as English. It could play an important role in influencing educational policy-makers to create the appropriate educational circumstances in primary schools so that Arabic language teaching is improved by addressing this particular phenomenon.

4.2 Methodology

4.2.1 Measures

The same measures applied during the cross-sectional study were used in the present study. These measures were phonological awareness task, reading ability task, phonological short term memory task, visual short term memory task and the Verbal IQ.

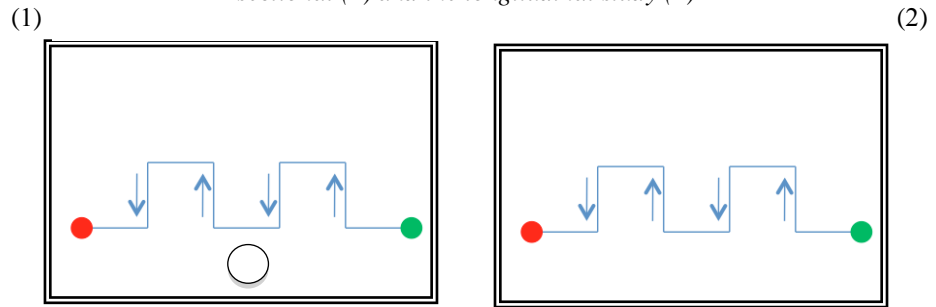
Reading ability task: Participants were presented with the same three single word-reading lists, MSAW, KLDW and KShW, as used in the cross-sectional study.

Phonological awareness task: Although children faced difficulties completing the phonological awareness task during the cross-sectional study, and they tended to delete the initial larger unit rather than the initial phonemes, it was thought important to re-administer this task on a larger sample size on a longitudinal basis to confirm the finding achieved from the cross-sectional study. In the present experiment, the three word type lists, MSAW only, KLDW only and KShW, administered in the cross-sectional study, were applied.

Phonological short term memory task: The same Digit Span test administered in the cross-sectional study was applied in the current study.

Visual short term memory task: visual short term memory ability was measured by the same copying task applied in the cross-sectional study. However, some modifications were made because of some difficulties noted during the cross-sectional study (Chapter Three). First the number of shapes introduced to children, was reduced to (13) instead of (18) shapes. This was considered to reduce problems of boredom and fatigue detected during the cross-sectional study. Second, some different combinations of discrete connected shapes from the cross-sectional study were applied. This was to reduce the level of prediction of shapes observed during the previous study. Third, the white circle on which participants were asked to put the stylus at the start point when they were ready to start the trial was removed (Figure 2). This is because it was noticed during the cross-sectional study that that the majority of children paid more attention to keeping their stylus on the circle rather than to looking at the shape.

Figure 2: the basic layouts of the visual short term memory task in the cross-sectional (1) and the longitudinal study (2)



Control variable: Verbal Intelligence scale (Verbal IQ): Participants' Verbal IQ was measured by the application of the Arabic version of the Verbal subtest from the Wechsler Preschool and Primary Scale of Intelligence Revised (Kuwaiti version of WPPSI-R III 1989). This scale has been standardized for a Kuwaiti population (Ministry of Education, Kuwait, 1988). The researcher followed the Methods defined in the WISC manual to test children. Children's Verbal IQ was considered as a control variable when investigating children's reading ability and reading related skills (Al-Mannai and Everatt 2005; Elbeheri et al. 2006; Mann and Liberman 1984). All the five subtests of the Verbal IQ applied during the cross-sectional study, applied during the current study as well.

4.2.2 Participants

First grade primary school children were randomly selected from different mainstream government single-sex schools. Children who took part in the experiment had started mainstream kindergarten at age three years and six months, spending two years in kindergarten with limited MSA writing and reading skills depending on their teachers' efforts. During the first phase, the participants had just started their school year and had not been introduced to the Arabic letters or gained the requirements of basic reading skills.

All participants were Kuwaiti and native speakers of the similar local form of the KLD. Also, with regard to the primary school participants, they receive their school instruction in MSA and are only introduced to MSA as a school subject at the beginning of their first year. All children with initial abilities in reading during Time One of the study were excluded. Also, the same exclusion criteria that were applied during the

cross-sectional study were also applied in the present study. So, children who failed to complete all the tests or were known to have learning difficulties or came from private English schools were excluded from the study.

At the start of the study, a total of 90 students participated. Demographic details for the participants are shown in Table 15. However, according to the exclusion criterion, five children were excluded from the study since they were able to read during Time One (Burgess and Lonigan 1998; Goswami and Bryant 1991; Rego and Bryant 1993). This is because they either attended an Arabic language summer course or came from private schools, which usually administer Arabic as a school subject a year before the mainstream schools in Kuwait. Therefore, a total of 85 students were introduced to all the tasks during Time One, with a mean age of 72 months and an age range of 63 months to 88 months.

Table 15: Demographic details for the participants

Areas	No. of schools	Participants	Gender
Ḥawally	4	40	25F-15M
Mubārak Al-kabir	5	30	11F-19M
Al-aḥmadi	4	20	9F-11M

During Time two, because four children moved from their schools to other schools and it was difficult to follow them, only 81 children re-participated in the study during Time Two with an age range of 70 to 86 months ($M=78.52$, $SD=3.53$). However, for reasons beyond the researcher's control, of the 81 children, 7 children did not complete the visual short term memory task, four other children did not complete the phonological short term memory task and one child did not undertake the Verbal IQ. Consequently, only 69 children completed all the tasks in Time Two.

In Time Three, three participants had moved from their schools and it was not possible to follow them. Consequently, 78 participants ($M=85.18$, $SD=3.51$) with an age range between 76 to 93 months were administered with Time Three tasks.

4.2.3 Procedure

In this longitudinal study, the data collection was conducted over three phases. The first phase of the experiment was during September / October 2011, which are the first two months of the school year in Kuwait. The second phase of the study was carried out at the end of the same school year, which was the end of the participants' first primary year (April / May 2012). The last phase was at the beginning of their second primary school year (October / November 2012). During the three study phases, all the tasks were administered in a balanced order in one session as follows; visual short term memory, phonological awareness, reading ability, phonological short term memory measures then the Verbal IQ. The same procedure for administering the tasks conducted in the cross-sectional study was followed in the present study. All potential ethical issues involved with conducting such research were taken into account.

4.2.4 Scoring

The scoring method in the current study followed the same scoring method applied in the cross-sectional study for all the tasks.

4.3 Results and analysis

This section presents descriptive data as well as data analysis for all participants and all measures of the current longitudinal study across Times One, Two and Three. In order to test the effect of word types on children's phonological and reading abilities, ANOVA was applied. In addition, the level of relationship between the variables phonological awareness, phonological short term memory, visual short term memory, Verbal IQ and reading ability was investigated using a Pearson correlation. Also, to investigate the contribution of the predicted measures phonological awareness, phonological short term memory, and visual short term memory to reading ability, a hierarchical multiple regression was computed. An inspection of data distribution for each variable was conducted before analysing the data for each of the three times. The same procedure conducted in the cross-sectional study was followed to assess the normality of the data across each time point (see Page 60). The values of skewness and kurtosis of between

+2 and -2 were taken to indicate a reasonable normal distribution (Rubin 2010; Bachman 2004 and Lewis-Beck et al. 2004). From now and throughout the thesis the data were taken to be normally distributed if the skewness and kurtosis were within +2 and -2.

4.3.1 Time One

4.3.1.1 Descriptive data

Reading ability task: The data showed that all 85 participants during Time One did not do the tasks and were pre-literate. Therefore, the mean and standard deviations across all word type lists were zero. Therefore, the data were not analysed.

Phonological awareness task: Descriptive results for participants' performances in phonological awareness task during Time One are reported in Table 16. Because of the floor effect of task scores, the data were not normally distributed to an acceptable level (Table 16). Therefore, the descriptive results only were reported, without any statistical analysis.

The majority of participants failed to complete either the IPD or the IUD (floor effect). Only a very few children were able to do some words from the task and achieved very low scores. From looking at the means there appear to be differences between children's performances on the different word types.

Seventy-four children (87.1%) could not do the phonological awareness task at all and they scored zero across all word lists. None of the children could complete the whole task. Of the remaining, 11 were able to complete the task for some of the words (12.9%), deleting either the initial phoneme (IPD), for some words (Table 17) or the IUD for the others (Table 18). Because of the small number of children who were able to complete the task, it was not possible to analyse it statistically as there is no meaningful variability to analyse these results further.

Table 16: Time One, Mean and Std. Deviation for 85 participants' scores in the phonological awareness task across word types

Deletion ability	Word Types	M (8)	SD
IPD⁷	MSAW	.09	.43
	KLDW	.21	.73
	KShW	.15	.66
IUD⁸	MSAW	.29	1.19
	KLDW	.21	.87
	KShW	.28	1.21
⁹Combined phonological awareness	MSAW	.39	1.32
	KLDW	.42	1.29
	KShW	.44	1.47
¹⁰Total phonological awareness / 48		1.25	4.02

Table 17: Time One, responses of the 11 participants who were able to delete IPD across word types

Word types	N	IPD responses	Responses %
MSAW	5	8	.39%
KLDW	8	18	.88%
KShW	6	13	.64%
Responses of 85 participants / 2040		39	1.91%

Table 18: Time One, responses of the 11 participants who were able to delete IUD across word types

Word types	N	IUD responses	Responses %
MSAW	6	25	1.23%
KLDW	6	18	.88%
KShW	6	24	1.18%
Responses of 85 participants / 2040		67	3.29%

7 IPD: Initial Phoneme Deletion (see scoring section in Chapter Two)

8 IUD: Initial Unit deletion ((see scoring section in Chapter Two)

9 The combined phonological awareness included both IPD and IUD

10 The Total phonological awareness task scores is the total scores of the combined phonological awareness scores across words.

Phonological short term memory tasks: The descriptive results for participants' performances in phonological short term memory measure show a Mean of 3.49 out of 7 digits and Standard Deviation of 0.7. The data were treated as normally distributed with skewness and kurtosis both within +/- 2.

Visual short term memory task: The Mean for visual short term memory is 13.83 and Standard Deviation of 3.38. The visual short term memory Skewness of 0.13 and Kurtosis is -0.87. The scores showed that only phonological short term memory and visual short term memory tasks were normally distributed to an acceptable level. This is because the values of skewness and kurtosis were between +2 and -2.

4.3.1.2 Summary of Time One data

All participants were pre-literate at Time one. There was a floor effect of phonological awareness task scores and a very few children were able to do some words from the task and achieved very low scores. According to the phonological awareness mean scores, there was no difference between children's performances on the different word types. No statistical analysis conducted on reading ability and phonological awareness scores.

4.3.2 Time Two

4.3.2.1 Descriptive data

Reading ability task: The reading ability task was administered to a total of 81 children. Descriptive results for participants' performances in the reading ability task during Time Two are reported in terms of the means and standard deviations in Table 19. The total scores for the reading ability task and scores across all word type lists are taken to be normally distributed to an acceptable level because the scores for both skewness and kurtosis were between +2 and -2.

A total of 20 children could not do the reading ability task (24.69%) as they scored zero across all the words while 61 children (75.31%) were able to read some words of the task (see Table 20). Of the 61 children, 36 were able to read some words across all the three lists; one child was able to read all words in all the three lists. Two children were

able to read all the words in the MSAW list only.

Table 19: Time Two, Mean and Std. Deviation for 81 participants' scores in the reading ability task across word types

Task	Word types	M (8)	SD
	MSAW	2.68	2.52
Reading ability	KLDW	1.35	1.96
	KShW	2.62	2.46
Total Reading ability / 24		6.64	6.53

Table 20: Time Two, responses of the 61 participants' who were able to read across word types

Word types	N	Responses	Responses %
MSAW	56	217	11.16%
KLDW	37	109	5.61%
KShW	58	212	10.91%
Responses of 81 participants / 1944		538	27.68%

Phonological awareness task: The phonological awareness task was administered to a total of 81 participants. Phonological awareness task scores during Time Two are descriptively reported in terms of the means and standard deviations for 81 children in Table 21. The total scores of the phonological awareness measure were taken to be normally distributed because the skewness and kurtosis were between +2 and -2. This applied for IUD scores as well. However, the IPD values for skewness and kurtosis were not normally distributed to an acceptable level.

Of the 81 participants, twenty-seven children could not do the phonological awareness task (33.3%). Of the remaining, 54 were able to do the some of the task (66.67%); they either deleted the initial phoneme for some words (Table 22) or the initial larger unit (Table 23).

Table 21: Time Two, Mean and Std. Deviation for 81 participants' scores in the phonological awareness task across word types

Deletion ability	Word types	M (8)	SD
IPD	MSAW	.51	1.15
	KLDW	.47	1.2
	KShW	.48	1.21
IUD	MSAW	.51	1.15
	KLDW	.47	1.2
	KShW	.48	1.21
Combined phonological awareness	MSAW	3.51	3.24
	KLDW	3.11	2.78
	KShW	3.54	3.1
Total phonological awareness / 48		10.16	8.83

Table 22: Time Two, responses of the 29 participants who were able to delete IPD across word types

Word types lists	N	Responses	Percentage
MSAW	21	41	2.11%
KLDW	19	38	1.95%
KShW	17	39	2.01%
Responses of 81 participants / 1944		118	6.1%

Table 23: Time Two, responses of the 50 participants who were able to delete IUD across word types

Word types lists	N	Responses	Percentage
MSAW	45	243	12.5%
KLDW	48	214	11.01%
KShW	47	248	12.76%
Responses of 81 participants / 1944		705	36.27%

Phonological short term memory tasks: The phonological short term memory mean span score of 77 participants was 3.82 out of the longest span 7 digit (SD = 0.68). Phonological short term memory skewness and kurtosis were within +/-2, therefore, the scores treated normally distributed.

Visual short term memory task: The mean of 74 participants' performances scores is based on an error score, which was 7.73. The skewness and kurtosis were within +/-2, therefore, the scores were taken to be normally distributed to an acceptable level.

Verbal IQ task: The current sample of 80 children achieved a mean score of 40.25 which almost reflects the mean value found in the test's manual for 6-7 year olds, which is 47 - 50. The skewness is .09 and kurtosis is -0.39. The total scores for the Verbal IQ were normally distributed.

4.3.2.2 Data analysis

4.3.2.2.1 ANOVA

Reading ability task:¹¹ A one-way ANOVA was conducted to compare the effect of the word types (MSAW, KLDW and KShW) on children's reading ability. There was a statistically significant effect of word types on reading ability ($F(2, 160) = 44.52$, $MSe = 1.03$, $p < 0.001$). The results of the Post-Hoc show that there is no significant difference between MSAW and KShW reading ability. However, these two word type lists differ highly significantly from KLDW at $p < 0.001$, (Table 19). These results are consistent with the cross-sectional study results. They indicate that children found it harder to read the KLDW than the other word types.

Phonological awareness task: Because of the small number of children who were able to delete the initial phonemes throughout the three words lists, it was not possible to analyse it statistically as there is no meaningful variability to analyse these results further (Table 21). Therefore we combined the IPD and IUD results to give a combined phonological awareness score, which represented children who were able to delete an initial sound, although not necessarily at the level of the phoneme.

¹¹ The same analysis was conducted for after excluding children who failed to complete the task and the same results obtained.

¹²A one-way ANOVA was conducted to compare the effect of the word types (MSAW, KLDW and KShW) on participants' phonological awareness. There was a statistically significant effect of word types on phonological awareness ($F(2, 160) = 5.41$, $MSe = .86$, $p < 0.001$). The pairwise comparison showed that there was no difference between MSAW and KShW. However, there was a significant difference between KLDW and both MSAW ($p < 0.01$) and KShW ($p = 0.05$), (Table 21). This showed that children found it easier to manipulate verbal units in both MSAW and KShW than KLDW.

4.3.2.2.2 Correlation

A Pearson correlation was computed to assess the relationship between reading ability and the predictor variables phonological awareness, phonological short term memory, visual short term memory amongst the first year primary school Kuwaiti children. The correlational analysis, as well as the following regression analysis, was run using the total score of the ¹³reading ability task, as well as the ¹⁴phonological awareness task.

Table 24 shows the correlation matrix, which indicated that there is a positive and significant correlation between reading ability and phonological awareness at $p < 0.001$ level. The correlations between reading ability and phonological short term memory and reading ability and visual short term memory was not significant. Also, the visual short term memory revealed negative correlation with reading ability.

The scoring process explains this correlation because low scores in the reading ability, phonological awareness and phonological short term memory tasks indicate low performance, while higher scores in visual short term memory task mean larger error because this task measured error. That is to say, reading ability correlated with all the variables.

¹² The same analysis conducted after excluded children who failed to complete the task and the same results obtained.

¹³ The total scores of reading ability across all words lists.

¹⁴ The total scores of phonological awareness across all words lists.

Table 24: Time Two, Pearson's correlations between the variable measures among (number of participants in brackets)

Tasks	1	2	3	4	5
1. Reading ability	—				
2. Phonological awareness	.55*** (81)	—			
3. Phonological short term memory	.15 (77)	.26* (77)	—		
4. Visual short term memory	-.1 (74)	-.2 (74)	-.17 (70)	—	
5. Verbal IQ	.31** (80)	.38** (80)	.15 (77)	-.2 (73)	—

Statistical significance: * $p < .05$; ** $p < .01$; *** $p < .001$

4.3.2.2.3 Regression

Hierarchical multiple linear regression analysis was used to investigate which of the measures, phonological awareness, phonological short term memory and visual short term memory, can predict reading ability in children amongst first grade primary school Kuwaiti children. In the first step, the Verbal IQ test and age were entered into the regression model as a control variable. Phonological awareness, phonological short term memory, and visual short term memory tasks were entered as the main predictor variables in the second step.

Variables entered in model 1 (Verbal IQ and age) contributed significantly to the regression model $F(2, 67) = 3.51, p < 0.05$, and explained 9.5% of variance in reading ability. The model at step 2 was also significant, $F(5, 64) = 5.81, p < 0.001$, explaining 31.2% of the variance. Therefore ΔR was 21.7%. However, when looking at the separate variables, only phonological awareness was a unique and significant predictor of reading ability. The β coefficient associated with phonological awareness (0.51) is positive, indicating a direct relationship in which higher numeric values for phonological awareness are associated with higher numeric values for reading ability (Table 25). These results are in line with the cross-sectional study results where phonological awareness was the only predicted variable of reading ability.

Because the phonological awareness was found to be such a strong predictor in the cross sectional study, and the phonological short term memory showed some contribution to the model if phonological awareness was not included, the same multiple regression steps were conducted excluding the phonological awareness as one of the predictor variables. At stage one, Verbal IQ and age contributed significantly to the regression model, $F(2, 67) = 3.51, p < 0.05$) and accounted for 9.5% of the variation in reading ability. The model at stage two was not significant, $F(4, 65) = 1.94, p > 0.01$), and explained 10.7% of variation in reading ability. Therefore ΔR was 1.2%. However, the reading ability was not predicted by any of the other variables such as phonological short term memory as in the cross-sectional study (Table 26).

Table 25: Time Two, Hierarchical multiple linear regression analysis including all the variables

Tasks	R	R2	R2 change	B	SE	β
Step 1	.31	.1				
Verbal IQ				.21	.1	.31*
Age				.06	.22	.03
Step 2	.56	.31	.217***			
Verbal IQ				.08	.08	.12
Age				.1	.2	.05
Phonological awareness				.37	.09	.51***
Phonological short term memory				.12	1.05	.01
Visual short term memory				.14	.35	.04

Statistical significance: * $p < .05$; ** $p < .01$; *** $p < .001$

Table 26: Time Two, Hierarchical multiple linear regression analysis when excluding phonological awareness

Tasks	<i>R</i>	<i>R</i> ²	<i>R</i> ² change	<i>B</i>	<i>SE</i>	<i>β</i>
Step 1	.31	.1				
Verbal IQ				.21	.08	.31*
Age				.059	.26	.03
Step 2	.33	.11	.01			
Verbal IQ				.19	.08	.29
Age				.07	.23	.04
Phonological short term memory				1.03	1.16	.11
Visual short term memory				-.03	.4	-.01

Statistical significance: * $p < .05$; ** $p < .01$; *** $p < .001$

4.3.2.3 Summary of Time Two data

To sum up, for the reading ability task, almost a third of the participants were able to do some of the task, one participant read all words in the task and two were able read all the MSAW list only. A one-way ANOVA showed that there was a statistically significant difference across word type lists showing that children found it easier to read MSAW and KShW than KLDW, which is consistent with the cross-sectional study results.

The results obtained from children's performances in the phonological awareness task, showed that none of the children could complete the entire task or all the words in a specific list. In addition, according to the total scores of children's performances in both deletion types, children found it easier to manipulate the larger unit rather than the phonemes within all words in the three lists. In addition, the analysis of the phonological awareness task across word type lists showed that children found it easier to manipulate verbal units in both MSAW and KShW than KLDW.

It was found that there was a significant positive relationship between reading ability and phonological awareness. On the other hand, phonological short term memory and visual short term memory were not found to be significantly correlated with reading ability. The regression analysis showed that only phonological awareness apart from all the other factors is a strong predictor of children reading ability.

4.3.3 Time Three

4.3.3.1 Descriptive data

Reading ability task: Descriptive results for the 78 participants' performances in reading ability measures during Time Three are reported in terms of the means and standard deviations in Tables 27. The data for total reading ability task scores were assessed to check for normality following previous methods. The assessment revealed that the data were between +/-2 and considered to be normally distributed.

A total of 14 children could not do the reading ability (17.95%) as they scored zero across all the words, while 64 children were able to do some of the task. Of the 64 children, eight of them were able to read all the words across the three lists while the remaining 56 were able to read some words across the three lists (Table 28).

Table 27: Time Three, Mean and Std. Deviation for 78 participants' scores in reading ability task

Task	Word types	M (8)	SD
Reading ability	MSAW	4.82	3.01
	KLDW	3.23	2.87
	KShW	4.68	3.02
Total reading ability / 24		12.73	8.9

Table 28: Time Three, responses of the 64 participants who were able to read across words types

Words types	N	Responses	Responses %
MSAW	64	376	20.1%
KLDW	59	252	13.46%
KShW	64	365	19.5%
Responses of 78 participants / 1872		993	53.1%

Phonological awareness task: The means and standard deviations for children's scores in the phonological awareness task are shown in Table 29. The data normality for the phonological awareness combined scores was examined. The examination revealed that the measured data could be considered to be normally distributed to an acceptable level which is between +2 and -2. However, as in Time Two phonological awareness

measured data, the skewness and kurtosis values for the IPD task were not normally distributed to the acceptable level.

Twenty-four children could not do the phonological awareness task (30.77%). Of the remainder, 54 were able to do some of the task (69.23%); they either deleted the initial phoneme for some words (Table 30) or the initial larger unit (Table 31). There were two children who were able to do all the words in the KLDW list while three children were able to do all the words in the KShW list at the IPD level. Regarding the IUD task, 8 children were able to do the entire MSAW list, 11 children were able to do all the KLDW and 14 were able to do the entire KShW list.

Table 29: Time Three, Mean and Std. Deviation for 78 participants' scores in the phonological awareness task across word types

Deletion type	Word types	M (8)	SD
IPD	MSAW	.6	1.42
	KLDW	.65	1.64
	KShW	.56	1.73
IUD	MSAW	3.79	3.3
	KLDW	3.55	3.26
	KShW	3.87	3.41
Combined phonological awareness	MSAW	4.4	3.4
	KLDW	4.21	3.42
	KShW	4.44	3.49
Total phonological awareness / 48		13.04	10.1

Table 30: Time Three, responses of the 34 participants who were able to delete IPD across word types

Word types	N	IPD responses	Percentage
MSAW	25	47	2.51%
KLDW	20	51	2.72%
KShW	16	44	2.35%
Responses of 78 participants / 1872		142	12.38%

Table 31: Time Three, responses of the 48 participants who were able to delete IUD across word types

Word types	N	IUD responses	Percentage
MSAW	47	296	15.81%
KLDW	47	277	14.8%
KShW	47	302	16.13%
Responses of 78 participants / 1872		875	46.74%

Phonological short term memory tasks: The phonological short term memory mean span score of 78 participants was 3.96 out of the longest span 7 digit (SD = 0.69). The phonological short term memory data were normally distributed.

Visual short term memory task: The mean of 78 participants' performances scores, which is based on error score, was 7.11. The visual short term memory data were found to be normally distributed.

4.3.3.2 Data analysis

4.3.3.2.1 ANOVA

Reading ability task:¹⁵To compare the effect of the word types (MSAW, KLDW and KShW) on reading ability, a one-way ANOVA was conducted. There was a statistically significant effect of word type on reading ability ($F(2, 154) = 47.01$, $MSe = 1.3$, $p < 0.001$). The results of the Post-Hoc showed that there was no significant difference between MSAW and KShW reading ability, but both differ highly significantly from KLDW at $p < 0.001$). The results are consistent with the cross-sectional study results as well as Time Two results in this longitudinal study. The analysis showed that children found it easier to read both MSAW and KShW than KLDW (Table 27).

Phonological awareness task:¹⁶A one-way ANOVA was conducted to compare the effect of the word types (MSAW, KLDW and KShW) on phonological awareness. There was not a statistically significant effect of word types on phonological awareness ($F(2, 154) = 1.7$, $MSe = 0.7$, $p > 0.05$). Taken together, these results suggest that children

¹⁵ The same analysis was conducted after excluding children who failed to complete the task and the same results obtained.

¹⁶ The same analysis was conducted after excluding children who failed to complete the task and the same results were obtained.

performed the same across all the three-word lists (Table 29). These results are different from Time Two.

4.3.3.2.2 Correlation

The relationship between the predictor variables phonological awareness, phonological short term memory, visual short term memory, Verbal IQ and the predicted reading ability measures amongst the second year primary school Kuwaiti children, was investigated by the Pearson correlation. The correlation analysis (as well as the following regression analysis) was conducted following the same techniques which were applied in Time Two.

The correlation matrix in Table 32 indicates a positive and significant correlation between reading ability and phonological awareness and reading ability and phonological short term memory approaching an alpha level of 0.001 and 0.01, respectively. Surprisingly, there is a correlation between reading ability and visual short term memory and it is negative because of the scoring process (see page 59). The relationship between reading ability and visual short term memory was not significant (Table 32).

Table 32: Time Three, Pearson's correlations between the variables measures of 78 participants

Tasks	1	2	3	4	5
1. Reading ability	—				
2. Phonological awareness	.61***	—			
3. Phonological short term memory	.3**	.23*	—		
4. Visual short term memory	-.11	-.21	-.17*	—	
5. Verbal IQ	.32**	.41***	-.05	.05	—

Statistical significance: * $p < .05$; ** $p < .01$; *** $p < .001$

4.3.3.2.3 Regression

Hierarchical multiple regression was performed to investigate the ability of phonological awareness, phonological short term memory and visual short term memory to predict reading ability, after controlling for Verbal IQ and age (Table 33). In the first step of hierarchical multiple regression, two control variables were entered which were Verbal IQ

and age. This model was statistically significant $F(2, 75) = 4.27, p < 0.05$ and explained 32% of variance in reading ability. After entry of the predictor variables at step 2, the model was still significant, $F(5, 72) = 9.8, p < 0.001$, and now explained 63.6% of the variance. Therefore ΔR was 30.3%. The table below shows that the only significant predictor out of three predictor variables of reading ability was phonological awareness. The β coefficient associated with phonological awareness (0.52) is positive, indicating a direct relationship in which higher numeric values for phonological awareness are associated with higher numeric values for reading ability. The results are consistent with the cross-sectional study results as well as Time Two results.

The same regression steps were also conducted excluding phonological awareness as one of the predictor variables, and Verbal IQ and age were entered in the first step as control variables. This model was statistically significant $F(2, 75) = 4.27, p < 0.05$ and explained 32% of variance in reading ability. After entry of the predictor variables at step 2, the model was also significant, $F(4, 73) = 4.71, p < 0.01$ and explained 45.3% of the variance. Therefore ΔR was 10.3%. The results indicated a significant prediction of reading ability for phonological short term memory (Table 34). This was also found in the cross-sectional study but not in Time Two.

Table 33: Time Three, Hierarchical multiple linear regression analysis including all the variables

Tasks	R	R2	R2 change	B	SE	β
Step 1	.32	.10				
Verbal IQ				.28	.1	.32**
Age				-.1	.26	-.04
Step 2	.64	.41	.30***			
Verbal IQ				.1	.1	.11
Age				.01	.22	.01
Phonological awareness				.44	.1	.52***
Phonological short term memory				2.29	1.17	.19
Visual short term memory				.12	.38	.03

Statistical significance: * $p < .05$; ** $p < .01$; *** $p < .001$

Table 34: Time Three, Hierarchical multiple linear regression analysis when excluding phonological awareness

Tasks	R	R2	R2 change	B	SE	β
Step 1	.32	.1				
Verbal IQ				.28	.1	.32**
Age				-.09	.26	-.036
Step 2	.45	.21	.1*			
Verbal IQ				.29	.1	.34**
Age				-.09	.25	-.04
Phonological short term memory				3.65	1.3	.3**
Visual short term memory				.12	.38	.03

Statistical significance: * $p < .05$; ** $p < .01$; *** $p < .001$

4.3.3.3 Summary of the Time Three Data

In summary, during the Time Three reading ability task, almost a quarter of the total number of children were not able to do the task, while the majority did some and a few completed the entire task. Children's reading ability performance scores in both MSAW and KShW were almost the same, but they found it difficult to read KLDW compared to the other two word types. The phonological awareness task results indicate that more children were able to delete the larger unit rather than the phoneme, across all word lists. Children who were able to complete the task or some of the task performed almost the same across all word type lists. There was no difference between children's performance across the three word type lists.

The correlation analysis showed that there are relationships between reading ability and all the cognitive variables. However, according to the regression analysis, only phonological awareness out of the three predictor variables was a statistically significant predictor of reading ability. However, when the same regression steps were conducted excluding the phonological awareness as one of the predictor variables, phonological short term memory significantly predicted reading ability.

4.3.4 Developmental comparison across age group

In order to assess children's developmental ability in all the measures across time, repeated mixed measures were run individually for each measure. Results from ANOVA across all

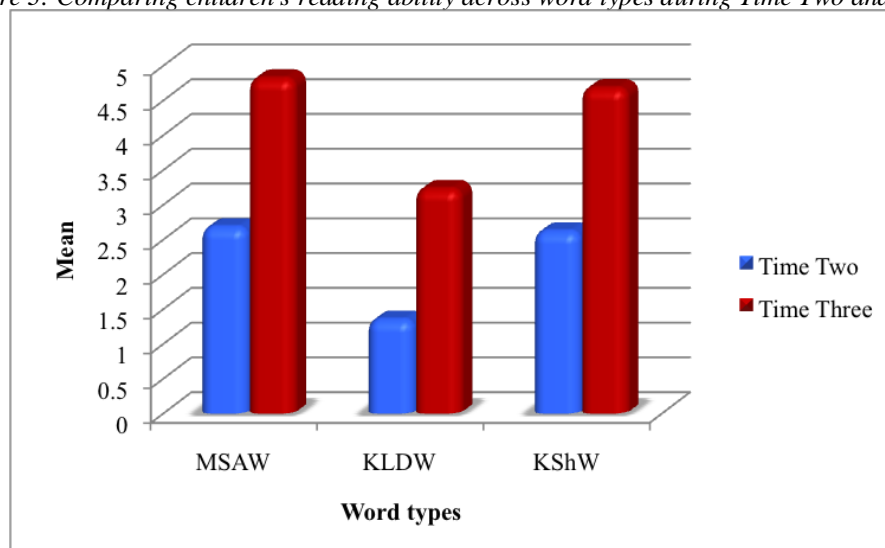
the measures showed significant developments in all measures across time.

4.3.4.1 Reading Ability

To investigate the effect of time on children's reading ability across word type lists, a 2 x 3 repeated mix measures ANOVA was run on the scores across two times only (Time One and Time two) and across the three reading ability word lists (MSAW, KShW and KLDW) on 78 children. Time One was not included in this analysis as all children were preliterate. The main effect of time on reading ability was significant ($F(1, 77) = 135.15$, $MSe = 3.36$, $p < 0.001$). Post Hoc analysis indicated that children performed differently across the two time points and showed that children performed the best during Time Three indicating significant developments in the measures across time (Time two $M = 2.27$ and Time Three $M = 4.24$).

Also, there was a main effect of word type ($F(2, 154) = 74.81$, $MSe = 1.4$, $p < 0.001$) and Post Hoc analysis showed that children performed differently across word type lists and found it easier to read both MSAW and KShW than KLDW throughout the study (MSAW $M = 3.79$, KLDW $M = 2.31$ and KShW $M = 3.67$), (Figure 3). There is not an interaction between times and word type in the reading ability task ($F(2, 154) = 0.61$, $MSe = 0.94$, $p > 0.05$).

Figure 3: Comparing children's reading ability across word types during Time Two and Three

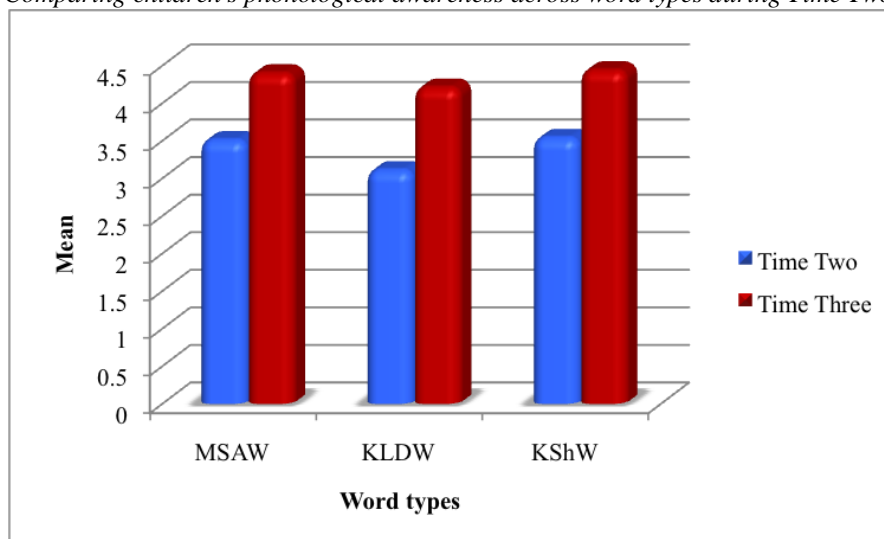


4.3.4.2 Phonological Awareness

It was also interesting to explore the effect of time on children's phonological awareness across word type lists. The development comparison of children's phonological awareness was conducted only between Time Two and Three but not Time One. This is because of the floor effect during Time One. Therefore, a 2 Times (Time Two and Time Three) x 3 phonological awareness across word type lists (MSAW, KShW and KLDW) repeated mixed measures ANOVA was conducted. There was a significant effect of time on children's phonological awareness ($F(1, 77) = 13.73$, $MSe = 6.35$, $p < 0.001$). Post Hoc analysis indicated that children performed differently across the two time points and showed that children performed the best during Time Three (Time Two $M = 3.48$ and Time Three $M = 4.35$).

There was a main effect of word type on phonological awareness across time ($F(2, 154) = 0.94$, $p < 0.01$). Children performed better on both MSAW and KShW than KLDW (MSAW $M = 4.01$, KLDW $M = 3.7$ and KShW $M = 4.04$). Although there was a different pattern in Time Two and Time Three, that difference was not enough to cause an interaction between times and word type ($F(2, 154) = 1.01$, $MSe = 0.65$, $p > 0.05$). This is because at Time Two, there was a main effect of word type on children's phonological awareness; the KLDW is worse than MSAW and KShW. At Time Three, children phonological awareness developed across all three-word types and there was still a small difference between word types but it was not significant, (Figure 4).

Figure 4: Comparing children's phonological awareness across word types during Time Two and Three



4.3.4.3 Phonological Short Term Memory

A one-way ANOVA was conducted to investigate the main effect of time on children's phonological short term memory ability. The main effect of time was significant ($F(2, 148) = 17.85, p < 0.001$). The results of the Post-Hoc analysis show that Time One differs highly significantly from Time Two and Time Three at $p < 0.001$ but not Time Two and Time Three. This indicates that children performed almost the same during Time Two and Three (Time One $M = 3.51$, Time two $M = 3.84$ and Time Three $M = 3.95$).

4.3.4.4 Visual Short Term Memory

A one-way ANOVA was conducted to investigate the main effect of time on children's visual short term memory ability. The main effect of time was significant ($F(2, 140) = 220.29, p < 0.001$). The results of the Post-Hoc analysis show that Time One differs highly significantly from Time Two and Time Three at $p < 0.01$ but not Time Two and Time Three. This indicates that children performed almost the same during Time Two and Three (Time One $M = 13.98$, Time two $M = 7.78$ and Time Three $M = 7.22$).

4.4 Discussion

This longitudinal study was conducted across three time points; the first two months of participants' primary school year, the last two months of their first primary school year and the first two months of their second primary school year. Five measures were used and introduced to all participants over the three occasions. This study was conducted in Kuwait to assess the level of Kuwaiti Arabic speaking children's reading ability and phonological awareness, over the three occasions, and across the three types of words to which they have been exposed: MSAW, KLDW and KShW. Also, the relationship between their reading ability and their phonological awareness, phonological short term memory and visual short term memory during these time points was investigated. Additionally, the predictive role of phonological awareness, phonological short term memory and visual short term memory in children's reading ability during this longitudinal study was investigated, while controlling for age and Verbal IQ.

4.4.1 Children's reading ability across word types during three time points

The present longitudinal study was the first study considering three word types in a reading ability measure. It was conducted to investigate children's reading ability across the three word type lists, MSAW, KLDW and KShW, over three time points. The total of children's reading ability scores across these word lists was correlated with all the other reading related measures, phonological awareness, phonological short term memory and visual short term memory. Because all participants were preliterate during Time One, reading ability was analysed according to the scores obtained during Time Two and Time Three only. The present study results were robust and consistent with the cross sectional study results. This is because the results of reading ability across word types over Time Two and Three were the same, showing that children found it easier to read MSAW and KShW than KLDW even though only MSA consonants were involved in all the word type lists. This can be related to three reasons, the orthographical familiarity of words, availability of grapheme-phonemes and the accessibility of matching between these graphemes and phonemes.

As discussed in Chapter Three (see page 67-68), children found it more difficult to read KLDW compared to KShW. This is because these words are perceived as pseudohomophones, which are phonetically familiar to speak but not orthographically to read (Goswami et al. 2001 and Torgesen et al. 1999). Children rarely see KLDW in a written form during their early reading stage compared to the other forms KShW and MSAW. Therefore, KLDW are more difficult to read than the other forms. Moreover, according to the Grain size theory (Ziegler and Goswami 2005), the availability of graphemes and phonemes in children's spoken language eases children's ability to map between graphemes and phonemes. Therefore, children were able to read the KShW where both graphemes and phonemes are available more easily than when some of the phonemes or graphemes are not accessible in their spoken language, KLDW. Also, although MSA is the literary language to which children had already been exposed six months prior to Time two and a year and so prior to Time Three, children found it easier to read MSAW compared to KLDW. This is because of the frequent, consistent and applicable matching between orthographical strings of MSAW and their phonemes (Terry 2012), (see cross-sectional study discussion).

4.4.2 Children's phonological awareness across word types during three time points

The phonological awareness task used in the previous cross-sectional study was also used in this particular longitudinal study. In the instruction children were asked to perform initial phoneme deletion; however, children were not able to manipulate the small phonological units and they showed sensitivity to large phonological units across all of the three word types, MSAW, KLDW and KShW by typically deleting a larger than a single phoneme unit. The results were consistent with the cross-sectional study results as well as studies relating to Arabic orthography (Saiegh-Haddad 2007) concerning children's phonological sensitivity to the large phonological units rather than small ones across all of the three word types. This is because, as discussed in the cross-sectional study and explained by the grain size theory, during the early reading stage, children show sensitivity to larger grain units before the smaller ones (Bradley 1983 and Bradley 1980; Goswami 1986; Wimmer and Goswami 1994; Ziegler and Goswami 2005). During Time Two and Three, the children had acquired MSA for almost a year before this study was conducted, which represents an early reading ability level (see the cross-sectional discussion).

In addition, as discussed in the cross-sectional study, the nature of Arabic orthography, in which the pronounceable units mostly represent syllabic combinations of consonant–vowel structures rather than a single phonemic segment, can be responsible for the children's phonological sensitivity level (Almusawi 2014; Saiegh-Haddad 2003; 2005; 2007), (see the cross-sectional discussion). Moreover, the teaching approach, which emphasises the awareness of syllables rather than phonemes in the Kuwaiti mainstream schools, can also play an important part in children's phonological development (Ziegler and Goswami 2005), (see the cross-sectional discussion).

One of the interesting findings of the present study was that children's phonological awareness across word types was different at different grade levels. During Time One, children's phonological awareness data displayed the floor effect and therefore were not statistically analysed (although the means can be seen in table 16). During Time two, children's phonological awareness performances differed across word types. Their phonological awareness scores in MSAW and KShW were better than their scores in KLDW. The results of Time two were not in line with the cross-sectional results that

indicated that there was no variation between children's phonological awareness across word types although all measures applied during both studies were the same. A possible reason is related to the difference between the numbers of participants in each study. In the cross-sectional study there were 49 participants while during Time Two in the longitudinal study there were 81 participants. The greater the number of participants in each study, the greater the statistical power will be (Werner and DeSimone 2012).

The results at Time Two were in line with Ibrahim (2010) who found that children manipulated phonemes in MSA better than in Palestinian LD. Ibrahim (2010) argued that this is because of the close association between children's verbal and visual abilities. To be more precise, children performed better in MSAW and KShW because these are written words with systematic orthographical structures, which are stored in children's orthographical lexicon (Ibrahim 2010). Thus, the familiarity of the orthographic structure of these words can play an important role in children's ability to analyse words phonetically (Ziegler and Goswami 2005). Therefore, according to current findings, although KLD represents children's everyday language, they use it only for oral communications. On the other hand, children use KShW, which exist in both KLD and MSA in everyday communications, written or spoken, and this can make them familiar and easy phonetically and orthographically. Besides, MSA is taught at school involving various literacy skills: reading, writing and listening. According to the literature, reading acquisition can also play a role in children's phonological awareness (Wagner and Torgesen 1987). Consequently they can perform better in MSAW and KShW than KLDW (Brunswick et al. 2012).

On the other hand, during Time Three, there was no difference in children's phonological awareness performances across different word types. During Time Three, participants' phonological awareness across word types was the same. A possible reason for this might be related to children being more experienced within the language domain in general: that is, their natural chronological development in oral communication and their simultaneous improvement in literacy acquisition. Therefore children at Time Three are better able to engage with the phonological task and to perform the appropriate segmentation of words. Indeed, children's overall performance on the phonological task did improve between Time Two and Time Three. Therefore, as children become more proficient in general at phonological awareness tasks, the

possible difficulties associated with the KLDW are overcome. Consequently, all the varieties of Arabic forms developed to a comparable level during this stage and generated the same level of reading difficulty.

4.4.3 The relationship between children's reading ability and their phonological awareness, phonological short term memory and visual short term memory across time

One of the most robust findings in other reading studies, as well as in the present study across Time Two and Time Three, is the significant correlation between children's reading ability and phonological awareness. The regression analysis of the current study data showed that phonological awareness was one of the best predictors of subsequent development of children's reading ability, independent of the variables of age and Verbal IQ. The findings are consistent with the previous predictive studies in English orthography (Adams 1990; Ellis 1990; Goswami and Bryant 1991; Mann and Liberman 1984; Rego and Bryant 1993; Rohl and Pratt 1995; Targeson et al. 1994; Perfetti et al. 1987; Whitehurst and Lonigan 1998) and the predictive studies of Arabic orthography (Al-Mannai and Everatt 2005). This is because the understanding of words' sound structure and the ability to manipulate them are vital in children's ability to acquire reading skills (see the cross-sectional study discussion).

Besides, the present study data showed that the other reading related skills measured in this study, phonological short term memory and visual short term memory, significantly correlated with children's reading ability for all age groups across Time Two and Time Three. The present longitudinal study results regarding the relationship between children's phonological short term memory and reading ability were consistent with the cross sectional study results as well as other studies conducted in English (Brunswick et al. 2012; Gathercole and Baddeley 1993; Mann and Liberman 1984; Rohl and Pratt 1995) and Arabic orthography (Zayed 2013; Siegh-Haddad 2005; Ibrahim 2010; Abu-Rabia 1995; Abu-Rabia and Sieghel 2002; Abu-Rabia et al. 2003; Elbeheri and Everatt 2007; Elbeheri et al. 2011). This is because phonological short term memory function is about placing information about words into children's memories and retrieving it when it is needed. Moreover, phonological short term memory helps children to learn the phonological structure of new words and read unfamiliar words, such as in the diglossic context, where children learn different forms of the same language including new

phonemes and vocabularies in literary Arabic that are not accessible in their spoken form. Therefore, phonological short term memory plays a key role in learning to read (see the cross-sectional study discussion).

It is worth mentioning that in the cross-sectional study, when phonological awareness was excluded from the regression analysis, phonological short term memory became a significant predictor of reading ability after controlling for age and Verbal IQ (Mann and Liberman 1984). This step was also conducted in this longitudinal study during Time Two and Time Three. Whilst the regression analyses for the Time Three data showed that phonological short term memory predicted reading ability after excluding phonological awareness, this was not the case for Time Two. Therefore, the research presented here suggests that phonological short term memory may be linked to reading ability. However, caution must be applied to this conclusion as the data at Time Two did not show this pattern, and the data for the cross-sectional study and at Time Three only showed phonological short term memory ability predicting reading ability when phonological awareness was removed from the regression.

In addition, the present findings did show a significant correlation between children's visual short term memory and reading ability because children may recognise words according to their shapes besides their awareness of a word's phonological structure. These results are in line with studies of English orthographies (Baker 1976; Brunswick et al. 2012; Carroll 1972; Ellis 1990; Ellis and Large 1988; Kulp et al. 2002; LeFever 1982; Schatscheider et al. 2004; Solan et al. 1985; Vellutino et al. 2007; Wesson 1993) and Arabic orthographies (Elbeheri and Everatt 2007; Elbeheri et al. 2011; Taha 2008; Taha 2013), (see the cross-sectional study discussion). However, visual short term memory did not contribute any unique variance to the regression model, even when phonological awareness was removed.

This may be explained by the nature of the measure used to study children's visual short term memory. In this measure discrete connected shapes were used, which might not reflect the shapes of Arabic orthography. Arabic orthography has complexity stemming from the similarity in the shape of letters, number of dots and diacritic marks, short vowels, above or below letters, the connection between the letters, together with the changing shape of letters depending on their location within the word. Therefore, the

present study measure did not reflect the complexity of Arabic orthography, which is more than basic isolated square shapes.

The lack of predictive power of the visual short term memory with regard to reading ability is consistent with English studies in English orthography (Schatschneider et al. 2004), but not with the Arabic studies. In studies conducted by Elbeheri et al. (2011) and Taha (2008), who were not considering Arabic diglossia, the visual short term memory measures showed a predictive validity in reading comprehension and reading single vowelized words. The interpretation of this result may be related to the type of assessment applied (see above). It may also be related to the age of the participants. For example, those Arabic predictive studies of visual short term memory were conducted on older children (grades 4-6 in Elbeheri et al. (2011) and grade 6 in Taha (2008), who can read non-vowelised Arabic, which is a high level of reading ability that requires intensive literacy skills. Therefore, they can depend on their visual memory more than their phonological awareness to read. However, the current study investigated this predictive relationship during an earlier reading level on younger children who depend mostly on their phonological awareness to read rather than their visual memory. This is because during the early reading stage, children have learnt to read vowelised words, which include vowels above or below the words. The vowels in Arabic produce a complicated visual input, but at the same time they facilitate reading accuracy in Arabic. Therefore, phonological awareness was the only predictor of reading ability in this study, not the visual short term memory.

4.4.4 Developmental comparison across age group

Results of the reading ability task showed that children's reading ability and their phonological awareness developed rapidly during the first years of their acquisition and they performed significantly better during Time Three. Since reading ability and phonological awareness were found to be correlated in the present study during Time Two and Time Three, they are developing at the same time. Children in Kuwait receive regular classroom literacy activities during school time on a daily basis. Habib-Allah (1985) discusses how curriculum techniques for children's literacy skills acquisition, for example, appropriate textbooks as well as effective teaching approaches, positively enhance children's reading abilities and produce significant gains in vocabulary, and recognition of words and their sound structure in the early years of school (in Abu-

Rabia 2000). Moreover, children's literacy activities at home with their parents and siblings, such as story reading, also have a positive impact on children's listening comprehension abilities as well as their spoken linguistic skills, which consequently increase their vocabularies at twice the normal rate (Abu-Rabia 2000; Elley 1991; Elley and Mangubhai 1983; Feitelson et al. 1993; Iraqi 1990)

Children's phonological short term memory and visual short term memory performance also improved over time. There was a significant difference for both phonological and visual short term memory scores between Time One and Time Two. These findings are in line with Alloway et al. (2006), which indicated that children's phonological and visual short term memory capacity increases linearly across age starting from the age of four years old to early adolescence. There was also a difference between Time Two and Time Three. However, this difference did not appear to be significant. A possible explanation of why there was not a significant difference between Time Two and Time Three could be related to the nature of Arabic orthography and phonology that was discussed earlier and the explicit teaching and practice of the phonological awareness in learning to read during this critical period. The best way to develop a skill is to practice. Children may unconsciously "prune" their cognitive abilities and focus only on what could be most relevant and efficient to their needs (Cherry 2010), which are in this case phonological awareness and reading development. Phonological awareness, according to the present findings, is the most appropriate strategy for children's reading development and the only predictor of reading ability. Therefore, children make the most use of this ability, which consequently reinforces, improves and maintains their phonological awareness apart from their other cognitive abilities, phonological and visual short term memory (Cherry 2010).

4.4.5 The significance of the study

Most of our present findings across the three time points were in line with the results of our previous cross-sectional study, which allows us to conclude the following:

- For the first time in a longitudinal study the level of Kuwaiti Arabic speaking children's reading ability and phonological awareness were explicitly assessed, over the three time points and across three types of words. Children found it easier to read MSAW and KShW than KLDW even though only MSA consonants were involved in all the word type lists.

- Although the instructions in the phonological awareness task described a single phoneme deletion, children consistently showed sensitivity to large phonological units across all of the three word types, MSAW, KLDW and KShW.
- Even though our analysis indicated relationships between children's reading ability and their phonological awareness, phonological short term memory and visual short term memory, the results of our two studies, longitudinal across Time Two and three and the cross-sectional, showed that phonological awareness was the one and only predictor of reading ability independent of the variables of age and Verbal IQ in reading Arabic.
- Although the visual short-term memory measure was further developed for the longitudinal study and involved some changes from the cross-sectional study, results still did not indicate a predictor role of visual short term memory on children's reading ability.
- On the other hand, interestingly, some results were obtained from the longitudinal study that differ from the cross-sectional study results. Although children's age during Time Two was the same as children's age during the cross-sectional study, the sample size was different and may play a part in the fact that the results in the current study were different from the cross-sectional study. Children's phonological awareness scores in MSAW and KShW were better than their scores in KLDW during Time Two. On the other hand, although the children's age during Time Three was different from that of the children in the cross-sectional study, children's phonological awareness across word types during Time Three was the same and in line with the cross-sectional results.
- Moreover, some new important findings were reached by the longitudinal investigation. First: the present findings showed an improvement pattern of all the cognitive abilities over time. Second: there was a relative stability of phonological and visual short-term memory abilities between time Two and Three.

Chapter Five

General discussion

The research reported in this thesis highlights the importance of reading-related cognitive skills in Arabic diglossia. This was achieved through various statistical analyses of a cross sectional study as well as an exploration of longitudinal study data which was conducted over three time points and lasted for almost 14 months. These studies are the first to take into account all of the three variations of Arabic that arise in Kuwaiti children's diglossic context: MSAW, KLDW and KShW. The research revealed that a number of factors affect the acquisition of reading vowelized Arabic and these factors are crucial for successful reading development within Arabic children in general, and Kuwaiti children in particular. The findings reported in this thesis suggest that children call on different cognitive skills to read, such as phonological awareness, phonological short term memory and visual short term memory, but children depend mostly on their phonological awareness to achieve a successful reading process during their early reading stage. The research data will be discussed in this chapter in four main sections. First, reading ability and phonological awareness. Second, reading ability and phonological short term memory. Third, reading ability and visual short term memory. Fourth, developmental changes in linguistic and cognitive skills. Finally, the limitations of this research will be presented followed by possible recommendations for future studies.

5.1 Reading ability and phonological awareness

This is the first research into Arabic diglossia that has assessed children's reading ability by having children read aloud single fully vowelized three types of words, MSAW, KLDW and KShW. These three categories represent the children's linguistic characteristics and the different challenge levels in terms of reading ability. The same types of words were applied in both the reading and the phonological measure (this measure assessed children's ability to manipulate the phonological structures of words by asking them to delete the initial sound from words). Across both studies it was found that the ability to read MSA and KShW was easier than KLDW. Moreover, it was

shown by Time Two data that children were able to manipulate the phonological structure of MSA KShW more easily than KLDW. Another interesting finding emerged from the phonological awareness measure in both studies. Data showed that children were deleting large phonological units (syllables or consonant-vowels components), rather than small ones (single phonemes), across all of the three word types, even though a small grain size measure (initial phoneme deletion) was applied. The above findings will be explained in this section in terms of four main factors: diglossia, Arabic orthography, grain size theory and familiarity of words.

5.1.1 Diglossia

The frequent mismatch between vocabularies and their orthographic representations in Arabic diglossia can have an impact on children's reading ability (Terry 2012). The data from this study indicated that the children's reading ability in KLDW was poor compared to MSAW and KShW. For example, most of the words in KLD cannot be translated in the orthographic representation. This is because KLD contains nonstandard phonemes that are not available in MSA, such as (g), (v), (p) and (ch) so 'galb' in KLD is pronounced as 'qalb' (heart) in MSA. Consequently, the frequent, consistent and applicable matching between orthographical strings and their phonemes are not always accessible in KLD (Almusawi 2014; Terry 2012). This could make the ability to read KLDW more difficult than the other two forms of Arabic.

The Arabic diglossia setting which is characterised by discrepancies between MSA and LD could also play an important role in the grain size deletion ability in the phonological awareness task. For example, once Arabic children start receiving literacy instruction in primary school, they learn new words and phonemes that do not exist in their spoken Arabic, alongside their growing spoken vocabularies. Therefore the quality of the phonological representation of words will be influenced since it raises the load for a very specific segmental representation (Saiegh-Haddad 2004). Therefore, their phonological decoding for Arabic words could be difficult and might not extend to recognition of a single phoneme.

5.1.2 Arabic orthography

It is also important to consider the nature of Arabic orthography as a factor that influences children's reading ability. To be more precise, as explained previously in this thesis, Arabic is considered as shallow and fully vowelized orthography with diacritic marks, and a highly consistent structure in terms of phoneme-grapheme relationship, especially in the first primary school years (Saiegh-Haddad 2005 and Smythe et al. 2008). This consistency of the orthographic and phonological relationship, which simplifies children's ability to read, is accessible in MSAW as well as KShW but not in KLDW.

For the reason that both MSAW and KShW have consistent structures in terms of the phoneme-grapheme relationship, their phonological representation can be easier to recover compared to KLDW (Ibrahim 2010). This explanation supports the longitudinal study data regarding the phonological awareness ability across word types during Time Two. On the other hand, during Time Three, in which data showed improvement of children's phonological awareness in general, children's phonological awareness performance across word types was almost the same. A possible reason for this as explained earlier might be related to children being more experienced within the language domain in general, which helped children to perform better across all word types to a comparable level during this stage.

In addition, Arabic orthography might throw light on the interesting results achieved by the phonological awareness measure in both studies. The pronounceable units in Arabic orthography mostly represent syllabic combinations of consonant-vowel structures rather than a single phonemic segment (Almusawi 2014; Saiegh-Haddad 2003). It was found that this relationship is consistent in Arabic orthography (Saiegh-Haddad 2003). Therefore, children tended to complete the phonological awareness task by deleting large phonological units (syllables or consonant-vowels components), rather than small ones (single phonemes), across all of the three word types.

The strong association between consonants and their subsequent vowels could also be reinforced by teaching approaches in the Kuwaiti schools. As Duncan (2010) claimed, children's phonological sensitivity to the larger unit can be related to the teaching methods. For example, as discussed earlier, in Kuwait teachers in classrooms emphasise

the awareness of syllables and consonant-vowel components rather than single consonants or phonemes.

Although the above explanation is mostly based on MSA orthography and its impact on children's phonological sensitivity level, it can also apply for KLD, as both orthographies differ in diverse manners. This is because LD is derived from the standard form and they share many similarities in term of phonology, semantic and syntactic characteristics: this is represented by the KSh form. Also, because KLD derives from the standard form and they are considered as one language, the same effects on children's phonological sensitivity levels can be achieved.

5.1.3 Grain size theory

The other possible factor explaining why children's reading performance on KShW was better than KLDW while both represent their native Arabic, is the availability of both graphemes and phonemes in the children's language, which was explained by the grain size theory (Ziegler and Goswami 2005). Ziegler and Goswami (2005) believed that when both graphemes and phonemes are accessible in children's language, learning to read will be facilitated. The graphemes are available because they are acquired by practice or exposure to books and media while the phonemes were already available in their dialects. This, consequently, eases the mapping between phonemes and graphemes and makes this process accessible using the same form of language, written and spoken. This can also be applied to MSA, as children use this form, both written and spoken, during classroom activities. Therefore, children can read both KShW and MSAW more easily than KLDW.

The availability of symbols and sounds in children's language (MSAW and KShW in this study) can also play an important role in children's ability to analyse words phonetically (Ziegler and Goswami 2005). This assumption supports the results of the present study, which indicated that children could manipulate the phonological structure of both MSAW and KShW more easily than KLDW. This is because they are written words with systematic orthographic and phonological structures that make the phonological structure easier to manipulate phonetically than KLD.

Although Arabic is considered as a highly consistent orthography with consistent grapheme phoneme relationships involving small phonological units, leading to a very precise mapping between graphemes and phonemes (Goswami et al 2005 and Joshi & Aaron 2006), children's performances in the phonemic deletion task showed sensitivity to large phonological units rather than small ones across all of the three word types. Grain size theory suggests that children's age and reading ability level could play an important role in children's phonological sensitivity level. This is because during the early stages of literacy, children develop their awareness of larger grain units before the smaller ones (Ziegler and Goswami 2005). This belief supports the current findings from both studies in which all participants were in the very early stages of reading acquisition, which may have had an impact on their phonological sensitivity level to the sound structure of all types of words.

5.1.4 Familiarity of words

It was found that familiarity of words in print produce better reading accuracy (Hirsh and Funnel 1995). During both studies children's reading ability in KShW was better than the KLDW because they are familiar with their letters and meanings. This is because these words represent children's literary form, which can be seen in schoolbooks, media or newspapers, as well as being included in their dialect form. On the other hand, KLD words are phonologically familiar for children to speak but they are not orthographically familiar to read, in particular at the early reading stage, compared to the KSh words.

The familiarity of the orthographic structure of words, such as both MSAW and KShW in this study, can play an important role in children's ability to analyse words phonetically (Ziegler and Goswami 2005). As discussed earlier, KLD represents children's everyday spoken language (i.e. oral communications only) while KSh exists in both KLD and MSA in everyday communications, both written and spoken. This could make the KSh form more familiar than KLD phonetically and orthographically. Moreover, MSA is taught at school involving various literacy skills: reading, writing and listening. According to the literature, reading acquisition can also play a role in children's phonological awareness (Wagner and Torgesen 1987). Consequently they can perform phonetically better in MSAW and KShW than KLDW (Brunswick et al. 2012).

In addition to the above results related to reading ability and phonological awareness across word types, this study has also shown that children's phonological awareness, represented by the total scores of their ability to delete both phonemes and large units, still predicted reading in Arabic. This is because the awareness of sounds represents the foundation skill for using any alphabetic concept. Since reading ability and phonological awareness were found to be correlated, they are also developing at the same time, as a result of regular classroom literacy activities during school time on a daily basis as well as literacy activities at home (Abu-Rabia 2000; Elley 1991; Elley and Mangubhai 1983; Feitelson et al 1993; Iraqi 1990)

5.2 Reading ability and phonological short term memory

Both studies results showed that reading ability and phonological short term memory were correlated. This correlation can be related to the strong correlation found between phonological awareness and phonological short term memory (Brady 1986; Brunswick et al. 2012; Passenger et al. 2000; Rohl and Pratt 1995). This is because both phonological short term memory and phonological awareness are functions of the general phonological processing perception that is essential for successful reading development (Alloway 2006). In order to read, children should be able to place information about words, such as phonological structure and meaning, into their memories, retain and retrieve them when needed. This process is vital for reading development in the diglossic context where there are different types of words and sounds, helping children to learn the phonological structure of new words that are not available in their LD but are in MSA.

Some researchers have suggested that there is not a direct influence of phonological short term memory on reading (Wagner et al 1997; Alloway 2006). In the present study, although the correlation was significant, the phonological short term memory was not a unique contributor to the regression model. It did however emerge as a significant predictor of reading ability when the phonological awareness was removed from the regression analysis, in both the cross-sectional study and Time Three of the longitudinal study. Alloway (2006) stressed that this can be related to the significant contribution of phonological awareness on children's reading ability in the early reading acquisition period, which is stronger than the effect of phonological short term memory ability on

reading development. On the other hand, the Time Two data indicated different results from Time Three and the cross-sectional study. The regression analyses for Time Two did not show that phonological short term memory predicted reading ability after excluding phonological awareness. One possible explanation for the difference in the results is that cross-sectional study had less statistical power as it included only 49 participants (Cohen, 1988). However, these contradictory findings suggest that caution must be exercised in suggesting that phonological short term memory is linked to reading ability, and that more research is needed to supplement these findings.

5.3 Reading ability and visual short term memory

The present study is the first study investigating children's visual short term memory and its relation to reading ability in a diglossic context by applying an electronic device with a highly sensitive recording technique. The initial results showed that visual short term memory significantly correlates with children's reading ability. This may be because children rely on their visual memory to read a word depending on its shape in addition to using their phonological awareness and phonological short term memory (Brunswick et al. 2012), and it particularly affects the ability to discriminate between letter-like shapes (Taha 2013). The results of the regression analysis, surprisingly, did not support the view that visual short term memory is a predictor of reading ability as had been expected. As explained previously, it was thought that this unexpected finding could be related to the procedure applied, predictive shapes used and length of the task, and developments to the task were applied including procedure, shapes and shortening the length of the task during the longitudinal study. However, although the developmental pattern was observed across time, the same results were obtained.

The complex features of the Arabic vowelized words may lead to the assumption that children's visual short term memory abilities play a significant role in children's reading ability as much as phonological awareness supports reading acquisition in Arabic orthography. However, the data indicated that phonological awareness was the only predictor of reading ability, which means that children rely more on this particular skill to achieve successful reading during this stage. So, while children clearly rely on their visual memory to distinguish words, this only occurs when they have already memorized and practiced them (Ehri 2005; Sadeghi 2013). Therefore, children

recognize words according to the grapheme-phoneme conversion rules rather than the graphemic representations of word as a whole (Wimmer & Goswami, 1994). This is because when such orthography is transparent, children trust and tend to rely on their grapheme-phoneme conversion rules of words rather than the orthographic structure of these words (Wimmer and Goswami, 1994). According to our data, during the early stages of reading development of vowelized Arabic, children rely more on their phonological awareness, which is a more effective learning skill for them to reach a successful reading achievement than their visual short term memory.

5.4 Limitations

In any piece of research there are limitations to what can be investigated. Three limitations affected this research.

The first limitation to be considered is that, although significant and clear results were obtained regarding the relationship between phonological awareness and reading ability, some limitations to the phonological awareness task appeared according to the reviewed results. It was thought that single phoneme deletion would be the best measure of children's phonological awareness for two reasons: first, there are clear results showing that measures of phoneme awareness are excellent simultaneous and longitudinal predictors of early reading skills in English orthography. The second reason related to the consistency of Arabic orthography during early reading stage. However, in the present research, the measure showed that children could not complete the task, even during Time Three where they were aged 7, and tended to delete the larger sound instead of the requested sound, the small sound. Therefore, the phoneme deletion task applied in this study could be a very precise task that may not be an appropriate tool for assessing Arabic children's phonological ability.

The second limitation in the present study is related to the visual short term memory measure, which was conducted for the first time in an Arabic diglossia context using an electronic device with a highly sensitive recording technique. Some developments to the task were applied after the cross-sectional study, including procedure, changing some of the shapes and shortening the length of the task during the longitudinal study. However,

although the developmental pattern was observed across time, the same results were obtained.

The third limitation is the availability of standardised tests. There were no standardised tests measuring children's reading ability and phonological awareness in Kuwait, so new reading and phonological awareness tasks were developed particularly for this research. This was a time-consuming procedure.

5.5 Recommendations

Our findings show that there is a need for future research to re-examine the degree to which phonological short term memory has a predictive role in the development of reading ability, in order to achieve clearer picture of this relationship and generalize the results. Further, future studies should include more control variables than those included in this research (age and Verbal IQ), such as the participants' socioeconomic background. This is because our results suggest that home activities might influence children's skills in some way.

Moreover, it will be important to replicate this study using an improved version of the visual short term memory task, to reflect Arabic orthographical structure. It should also include a syllable deletion task as a measure of children's phonological awareness ability. It could also prove more effective if it included pre-readers, who are starting to acquire vowelized Arabic, and advanced readers, who can read unvowelized Arabic.

Although there is an assumption that there is a strong relationship between graphemes and phonemes in Arabic that influences children's ability to delete single phonemes, teachers also need to enhance children's ability to manipulate phonemes, rather than focusing only on larger grain units such as syllables. This may provide a better awareness of the phonological structure of words, which would consequently improve children's reading ability. More interestingly, a training study could be conducted to support this assumption and to verify the predictor role of phoneme awareness on reading ability. For example, this study might include three groups of participants, one group as a control group, and two experimental groups each of which are introduced to a different type of teaching approach. One type would raise levels of phonemic

awareness by emphasizing the awareness of single consonants or phonemes, while the other type would raise the awareness of syllables and consonant-vowel components. This could provide a wider understanding of diglossia and the nature of Arabic orthography and its relationship to children's phonological awareness and to reading ability.

The research findings are suggestive of the key role played by phonological awareness from a young age in Arabic reading ability. Therefore, the awareness of the sound structure of words should be enhanced in classrooms by applying a range of literacy activities that involve different phonological sensitivity levels. The ability to manipulate different phonological grain size units leads to improve reading ability levels (Zigler and Goswami 2005). The results of the current study also emphasize the relationship between orthographic skills and phonological skills. Therefore, teachers should include various activities that enhance children's linguistic and cognitive activities for better reading achievement. It would be ideal to start with activities leading to the development of phonological awareness, because it was found to be a strong predictor of reading.

References

- Abu-Rabia, S. (1995). Learning to read in Arabic: Reading, syntactic, orthographic and working memory skills in normally achieving and poor Arabic readers. *Reading Psycholog*, 16, 351–394
- Abu-Rabia, S. (1997). Reading in Arabic orthography: The effect of vowels and context on reading accuracy of poor and skilled native Arabic readers. *Reading and Writing: An Interdisciplinary Journal*, 9, 65–78.
- Abu-Rabia, S. (2000). Effects of exposure to literary Arabic on reading comprehension in a diglossic situation. *Reading and Writing: An Interdisciplinary Journal*, 13, 147–157.
- Abu-Rabia, S., & Siegel, L. S. (2002). Reading, syntactic, orthographic, and working memory skills of bilingual Arabic-English speaking Canadian children. *Journal of Psycholinguistic Research*, 31(6), 661-678.
- Abu-Rabia, S., Share, D., & Mansour, M. (2003). Word recognition and basic cognitive processes among reading-disabled and normal readers in Arabic. *Reading and Writing: An Interdisciplinary Journal*, 16, 423–442.
- Abu-Rabia, S., & Taha, H. (2006). Phonological errors predominate in Arabic spelling across grades 1 to 9. *Journal of Psycholinguistic Research*, 35, 167–188.

- Adams, M. (1990). *Beginning to read: thinking and learning about print*. Cambridge, Massachusetts: MIT Press
- Al-diyar, M. A., & Salem, A. A. (2013). Working Memory Tasks in Relation to Phonological Processes of Arab Dyslexics in the State of Kuwait. *International Education Studies*, 6(9), 107-118.
- AlMushaan, M. A., Alameeri, A. A., Alameeri, S. R., Almukaimi, W. M, Alhajri, F. K., Alghanim, H. A., & Almutairi, J. N. (2000-2001). *Teacher's Guideline to the educational experience in kindergarten, level 1; first audition*. Kuwait, Department of Curriculum Development: The ministry of education Press.
- AlMushaan, M. A., Alameeri, A. A., Alameeri, S. R., Almukaimi, W. M, Alhajri, F. K., Alghanim, H. A., & Almutairi, J. N. (2000-2001). *Teacher's Guideline to the educational experience in kindergarten, level 2, first audition*. Kuwait, Department of Curriculum Development: The ministry of education Press
- Alloway, T. P. (2006). How does working memory work in the classroom?. *Educational Research and Reviews*, 1 (4), 134-139.
- Alloway, T. P., Gathercole, S. E., Adams, A. M., Willis, C., Eaglen, R., & Lamont, E. (2005). Working memory and phonological awareness as predictors of progress towards early learning goals at school entry. *British Journal of Developmental Psychology*, 23(3), 417-426.

- Alloway, T. P., Gathercole, S. E., & Pickering, S. J. (2006). Verbal and Visuospatial Short-Term and Working Memory in Children: Are They Separable?. *Child development*, 77(6), 1698-1716.
- Al-Mannai, H., & Everatt, J. (2005). Phonological processing skills as predictors of literacy amongst Arabic speaking Bahraini children. *Dyslexia*, 11(4), 269-291.
- Almusawi, H. (2014). *The role of phonology, morphology and dialect in reading Arabic among hearing and deaf children* (unpublished PhD thesis, University of Oxford)
- Al-Wer, E. (1997). Arabic between reality and ideology. *International journal of applied linguistics*, 7(2), 251-265.
- Ammar, M., & Maad, M. R. B. (2013) The role of Arabic orthographic literacy in the phonological awareness of Tunisian children. *The African Symposium*, 13 (1), 19-27.
- Al Otaiba, S., Puranik, C., Ziolkowski, R., & Curran, T. (2009). Effectiveness of early phonological awareness interventions for students with speech or language impairments. *The Journal of special education*, 43(2), 107-128.
- AL-Qenaie, S. D. (2011). *Kuwaiti Arabic: A Socio-Phonological Perspective* (PhD thesis, Durham University).
- Ayari, S. (1996). Diglossia and illiteracy in the Arab world. *Language, Culture and Curriculum*, 9, 243-252.

- Bachman, L. F. (2004). *Statistical analysis for language assessment*. Cambridge, UK: Cambridge university press.
- Baddeley, A. D. (1986). *Working Memory*. New York: Oxford University Press.
- Baddeley, A. D. (2000). The episodic buffer: a new component of working memory? *Trends Cognitive Sciences*, 4, 417–423
- Baddeley, A. (2003). Working memory: looking back and looking forward. *Nature Reviews Neuroscience*, 4(10), 829-839.
- Baddeley, A. D., & Hitch, G. J. (1974). Working memory. In G. A. Bower, (Ed.), *Recent advances in learning and motivation* (pp. 47–89). New York: Academic Press.
- Badian, N. A. (2001). Phonological and orthographic processing: Their roles in reading prediction. *Annals of Dyslexia*, 51(1), 179-202.
- Barker, B. M. (1976). Interrelationships of perceptual modality, short term memory and reading achievement. *Perceptual and motor skills*, 43(3), 771-774.
- Bentin, S., & Ibrahim, R. (1996). New evidence for phonological processing during visual word recognition: The case of Arabic. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 22(2), 309-323.
- Bialystok, E. (1997). Effects of bilingualism and biliteracy on children's emerging concepts of print. *Developmental Psychology*, 33(3), 429-440.

- Bialystok, E; Majumder, S & Martin, MM. (2003) Developing phonological awareness: Is there a bilingual advantage?. *Applied Psycholinguistics*, 24(1), 27-44.
- Bird, G., Beadman, J. & Buckley, S. (2001). *Reading and Writing for Children with Down Syndrome (5-11 years)*. Portsmouth, UK: The Down Syndrome Education Trust.
- Bowey, J. A. (1994). Phonological sensitivity in novice readers and nonreaders. *Journal of Experimental Child Psychology*, 58(1), 134-159.
- Bowey, J. A, Cain, M. T. & Ryan, S. M. (1992). A reading –level design study of phonological skills underlying forth-grade children’s word reading difficulties. *Child development*, 63, 999-1011.
- Brady, S. (1986). Short-term memory, phonological processing, and reading ability. *Annals of dyslexia*, 36(1), 138-153.
- Brunswick, N., Neil Martin, G., & Rippon, G. (2012). Early cognitive profiles of emergent readers: A longitudinal study. *Journal of experimental child psychology*, 111(2), 268-285.
- Bryant, P. E., MacLean, M., Bradley, L. L. & Crossland, J. (1990). Rhyme and alliteration, phoneme detection, and learning to read. *Developmental psychology*, 26(3), 429-438.
- Bull, R. (2008). Short-term memory, working memory, and excutive functioning in preschoolers: longitudinal predictors of mathematical achievemnt at age 7 years. *Develommental neuropsychooogl*, 33(3), 205-228.

- Burgess, S. R., & Lonigan, C. J. (1998). Bidirectional relations of phonological sensitivity and prereading abilities: Evidence from a preschool sample. *Journal of experimental child psychology*, 70(2), 117-141.
- Bus, A. G., & van IJzendoorn, M. H. (1999). Phonological awareness and early reading: A meta-analysis of experimental training studies. *Journal of Educational Psychology*, 91(3), 403.
- Byrne, B., & Fielding-Barnsley, R. (1993). Evaluation of a program to teach phonemic awareness to young children: A 1-year follow-up. *Journal of Educational Psychology*, 85(1), 104-111.
- Byrne, B., & Fielding-Barnsley, R. (1995). Evaluation of a program to teach phonemic awareness to young children: A 2-and 3-year follow-up and a new preschool trial. *Journal of Educational Psychology*, 87(3), 488-503.
- Carroll, J. L. (1972). A visual memory scale (VMS) Designed to measure short-term visual recognition memory in 5-and 6-year-old children. *Psychology in the Schools*, 9(2), 152-158.
- Carroll, J. M., Snowling, M. J., Stevenson, J., & Hulme, C. (2003). The development of phonological awareness in preschool children. *Developmental psychology*, 39(5), 913-923.
- Castles, A., & Coltheart, M. (2004). Is there a causal link from phonological awareness to success in learning to read?. *Cognition*, 91(1), 77-111.

- Cherry, K. (2010). *The Everything Psychology Book: An introductory guide to the science of human behaviour*. 2nd ed. Avon, MA: Adams Media
- Clément, R. (1986). Second language proficiency and acculturation: An investigation of the effects of language status and individual characteristics. *Journal of Language and social Psychology*, 5(4), 271-290.
- Coltheart, M. (1996). *Phonological dyslexia a special issue of cognitive neuropsychology*. Erlbaum UK: Taylor and Francis Ltd. Psychology press
- Cornwall, A. (1992). The relationship of phonological awareness, rapid naming, and verbal memory to severe reading and spelling disability. *Journal of Learning Disabilities*, 25(8), 532-538.
- Culmer, P. R., Levesley, M. C., Mon-Williams, M., & Williams, J. H. (2009). A new tool for assessing human movement: the kinematic assessment tool. *Journal of neuroscience methods*, 184(1), 184-192.
- Cunningham, A. E. (1990). Explicit versus implicit instruction in phonemic awareness. *Journal of experimental child psychology*, 50(3), 429-444.
- D'Angiulli, A., Siegel, L. S., & Serra, E. (2001). The development of reading in English and Italian in bilingual children. *Applied Psycholinguistics*, 22(4), 479-507.

- Deacon, S. & Kirby, J. (2004). Morphological awareness: just 'more phonological'? the roles of morphological and phonological awareness in reading development, *Applied Psycholinguistics*, 25, 223–238.
- Demont, E. (2001). Contribution of early 2nd-language learning to the development of linguistic awareness and learning to read. *International Journal of Psychology*, 36(4), 274-285.
- Duncan, L. G. (2010). Phonological development from a cross-linguistic perspective. In N. Brunswick, S. McDougall & P. d. M. Davies (Eds.), *Reading and dyslexia in different orthographies* (1 ed., pp. 43-68). Hoboken: Psychology Press.
- Ehri, L. C. (1989). The development of spelling knowledge and its role in reading acquisition and reading disability. *Journal of Learning Disabilities*, 22(6), 356-365.
- Ehri, L. C. (2005). Learning to read words: Theory, findings, and issues. *Scientific Studies of reading*, 9(2), 167-188.
- Ehri, L. C., Nunes, S. R., Willows, D. M., Schuster, B. V., Yaghoub-Zadeh, Z., & Shanahan, T. (2001). Phonemic awareness instruction helps children learn to read: Evidence from the National Reading Panel's meta-analysis. *Reading research quarterly*, 36(3), 250-287.
- Ehri, L. C., & Wilce, L. S. (1985). Movement into reading: Is the first stage of printed word learning visual or phonetic?. *Reading Research Quarterly*, 20(2), 163-179.

- Elbeheri, G., & Everatt, J. (2007). Literacy ability and phonological processing skills amongst dyslexic and non-dyslexic speakers of Arabic. *Reading and writing*, 20(3), 273-294.
- Elbeheri, G., Everatt, J., Reid, G., & Al-Mannai, H. (2006). Dyslexia assessment in Arabic. *Journal of Research in Special Educational Needs*, 6(3), 143-152.
- Elbeheri, G., Everatt, J., Mahfoudhi, A., Abu Al-Diyar, M., & Taibah, N. (2011). Orthographic processing and reading comprehension among Arabic speaking mainstream and LD children. *Dyslexia*, 17(2), 123-142.
- Elley, W. B. (1991). Acquiring Literacy in a Second Language: The Effect of Book-Based Programs. *Language learning*, 41(3), 375-411.
- Ellis, N. (1990). Reading, phonological skills and short term memory: interactive tributaries of development. *Journal of research in reading*, 13(2), 107-122.
- Ellis, N., & Large, B. (1988). The early stages of reading: A longitudinal study. *Applied Cognitive Psychology*, 2(1), 47-76.
- Eviatar, Z., & Ibrahim, R. (2000). Bilingual is as bilingual does: Metalinguistic abilities of Arabic-speaking children. *Applied Psycholinguistics*, 21(04), 451-471.
- Fathman, A. (1975). The relationship between age and second language productive ability. *Language learning*, 25(2), 245-253.

- Feagans, L. V., & Merriwether, A. (1990). Visual discrimination of letter-like forms and its relationship to achievement over time in children with learning disabilities. *Journal of Learning Disabilities*, 23, 417–425.
- Feitelson, D., Goldstein, Z., Iraqi, J. & Share, D. (1993). Effects of listening to story reading on aspects of literacy acquisition in a diglossic situation. *Reading Research Quarterly*, 28, 71–79.
- Felton, R. H., & Pepper, P. P. (1995). Early identification and intervention of phonological deficits in kindergarten and early elementary children at risk for reading disability. *School Psychology Review*, 24(3), 405-411.
- Ferguson, C. A. (1959). “Diglossia”. *Word*, 15, 232-251.
- Fletcher, J. M., Shaywitz, S. E., Shankweiler, D. P., Katz, L., Liberman, I. Y., Stuebing, K. K., Francis, D. J., Fowler, A. E. & Shaywitz, B. A. (1994). Cognitive profiles of reading disability: Comparisons of discrepancy and low achievement definitions. *Journal of Educational Psychology*, 86(1), 6-23.
- Gardener, R. C. (2007). Motivation and Second Language Acquisition1. *Porta Linguarum* 8, 9-20.
- Gathercole, S. E. (1999). Cognitive approaches to the development of short term memory. *Trends in cognitive sciences*, 3(11), 410-419.

- Gathercole, S. E., Alloway, T. P., Willis, C., & Adams, A. M. (2006). Working memory in children with reading disabilities. *Journal of experimental child psychology*, 93(3), 265-281.
- Gathercole, S. E. & Baddeley, A. D. (1989). Evaluation of the role of phonological STM in the development of vocabulary in children: a longitudinal study. *Journal of memory and language*, 28(2), 200-213.
- Gathercole, S. E., & Baddeley, A. D. (1990). Phonological memory deficits in language disordered children: Is there a causal connection?. *Journal of memory and language*, 29(3), 336-360.
- Gathercole, S. E. & Baddeley, A. D. (1993). Phonological working memory: a critical building block for reading development and vocabulary acquisition? *European journal of psychology of education*, 8(3), 259-272.
- Gathercole, S. E. & Baddeley, A. D. (1993). *Working memory and language*. Hove, UK: Lawrence Erlbaum Associated Ltd, Publisher.
- Gathercole, S. E., Hitch, G. J., & Martin, A. J. (1997). Phonological short term memory and new word learning in children. *Developmental psychology*, 33(6), 966.
- Gathercole, S. E., Service, E., Hitch, G. J., Adams, A. M., & Martin, A. J. (1999). Phonological short-term memory and vocabulary development: further evidence on the nature of the relationship. *Applied cognitive psychology*, 13(1), 65-77.

- Gathercole, S. E., Willis, C. & Baddeley, A. D. (1991). Differentiating phonological memory and awareness of rhyme: Reading and vocabulary development in children. *British Journal of Psychology*, 82, 387-406
- Gathercole, S. E., Willis, C. S., Emslie, H. & Baddeley, A. D (1992). Phonological memory and vocabulary development during the early school years: a longitudinal study. *Developmental psychology*, 18(5), 887-898.
- Geudens, A. (2006). 'Phonological awareness and learning to read a first language: controversies and new perspectives'. In Van der Craats, I., J. Kurvers, M. Young-Scholten (eds.), *Low-educated second language and literacy acquisition* (pp. 25-44). Utrecht: LOT.
- Gollan, T. H., Montoya, R. I., Fennema-Notestine, C., & Morris, S. K. (2005). Bilingualism affects picture naming but not picture classification. *Memory and Cognition*, 33(7), 1220-1234.
- Gonzalez, C.; Anderson, J; Culmer, P.; Bruke, M. R.; Mon-Williams, M. & Wilkie, R. M. (2010). Is tracing or copying better when learning to reproduce a pattern?, *Exp Brain Res*, 208, 459-465
- Goswami, U. & Bryant, P. (1990) *Phonological Skills and Learning to Read*. Hove, UK: Lawrence Erlbaum Associates

- Goswami, U., Ziegler, J. C., Dalton, L., & Schneider, W. (2001). Pseudohomophone effects and phonological recoding procedures in reading development in English and German. *Journal of Memory and Language*, 45(4), 648-664.
- Goswami, U., Ziegler, J. C., & Richardson, U. (2005). The effects of spelling consistency on phonological awareness: A comparison of English and German. *Journal of experimental child psychology*, 92(4), 345-365.
- Habib-Allah, M. (1985). Reading and reading comprehension, *Reading Circles*, 21, 87–96.
- Hansen, J., & Bowey, J. A. (1994). Phonological Analysis Skills, Verbal Working Memory, and Reading Ability in Second-Grade Children. *Child Development*, 65(3), 938-950.
- Harley, T. A. (2008). *The psychology of language from data to theory 3rd ed.* New York, USA: Taylor and Frances Group, Psychology Press
- Harley, T. A. (2014). *The psychology of language from data to theory, 4th ed.* New York, USA: Taylor and Frances Group, Psychology Press
- Hatcher, P. J., & Hulme, C. (1999). Phonemes, rhymes, and intelligence as predictors of children's responsiveness to remedial reading instruction: Evidence from a longitudinal intervention study. *Journal of experimental child psychology*, 72(2), 130-153.

- Hoover, W. A. (2002). The importance of phonemic awareness in learning to read. *SEDL*, 14(3). Retrieved from <http://www.sedl.org/pubs/sedl-letter/v14n03/3.html> (March, 2014)
- Holes, C. (1995). *Modern Arabic: Structures, functions and varieties*. Essex: Longman Group.
- Hoiem, T., Lundberg, I., Stanovich, K. E., & Bjaalid, I. K. (1995). Components of phonological awareness. *Reading and Writing*, 7(2), 171-188.
- Hirsh, K. W., & Funnell, E. (1995). Those old, familiar things: Age of acquisition, familiarity and lexical access in progressive aphasia. *Journal of Neurolinguistics*, 9(1), 23-32.
- Hulme, C., Hatcher, P. J., Nation, K., Brown, A., Adams, J., & Stuart, G. (2002). Phoneme awareness is a better predictor of early reading skill than onset-rime awareness. *Journal of experimental child psychology*, 82(1), 2-28.
- Hulme, C., Muter, V., & Snowling, M. (1998). Segmentation does predict early progress in learning to read better than rhyme: A reply to Bryant. *Journal of Experimental Child Psychology*, 71(1), 39-44.
- Ibrahim, R. (2009). The cognitive basis of diglossia in Arabic: Evidence from a repetition priming study within and between languages. *Psychology research and behavior management*, 2, 93-105.
- Ibrahim, R. (2010). How does dissociation between written and oral forms affect reading: evidence from auxiliary verbs in Arabic. *Journal of Research in Reading*, 34(2), 1-16.

- Ibrahim, R. (2010). Psycholinguistic challenges in processing the Arabic language. In E. F. Caldwell (ed), *Bilinguals: cognition, Education and language processing* (4, pp. 81-102). New York: Nova sciences Publishing.
- Ibrahim, R. (2010). Neurocognitive aspects of processing Arabic and Hebrew. In E. F. Caldwell, E. (ed), *Bilinguals: cognition, Education and language processing* (pp. 103-122). New York: Nova sciences Publishing.
- Ibrahim, R. (2011). Literacy problems in Arabic: Sensitivity to diglossia in tasks involving working memory. *Journal of Neurolinguistics*, 24(5), 571-582.
- Ibrahim, R. (2013). Reading in Arabic: New Evidence for the Role of Vowel Signs. *Creative Education*, 4(4), 248-253.
- Ibrahim, R. (2013). Beginning Readers in Arabic and the Distance between Literary and Spoken Arabic. *Creative Education*, 4(5), 307-314.
- Ibrahim, R., & Aharon-Peretz, J. (2005). Is literary Arabic a second language for native Arab speakers?: Evidence from semantic priming study. *Journal of psycholinguistic research*, 34(1), 51-70.
- Ibrahim, R., Eviatar, Z., & Aharon-Peretz, J. (2002). The characteristics of Arabic orthography slow its processing. *Neuropsychology*, 16(3), 322.
- Joshi, R. M. & Aaron, P. G. (2006). *Handbook of orthography and literacy*. Mahwah, New Jersey: Lawrence Erlbaum associates, Inc., Publishers

- Johnston, R. S., Anderson, M., & Holligan, C. (1996). Knowledge of the alphabet and explicit awareness of phonemes in pre-readers: The nature of the relationship. *Reading and writing*, 8(3), 217-234.
- Katz, L., & Frost, R. (1992). The reading process is different for different orthographies: The orthographic depth hypothesis. *Advanced in psychology –Amsterdam*, 94, 67-67.
- Kandel E. R., Schwartz J. H., & Jessell T. M. (2000). Principles of Neural Science, 4th ed. McGraw-Hill, New York.
- Kirk, U. (1980). Learning to Copy Letters: A Cognitive Rule-Governed Task. *Elementary School Journal*, 81(1), 28-33.
- Kulp, M. T., Edwards, K. E., & Mitchell, G. L. (2002). Is visual memory predictive of below-average academic achievement in second through fourth graders?. *Optometry & Vision Science*, 79(7), 431-434.
- Kuo, L. J., & Anderson, R. C. (2012). Effects of early bilingualism on learning phonological regularities in a new language. *Journal of experimental child psychology*, 111(3), 455-467.
- Le Fevre, C. J. (1982). Visual memory of pseudographs in first, second, and third grade good and poor readers. (PhD thesis, University of Maiami)

- Leikin, M., Ibrahim, R., & Eghbaria, H. (2014). The influence of diglossia in Arabic on narrative ability: evidence from analysis of the linguistic and narrative structure of discourse among pre-school children. *Reading and Writing*, 27(4), 733-747.
- Levin, I., Saiegh-Haddad, E., Hende, N., & Ziv, M. (2008). Early literacy in Arabic: An intervention study among Israeli Palestinian kindergartners. *Applied Psycholinguistics*, 29(03), 413-436.
- Lewis-Beck, M. S., Bryman, A. E., & Liao, T. F. (Eds.). (2004). *The Sage encyclopedia of social science research methods (Vol. 1)*. London: Sage.
- Longcamp, M., Boucard, C., Gilhodes, J. C., Anton, J. L., Roth, M., Nazarian, B., & Velay, J. L. (2008). Learning through hand-or typewriting influences visual recognition of new graphic shapes: Behavioral and functional imaging evidence. *Journal of Cognitive Neuroscience*, 20(5), 802-815.
- Lurenz, F. (2012). *Basics of Phonetics and English Phonology*. Logos Verlag Berlin GmbH.
- Maamouri, M. (1998). *Language Education and Human Development: Arabic Diglossia and its Impact on the Quality of Education in the Arab Region*. Paper presented at the Mediterranean Development Forum, Marrakesh, Morocco, 3-6 September 1998
- Mahfoudhi, A., Everatt, J., & Elbeheri, G. (2011). Introduction to the special issue on literacy in Arabic. *Reading and Writing*, 24(9), 1011-1018.

- Mather, N., Bos, C., & Babur, N. (2001). Perceptions and knowledge of preservice and inservice teachers about early literacy instruction. *Journal of learning disabilities*, 34(5), 472-482.
- Mann, V. A., & Liberman, I. Y. (1984). Phonological awareness and verbal short term memory. *Journal of learning disabilities*, 17(10), 592-599.
- McDougall, S., Brunswick, N., & de Mornay Davis, P. (2010). *Reading and dyslexia in different orthographies: An introduction and overview*. Hove, East Sussex: Psychology Press.
- Moats, L., & Tolman, C (2009). Excerpted from Language Essentials for Teachers of Reading and Spelling (LETRS): The Speech Sounds of English: Phonetics, Phonology, and Phoneme Awareness (Module 2). Boston: Sopris West.
- Morris, R. D., Stuebing, K. K., Fletcher, J. M., Shaywitz, S. E., Lyon, G. R., Shankweiler, D. P., Katz, L., Francis, D. J. & Shaywitz, B. A. (1998). Subtypes of reading disability: Variability around a phonological core. *Journal of educational psychology*, 90(3), 347-373.
- Muter, V., Hulme, C., Snowling, M., & Taylor, S. (1997). Segmentation, not rhyming, predicts early progress in learning to read. *Journal of experimental child psychology*, 65(3), 370-396.
- Myronenko, A., & Song, X. (2010). Point set registration: Coherent point drift. *Pattern Analysis and Machine Intelligence, IEEE Transactions on*, 32(12), 2262-2275.

- Nation, K., & Hulme, C. (1997). Phonemic segmentation, not onset-rime segmentation, predicts early reading and spelling skills. *Reading Research Quarterly*, 32(2), 154-167.
- Nithart, C., Demont, E., Metz-Lutz, M. N., Majerus, S., Poncelet, M., & Leybaert, J. (2011). Early contribution of phonological awareness and later influence of phonological memory throughout reading acquisition. *Journal of research in reading*, 34(3), 346-363.
- Pallant, J. (2005). *SPSS survival manual: a step by step guide to data analysis using SPSS for Windows*. Maidenhead: Open University Press.
- Passenger, T., Stuart, M., & Terrell, C. (2000). Phonological processing and early literacy. *Journal of Research in Reading*, 23(1), 55-66.
- Peçenek, D. (2011). A longitudinal study of two boys' experiences of acquiring Italian as a second language: the influence of age. *International Journal of Bilingualism* 15 (3), 268-290
- Perfetti, C. A., Beck, I., Bell, L. C., & Hughes, C. (1987). Phonemic knowledge and learning to read are reciprocal: A longitudinal study of first grade children. *Merrill-Palmer Quarterly*, 33(3), 283-319.
- Rapala, M. M., & Brady, S. (1990). Reading ability and short term memory: The role of phonological processing. *Reading and Writing*, 2(1), 1-25.

- Rego, L. L. B., & Bryant, P. E. (1993). The connection between phonological, syntactic and semantic skills and children's reading and spelling. *European Journal of Psychology of Education*, 8(3), 235-246.
- Rohl, M., & Pratt, C. (1995). Phonological awareness, verbal working memory and the acquisition of literacy. *Reading and Writing*, 7(4), 327-360.
- Rubin, A. (2010). *Statistics for evidence-based practice and evaluation. (2nd ed)*, Belmont, CA: Brooks/Cole.
- Sadeghi, A. (2013). Towards a universal model of reading investigations into Persian monolingual and English-Persian bilingual speakers. (PhD thesis, University of Canterbury)
- Saiegh-Haddad, E. (2003). Linguistic distance and initial reading acquisition: The case of Arabic diglossia. *Applied Psycholinguistics*, 24(03), 431-451.
- Saiegh-Haddad, E. (2004). The impact of phonemic and lexical distance on the phonological analysis of words and pseudowords in a diglossic context. *Applied Psycholinguistics*, 25(04);495-512.
- Saiegh-Haddad, E. (2005). Correlates of reading fluency in Arabic: Diglossic and orthographic factors. *Reading and Writing*, 18(6), 559-582.
- Saiegh-Haddad, E. (2007). Linguistic constraints on children's ability to isolate phonemes in Arabic. *Applied Psycholinguistics*, 28(04), 607-625.

- Saiegh-Haddad, E. (2012). Literacy reflexes of Arabic diglossia. *Literacy studies*, 5, 43-55
- Saiegh-Haddad, E., Levin, I., Hende, N., & Ziv, M. (2011). The Linguistic Affiliation Constraint and phoneme recognition in diglossic Arabic. *Journal of child language*, 38(2), 297-315.
- Schatschneider, C., Fletcher, J. M., Francis, D. J., Carlson, C. D., & Foorman, B. R. (2004). Kindergarten prediction of reading skills: A longitudinal comparative analysis. *Journal of Educational Psychology*, 96(2), 265-282.
- Shaywitz, S. E. (1998). Dyslexia. *New England Journal of Medicine*, 338(5), 307-312.
- Smith, D. R. (2004). Making the Reading Connection. Statewide Evaluation Conference. Corpus Christi, TX: Pearson Education, Inc.
- Smythe, I., Everatt, J., Al-Menaye, N., He, X., Capellini, S., Gyarmathy, E., & Siegel, L. S. (2008). Predictors of word-level literacy amongst Grade 3 children in five diverse languages. *Dyslexia*, 14(3), 170-187.
- Solan, H. A., Mozlin, R., & Rumpf, D. A. (1985). Selected perceptual norms and their relationship to reading in kindergarten and the primary grades. *Journal of the American Optometric Association*, 56(6), 458-466.
- Stanovich, K. E. (1993). A model for studies of reading disability. *Developmental Review*, 13(3), 225-245.

- Stanovich, K. E., & West, R. F. (1989). Exposure to print and orthographic processing. *Reading Research Quarterly*, 24(4), 402-433.
- Stevens, J. P. (2009). *Applied Multivariate statistics for the social sciences* (5th ed). New York: Taylor and Francis group, LLC
- Storch, S. A., & Whitehurst, G. J. (2002). Oral language and code-related precursors to reading: evidence from a longitudinal structural model. *Developmental psychology*, 38(6), 934-947.
- Taha, H. (2008). The contribution of visual processing, phonological and morphological processing and naming speed to the reading abilities of normal and poor native Arabic readers. <http://www.hebpsy.net/articles.asp?id=1808>. (retrieved on 18/4/2014).
- Taha, H. Y. (2013). Reading and Spelling in Arabic: Linguistic and Orthographic Complexity. *Theory & Practice in Language Studies*, 3(5), 721-727.
- Tahan, S., Cline, T., & Messaoud-Galusi, S. (2011). The relationship between language dominance and pre-reading skills in young bilingual children in Egypt. *Reading and Writing*, 24(9), 1061-1087.
- Taha, H., Ibrahim, R., & Khateb, A. (2012). How Does Arabic Orthographic Connectivity Modulate Brain Activity During Visual Word Recognition: An ERP Study. *Brain topography*, 26, 292-302.

- Talcott, J. B., Witton, C., Hebb, G. S., Stoodley, C. J., Westwood, E. A., France, S. J., Hensen, P. C. & Stein, J. F. (2002). On the relationship between dynamic visual and auditory processing and literacy skills; results from a large primary-school study. *Dyslexia*, 8(4), 204-225.
- Taibah, N. J. & Haynes, C. W. (2011). Contribution of phonological processing skills to reading skills in Arabic speaking children. *Reading and writing*, 24(9), 1019-1042.
- Terry, N. P. (2012). Examining relationships among dialect variation and emergent literacy skills. *Communication Disorders Quarterly*, 33(2): 67–77.
- Torgesen, J. K. (1978). Performance of reading disabled children on serial memory tasks: A selective review of recent research. *Reading Research Quarterly*, 14 (1), 57-87.
- Torgesen, J. K., Morgan, S. T., & Davis, C. (1992). Effects of two types of phonological awareness training on word learning in kindergarten children. *Journal of Educational psychology*, 84(3), 364-370.
- Torgesen, J. K., Wagner, R. K., & Rashotte, C. A. (1994). Longitudinal studies of phonological processing and reading. *Journal of learning disabilities*, 27, 276-286.
- Torgesen, J. K., Wagner, R. K., Rashotte, C. A., Burgess, S. & Hicht, S. (1997). Contributions of phonological awareness and rapid automatic naming ability to the growth of word-reading in second- to fifth- grade children. *Scientific studies of reading*, 1(12), 161-185.

- Torgesen, J. K., Wagner, R. K., Rashotte, C. A., Rose, E., Lindamood, P., Conway, T., & Garvan, C. (1999). Preventing reading failure in young children with phonological processing disabilities: Group and individual responses to instruction. *Journal of Educational Psychology*, 91(4), 579-593.
- Thompson, G. B., Tunmer, W. E., & Nicholson, T. (1993). *Reading Acquisition Processes*. Clevedon: Multilingual Matters Ltd.
- Tunmer, W. E. (1991). Phonological awareness and literacy acquisition. Learning to read: Basic research and its implications, 105-119.
- Wagner, R. K., & Torgesen, J. K. (1987). The nature of phonological processing and its causal role in the acquisition of reading skills. *Psychological bulletin*, 101(2), 192-212.
- Wagner, R. K., Torgesen, J. K., & Rashotte, C. A. (1994). Development of reading-related phonological processing abilities: New evidence of bidirectional causality from a latent variable longitudinal study. *Developmental psychology*, 30(1), 73-87.
- Wagner, R. K., Torgesen, J. K., Rashotte, C. A., Hecht, S. A., Barker, T. A., Burgess, S. R., Donahue, J. & Garon, T. (1997). Changing relations between phonological processing abilities and word-level reading as children develop from beginning to skilled readers: a 5-year longitudinal study. *Developmental psychology*, 33(3), 468-479.
- Werner, J. M., and DeSimone, R. L. (2009). *Human Resource Development, 5th Ed*, US: South-Western Cengage Learning.

- Wesson M. D. (1993). Diagnosis and management of reading dysfunction for the primary care optometrist. *Optometry & Vision Science*, 70(5), 357-368.
- Whitehurst, G. J., & Lonigan, C. J. (1998). Child development and emergent literacy. *Child development*, 69(3), 848-872.
- Wimmer, H., & Goswami, U. (1994). The influence of orthographic consistency on reading development: word recognition in English and German children. *Cognition*, 51(1), 91-103.
- Yopp, H. K. (1988). The validity and reliability of phonemic awareness tests. *Reading Research Quarterly*, 159-177.
- Zayed, A. M., Roehrig, A. D., Arrastia-Lloyd, M. C., & Arrastia-Lloyd, C. (2013). Phonological Awareness and Working Memory in Arabic-Speaking Egyptian Preschool Children at Risk for Dyslexia. *International Journal of Psychological Studies*, 5(1), 139-149.
- Ziegler, J. C., & Goswami, U. (2005). Reading acquisition, developmental dyslexia, and skilled reading across languages: a psycholinguistic grain size theory. *Psychological bulletin*, 131(1), 3-29.
- Ziolkowski, R. A., & Goldstein, H. (2008). Effects of an embedded phonological awareness intervention during repeated book reading on preschool children with language delays. *Journal of Early Intervention*, 31(1), 67-90.

Zuzovsky, R. (2010). Instructional Variables Involved in Problems Associated with Diglossia in Arabic Speaking Schools in Israel: PIRLS 2006 Findings. *Journal for Educational Research Online*, 2(1), 5–31

Wechsler, D. (2007). *Kuwaiti Wechsler intelligence scale for children (3rd ed)*. Kuwait, The ministry of education.

Appendices

Appendix 1- Reading ability task / pilot study

(International Phonetic Alphabet)

Reading ability task Words from schoolbooks	
Arabic standard Arabic	Kuwaiti shared words
aanf	fīl
sāhin	kūb
hātif	alwān
riyāh	ašyāa
ruz	insān
Yaḥḍur	jumlah
Afḍal	‘ayn
Yaḍbiṭ	kalimah
riyāḍah	ḥarf
nāfiḍah	šams

Reading ability task Words not from school books	
Arabic standard words	Kuwaiti shared words
tanmū	bāb
tajrī	Šahr
gīdāa	ḥamāmah
Miqas	aaṭ’ āṭ’
wāḍiḥ	Ḥufrah
jāf fah	baṭ ṭah
Faarah	qiṣ ṣah
ḥāsūb	ṭāwilah
Aqra	ḥarūf
ašjār	ḥalīb

(Arabic Alphabet)

مقياس القدره القرانيه كلمات ليست ضمن الكتاب المدرسي للصف الأول الابتدائي	
كلمات باللغه العربيه	كلمات مشتركه كويتيه
تنمو	باب
تجري	شهر
غذاء	حمامه
مقص	أثاث
واضح	حفرة
جافه	بطه
فأره	قصه
حاسوب	طاولة
أقرأ	حروف
أشجار	حليب

مقياس القدره القرانيه كلمات ضمن الكتاب المدرسي للصف الأول الابتدائي	
كلمات باللغه العربيه	كلمات مشتركه كويتيه
أنف	فيل
ساخن	كوب
هاتف	ألوان
رياح	أشياء
رز	إنسان
يحضر	جملة
أفضل	علامة
يضبط	كلمه
رياضه	حرف
نافذه	شمس

Appendix 2- Phonological awareness task / pilot study

(International Phonetic Alphabet)

Phonological awareness task Words from schoolbooks	
Arabic standard words	Kuwaiti shared words
Qit	Wardah
ṭa'ām	Dars
samāa	Baḥr
farāġ	ṣūrah
taqūl	ṭabīb
tilmīd	Jumlah
bayḍāa	farāṣah
ḥikāyah	ḥadiqah
jamīlah	Taḥt
mufīdah	Hadiyyah

Phonological awareness task Words not from schoolbooks	
Arabic standard words	Kuwaiti shared words
muhḍḍab	Jaw
yarā	t'alj
Qird	rabi'
Jalasad	Jamal
jidār	kitāb
miḍyāa	ḥarūf
maq'ad	'alam
Manzil	jazīrah
miṣbāh	Maktabah
yaf'al	Madrasah

(Arabic Alphabet)

مقياس الوعي الصوتي كلمات ضمن الكتاب المدرسي للصف الأول الابتدائي	
كلمات باللغة العربية	كلمات مشتركة كويتيه
قط	ورده
طعام	درس
سما	بحر
فراغ	صوره
تقول	طبيب
تلميذ	جملة
بيضاء	فراشه
حكاية	حديقة
جميلة	تحت
مفيدة	هدية

مقياس الادراك الصوتي كلمات ليست ضمن الكتاب المدرسي للصف الأول الابتدائي	
كلمات باللغة العربية	كلمات مشتركة كويتيه
مهدب	جو
يرى	ثلج
قرد	ربيع
جلست	جمل
جدار	كتاب
مذيع	خروف
مقعد	علم
منزل	جزيره
مصباح	مكتبه
يفعل	مدرسه

Appendix 3- Reading ability task

(International Phonetic Alphabet)

Words types		
Kuwaiti dialect words	Kuwaiti shared words	Standard Arabic words
kabat	Wardah	Aanf
aūfī	šārī'	t'amarah
mtrūs	sayyārah	hātif
bālṭū	bāb	riyāḥ
ḥarbān	Jadwal	ḥaqībah
kambal	maktab	Manzil
bardah	maṭbaḥ	sāḥin
fanīlah	yamšī	qālat

(Arabic Alphabet)

انواع الكلمات		
كلمات اللهجه العاميه	الكلمات المشتركه	كلمات اللغه العربيه
كبت	ورده	أنف
أوتي	شارع	ثمرة
متروس	سياره	هاتف
بالطو	باب	رياح
خربان	جدول	حقيبة
كمبل	مكتب	منزل
برده	مطبخ	ساخن
فنيله	يمشي	قالت

Appendix 4- Phonological awareness task

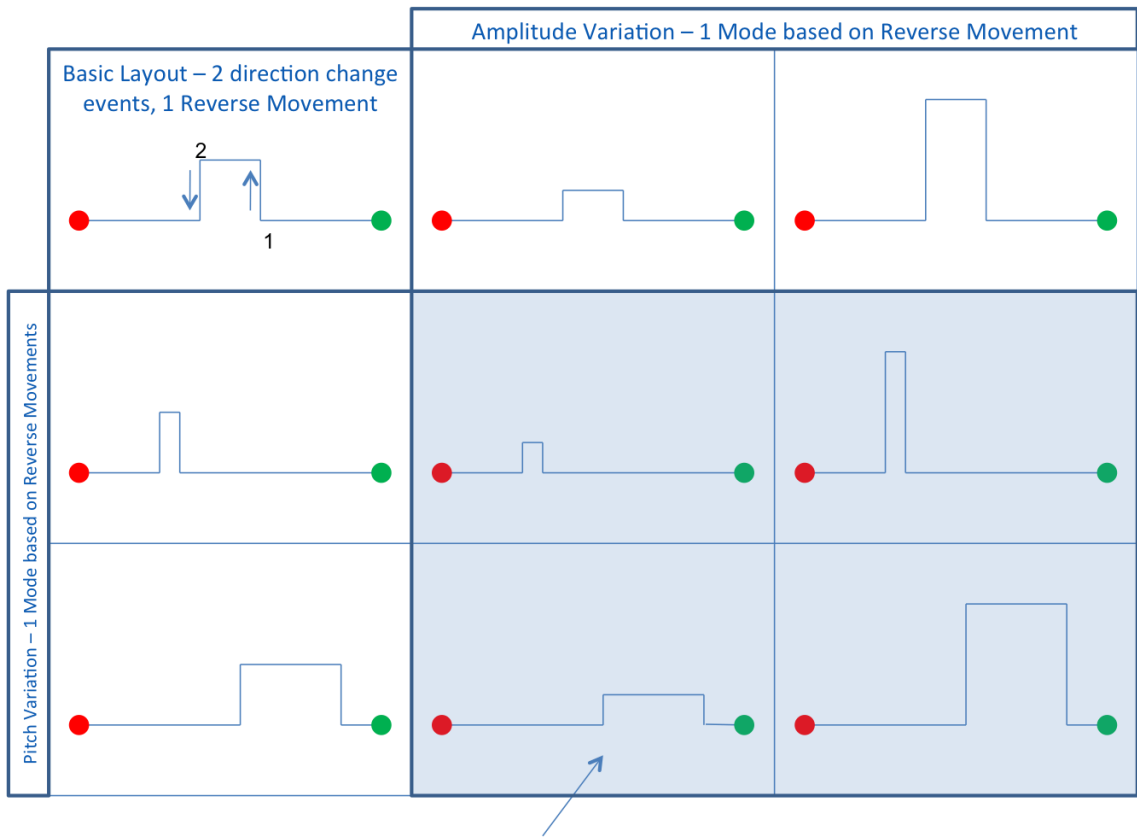
(International Phonetic Alphabet)

Words types		
Kuwaiti dialect words	Kuwaiti shared words	Standard Arabic words
ʔaq	ʃuwar	yarā
janʔah	jamal	jidār
qanafah	tuffāḥ	yafʻal
qaʃʃah	ḥarūf	farāġ
mandarah	ḥamāmah	ʔaʻām
nafnūf	wardah	maqʻad
dirīšah	maktabah	ḥikāyah
zaʻlān	farāšah	muʻfidah

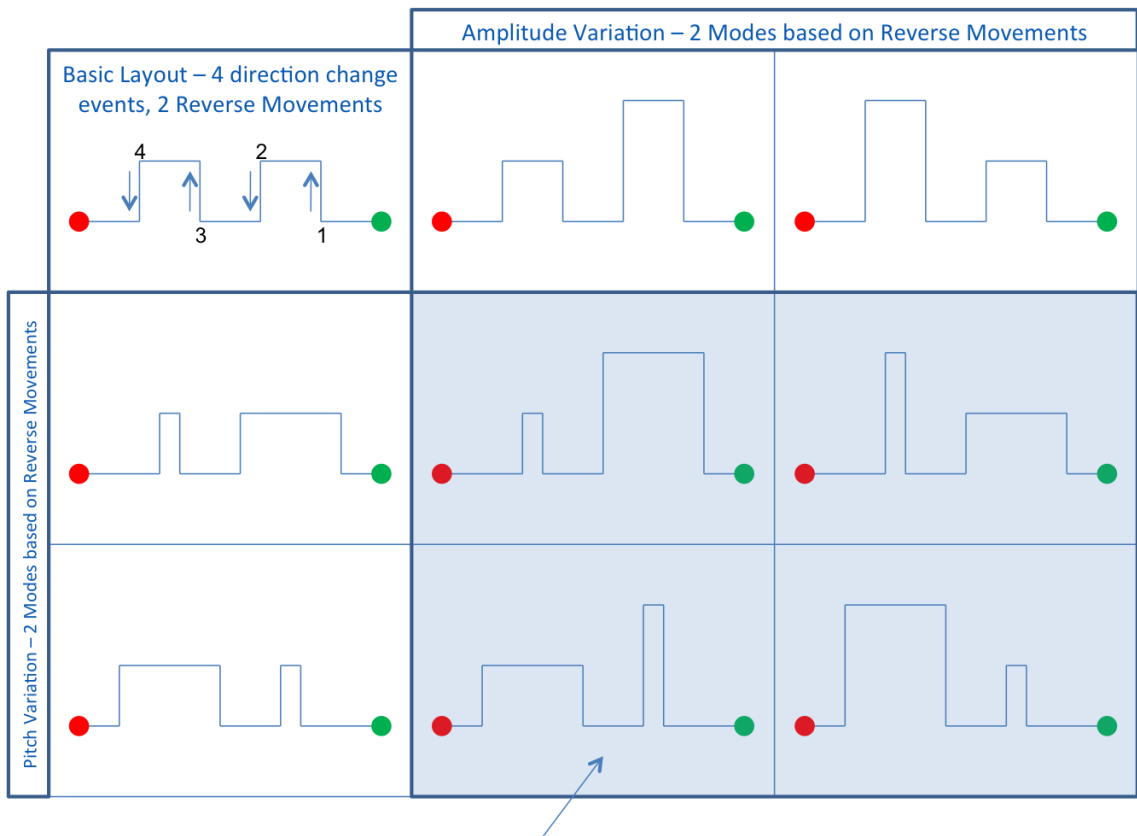
(Arabic Alphabet)

انواع الكلمات		
كلمات اللهجه العاميه	كلمات اللهجه العاميه	كلمات اللهجه العاميه
طق	صور	برى
جنطه	جمل	جدار
قنفه	تفاح	يفعل
قفشه	خروف	فراغ
منظره	حمامه	طعام
نقنوف	ورد	مقعد
دريشه	مكتبة	حكايه
زعلان	فراشة	مفيده

Appendix 5- Visual short term memory tasks' shapes

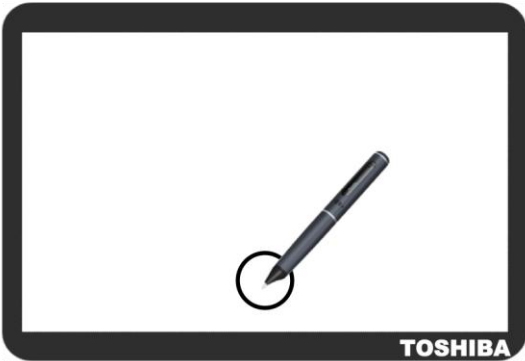


More Difficult – 2 Parameter Variation

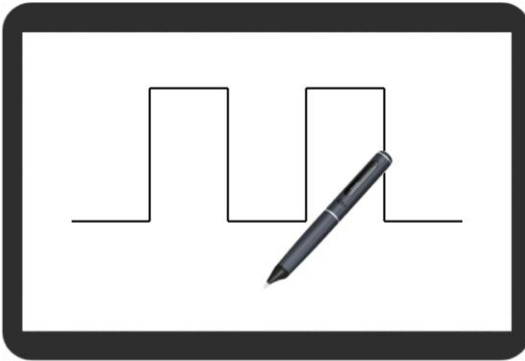


More Difficult – 2 Parameter Variation

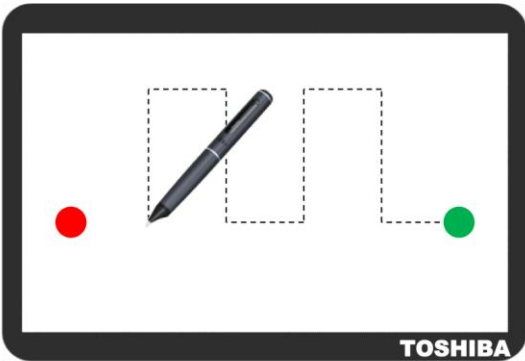
Appendix 5- visual short term memory task's instructions



- You should wait until a white dot appears
- Put the pen on the white dot without touching the screen with your hand
- Do not move the pen
- Waite until you see a shape
- Do not move the pen



- look at the shape
- Remember the shape



- drew the shape starting from the green dot to reach the red dot as well and fast as you can
- Take the pen off the screen and wait for the white dot again
- You will play this game following the same instructions several times