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Developmental Variation in Predictors of Reading Comprehension amongst Maltese Students

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Abstract: This study examined cognitive and language skills that are predictive of reading comprehension in Maltese in typically developing students of different ages. A structured random sample of three different grade groups of Maltese state school students, aged between 9 and 12 years participated in this study. This sample was representative of the population. They were administered a Maltese Reading Comprehension test together with three word-level tests (Non-Word Reading, Digit Span, and Rapid Naming), and three understanding-level tests (Jumbled Sentences, Listening Comprehension, and Ravens Progressive Matrices). Statistical analyses indicated that Reading Comprehension scores were primarily related to scores on listening comprehension and syntactic awareness (Jumbled Sentences). However, the youngest students showed greater influence of word-level processes on reading comprehension in contrast to their older peers.

Keywords: Reading comprehension; Maltese speakers; Simple model of reading; Predictors of reading comprehension

Introduction

Reading for meaning involves an array of different language and cognitive skills. Each skill necessitates the interaction with other skills in order for successful reading to occur (Norton & Wolf, 2012). These skills are initiated in the early years of reading and gradually improve and develop throughout the school years. Unlike oral language acquisition (Minagawa-Kawai et al, 2011), brain structures are not predisposed to learn how to read. The ability to get information from print activates a number of brain areas 'that support every level of language-phonology, morphology, syntax and semantics, as well as visual and orthographic processes, working memory, attention, motor movement and higher order comprehension and cognition' (Norton & Wolf, 2012, p 429) . Therefore, successful understanding demands that the learner acquires complex skills and develops strategies to utilise these skills effectively when reading.

The objective of this paper is to investigate which language and cognitive skills are more likely to predict reading comprehension in Maltese. The evidence so far argues for two basic processes in reading comprehension: word decoding and language understanding (sometimes referred to as the Simple Model of Reading: Gough & Tunmer, 1986; Hoover & Gough, 1990). However, it is being questioned as maybe too simple (Hoffman, 2017), while there is also a need for more investigation as to what skills underlie word decoding and language understanding processes. The model suggests that reading comprehension occurs when a learner decodes words (familiar and unfamiliar), while also having strong oral language/linguistic comprehension (Fricke, Bowyer-Crane, Haley, Hulme & Snowling, 2013). Some (e.g. Eason, Sabatini, Goldberg, Bruce & Cutting, 2013), have also included reading fluency as being a significant predictor for reading comprehension. Clearly understanding each of these components will have significant implications for both assessment and intervention.

Word-level processes

It is word decoding, phonological processing and letter-sound translation that have been the focus of much of the research. Indeed, there is considerable evidence that phonological skills are related to the acquisition of reading in the English language (Castles & Coltheart, 2004; Hulme, Bowyer-Crane, Carroll, Duff & Snowling, 2012), while mapping between the printed and spoken word has been considered of central importance in learning to read in many languages (see Smythe, Everatt, Al-Menaye, He, Capellini, Gyarmathy & Siegel, 2008; Zeigler & Goswami, 2005). For example, previous and current research have suggested that a phonological processing deficit is the core cognitive-linguistic reason for reading failure (Snowling & Hulme, 2012). The ability to read involves the awareness and manipulation of letter sounds and

the ability to string these sounds together to form a word. Mastery in this area will assist in making word recognition (for both old and new words) a simple and automatic task. These fluent decoding skills are necessary not only for word reading but also for successful reading comprehension (Perfetti & Stafura, 2014).

The ability to translate letter sequences into appropriate sound forms, has been typically assessed through non-word reading measures. Non-word reading cannot be performed by visual whole word recognition that readers may use with familiar words. It requires the child to recognise and translate the letter units smaller than the whole word. Therefore, asking children to read non-words provides a test of phonological decoding (Elbeheri, Everatt, Mahfoudhi, Al-Diyar & Taibah, 2011).

Cross-language studies suggest that the specific relationship between reading ability and phonological decoding may vary across languages/scripts, thus clarifying the precise role that phonological deficits play in different orthographies (Smythe et al., 2008). For example, whereas accuracy of decoding may be a useful tool to identify reading difficulties in English, they may be of limited value when assessing poor readers of transparent languages which have a stronger one-to-one relationship between meaning and form (see Goulandris, 2003). Many studies conducted on highly transparent orthographies argue for reading rate being a better way of distinguishing between poor and good readers (see discussions in Goswami, 2000; Smythe & Everatt, 2004). For successful understanding, reading needs to be automatic as well as precise. This automatic process will allow for more mental resources to enable the meaning of what was read to be accessed easily and rapidly by the reader. Studies have confirmed that poor rapid naming (accompanied by poor decoding) is one of the best predictors of reading failure and dyslexia (e.g. Kirby, Parrila & Pfeiffer, 2003; Savage & Frederickson, 2005; Norton & Wolf, 2012). Wolf, Bowers and Biddle (2000) point out that a significant number of individuals with reading problems do not have phonological decoding difficulties but nevertheless show deficits in naming or naming-speed tasks. They suggested a double deficit hypothesis in which both phonological problems and rapid naming deficits can be independent causes of reading difficulties. Similarly, rapid naming speed was related to reading ability across languages that vary in orthographic consistency (Georgiou, Parrila, Liao, Writ, 2008). Therefore, rapid naming is similar to phonological decoding in being a potential predictor of reading acquisition and reading disability. Hence, when investigating processes involved in word-level reading, measures of rapid naming need to be considered.

Another related but separately assessed predictor of reading comprehension has been the adequacy of short term memory (see Long, Johns, & Morris,

2006). Studies across different languages have suggested that children who experience difficulties with retaining sounds in short term memory are likely to have problems with the acquisition of verbal vocabulary and the development of stable graphic-sound associations, both of which can impact on reading and listening comprehension, as well as on language acquisition. Indeed, measures of short-term retention of information have been found to be predictive of future literacy levels and educational achievement (Gathercole, Brown & Pickering, 2003; Gathercole & Pickering, 2000). Again, such short-term memory tasks are potential predictors of reading comprehension levels.

Understanding-level processes

While the ability to recognise a word and identify meaning from that word are both important aspects of reading (Perfetti et al., 2005), yet they are not necessarily the same skill (Muter, Hulme, Snowling & Stevenson, 2004). Uncertainties have been expressed as to whether problems in reading comprehension are due primarily to a decoding difficulty (Keenan, Betjemann, Wadsworth, DrFries & Olson, 2006). Similarly, there are many cases where children's decoding abilities have been found to be intact despite poor reading comprehension skills (e.g. Cain, Oakhill & Bryant, 2004; Adlof, Perfetti & Catts, 2011 & Oakhill, Cain and Elbro, 2014). For instance, Cutting and Scarborough (2006) reported that between 10% to 25% of poor readers did not exhibit decoding and single word reading difficulties. Similarly, Spooner, Gathercole and Baddeley (2006) found that 10% to 15% of school age children exhibited comprehension difficulties, despite demonstrating a good level of decoding skills.

Furthermore, evidence shows that, although there are significant relationships between decoding skills and comprehension skills in the early years of a child's reading development, this correlation decreases as the child matures (Catts, Hogan & Adolf, 2005, Oakhill et al, 2014). Listening comprehension in older children becomes more highly correlated with reading comprehension, especially in transparent languages (Gentaz, Sprenger-Charolles, Theurel, 2015). The suggestion that a phonological influence on reading comprehension is greater in a child's early reading development compared to later calls for the need to acknowledge that a percentage of children have comprehension difficulties due to reasons other than word decoding problems. Evidence for a dissociation between decoding and comprehension skills (Keenan & Betjemann, 2006; Oakhill, 1994) suggests that problems exhibited in reading comprehension do not occur merely due to phonological and orthographic processing deficits (Perfetti et al., 2005). Evidence also argues for levels of expressive language (e.g., Muter et al., 2004) and syntactic processing (Cain, 2010; Kahmi & Catts, 2012) to be positively related to reading comprehension, and that these elements may predict

reading comprehension over-and-above the level of prediction provided by decoding skills. Two separate longitudinal studies (Nakamoto, 2008, and Gottardo & Mueller, 2009) on Spanish children learning English as a foreign language found that, in addition to decoding skills, listening comprehension as well as knowledge of vocabulary were significant in the prediction of reading comprehension in both Spanish and English. Interestingly the influence of decoding as a predictor of reading comprehension decreases over time. Other skills, such as listening comprehension (Catts, Adolf & Weismer, 2006, Geva & Farnia, 2012) combined with vocabulary (Ouellete & Beers, 2010), morphology and syntactic knowledge (Lesaux & Kieffer, 2010) show more unique variance by the time the child is 13 years old.

The role of syntactic awareness and its relationship with reading ability has grown in importance over the years (Leikin, 2002). To make sense of text, words and sentences need to be assimilated in a structured, linear and coherent way (Alderson, 2000; Leikin, 2002). For example, it has been documented that vocabulary and syntactic knowledge are necessary skills for reading comprehension (e.g. Oakhill et al., 2014). Shiotsu (2007) suggests that syntactic awareness may be an even stronger predictor of reading comprehension than vocabulary. On the other hand, it has also been proposed that a syntactic difficulty on its own is not the specific reason for poor reading levels (see discussions in Perfetti et al., 2005). The answer as to whether syntactic awareness difficulties are a language difficulty per se, or whether they form part of a phonological deficit in poor readers, is still uncertain. However, various studies suggest that proficiency in syntactic awareness can support word decoding in addition to playing an essential role in reading comprehension and, therefore, being a strong predictor for reading comprehension (Oakhill et al, 2014). This was further demonstrated in children with reading comprehension difficulties who, in the absence of decoding problems, scored badly in word order activities, a skill that is considered the basis of syntactic awareness (Nation & Snowling, 2000).

From a young age, children are taught how to decode single words, as well as derive meaning from these words. Learners are expected to understand the meaning at word, sentence and whole passage levels within different contexts and genres (Perfetti, Landi & Oakhill, 2005). Nonetheless, the available evidence in British and American studies, suggest that 3-10% of school age children have intact word recognition and decoding skills, yet, they have difficulty to derive meaning from what they read**.** Current evidence (e.g. Oakhill et al, 2014; Cutting et al, 2013) validates the view that reading difficulties can be differentiated between two types of learners; those who have difficulty understanding at word level and those who have difficulty understanding text at sentence and passage level. Knowing what sub-skills are involved in the development of expertise in reading comprehension, and how they occur at different levels of reading, would be most useful for

understanding the challenges experienced by struggling readers and for developing relevant intervention procedures. For this reason, both syntactic awareness and listening comprehension activities were seen as valid measures to use when evaluating skills related to reading comprehension.

Moreover, this study aims to investigate whether the challenges for reading comprehension in Maltese, are similar to those reported in studies from other countries. Again this will be most useful for understanding and supporting Maltese readers.

Method

The aim of this study was to investigate influences of word-level and understanding-level processes on Maltese reading comprehension. A quantitative design was required in order to be able to determine which of the several components of reading comprehension ability would predict performance on reading comprehension as the dependent variable.

Participants

The sample consisted of a representative sample of 126 typically developing children attending Maltese state schools (see Table I). In order to capture relevant developmental levels in reading comprehension, these were selected from three different grades and age-groups which would be expected to have reached a level of comprehension that evidenced both word-level and understanding-level influence (based on the model of Wilson & Rupley, 1997). In the Maltese education context, these would be students aged 9 to 11 and attending the last two years of Primary school (Year 5 and Year 6), as well as students who are aged between 11 and 12 and attending Secondary school (Form 1). None of the participants had evidence of prolonged problems with reading development or specific learning difficulties (based on school reports). All students were Maltese speakers as would be expected from most of the population of students attending state schools in Malta (Baldacchino, 1996; Firman, 2007). Final inclusion in the present data set was based on the granting of guardian consent, school records confirming no recorded disability or difficulty, and completion of all tests.

Table I: Number of participants by Grade, Age, and Gender

	Year 5 Primary	Year 6 Primary	Form 1 Secondary	Total
Mean Age in Yrs	9.48	10.44	11.51	
(*SD*)	(0.43)	(0.38)	(0.34)	
Male	19	24	16	59
Female	21	20	26	67
Total	40	44	42	126

Stratified random sampling ensured that these students were representative of the population of students in Maltese state schools. Three primary schools and two secondary schools were randomly selected. The targeted year groups were Year 5 and 6 for the Primary years and Form 1 for the Secondary years. Each of these schools had four different classes with approximately 24 students per class per year group. In order to select an appropriate number of students in each year group, the parents of every fourth student on the Year 5 or Year 6 register were given a consent form by the school to be given permission to participate in the project. A similar process was undertaken in secondary schools, with the parents of every fourth student, from five different classes per school, on the Form 1 registers of the schools being asked for consent for their child to participate. Out of the 204 consent forms that were distributed by the school to the parents, a total of 126 students were granted permission to participate (See Table I). There was no evidence of any particular group differences between those who gave the consent and those who did not.

Each student completed a number of tasks over a period of two days. The tests were divided into group tests and individual tests. Group testing included a syntactic awareness exercise, a listening comprehension and the non-verbal activity. The group session lasted approximately 50 minutes. The individual activities included reading comprehension activity, where the number of reading errors as well as the number of time taken to read the passage was noted. In Addition, the individual session included a non-word reading exercise, a digit span exercise and a rapid naming exercise. The individual session took around 25minutes per participant. The time taken with each student depended on the reading ability of the student.

Measures

Given the studies on word-level processes reviewed in the introduction, the present study included a measure of non-word reading in order to assess specifically letter-sound translation skills within Maltese text reading. However, given the evidence that rapid naming and verbal short-term memory may be better predictors of word level literacy skills amongst children learning a more transparent orthography, such as Maltese, these measures were also included to investigate the influence of word-level processes on Maltese reading comprehension.

In addition, based on the review of predominantly English literacy acquisition work, the present study included measures of listening comprehension and syntactic awareness to assess the influence of understanding-level processes on Maltese reading comprehension. Finally, understanding has often been associated with intelligence and those with

higher scores on intelligence tests typically score higher on comprehension measures (Lynn & Mikk, 2009; Rathvon, 2004). Therefore, a non-verbal reasoning task (Raven's Matrices Task) was included in the study to determine the influence of this area of processing on Maltese reading comprehension. A non-verbal measure was selected to reduce the specific influence of verbal skills on the relationship between reasoning and reading comprehension.

Newly written reading comprehension passages, as well as a number of word- and understanding-levelled tests were developed specifically for this study (see below). The study used three measures of word-level processes, namely non-word decoding (Non-Word Reading), rapid naming (Rapid Naming Task) and verbal short-term memory (Digit Span), and two measures of understanding-level processes, namely the measures included a Listening Comprehension measure, Syntactic Awareness measure and non-verbal reasoning activity (Raven's Matrices Task). All measures were presented and performed in the Maltese language/orthography. Existing tests were used or measures were developed based on those in other languages (primarily in the English language). All measures were piloted prior to data collection to ensure that they were appropriate for the targeted population.

Passage Reading Speed and Comprehension

Due to the lack of a standardized Maltese Reading Comprehension Test, this measure was developed for the present study. A set of six Maltese written passages were constructed based on the format used in the Neale Analysis of Reading Ability (NARA II) (Neale, 1989) and the Gray Diagnostic Reading Comprehension Tests (Wiederholt & Bryant, 2001). In order to develop passages appropriate for the target population, the content of the passages comprised adaptations of texts in the reading books that formed part of the Year 6's Maltese syllabus. Comprehension questions were then developed based on the content of each passage. Pilot work was conducted with students independent of those in the present study to ensure that the passages and questions were appropriate for the target grades. Data from this pilot work indicated good reliability levels for the test, as well as expected improvements in scores with grade. Additionally, good correlations were found between this Maltese comprehension measure and the NARA II, which was performed in English given that the students in the pilot work were Maltese-English bilinguals and were acquiring literacy in both languages.

Passages were developed such that the number of words and level syntactic and semantic complexity progressed gradually from one reading passage to the next, the first passage being the easiest and the last passage being the most difficult. Questions that assessed the degree of comprehension also increased in number per passage, from 4 to 8 each for the six passages used in

the test. Comprehension questions were designed such that either the answers could be found directly in the passage or the questions needed an amount of inference requiring the application of general knowledge or the combination of details across different sections of the passage. According to Oakhill, Cain and Elbro (2014) the accomplishment to infer accurately is essential to determine whether or not a student has understood what he/she has read. It is necessary for the reader to be able to integrate and infer his/her understanding on two separate but related levels: on a sentence level and on a general knowledge one.

Initial piloting involved 11 passages with these being reduced to the best 6 in terms of improvements with age and reliability. All 6 passages were read aloud by the student allowing the assessor to time reading. After the student had read a passage, they were asked the open ended comprehension questions related to that passage. A record was taken of the time taken to read each passage which was turned into a reading speed score. The number of correct answers given to the comprehension questions was turned into a comprehension score.

Non-Word Reading

The Non-Word Reading measure used in the current study comprised 24 non-words (items and procedures followed those used in similar English-language measures: see, e.g., Snowling, Stothard & McLead, 1996). Each non-word was created following Maltese orthographic rules and was decodable based on Maltese alphabetic coding (e.g. non-word = nir, original Maltese word is 'nar' meaning fire; non-word = sarmil, original Maltese word is 'barmil' meaning bucket; non-word = ġelaq, original Maltese word is 'ġelat' meaning ice-cream). The non-words had different syllable formats, ranging from one to four. To produce a simple increase in pronunciation difficulty, the non-words were presented to the participants in increasing syllable order from one to four syllables. The duration that the participant took to read all 24 items was recorded to provide a measure of the speed of non-word reading. The number of non-words read correctly, based on Maltese orthographic rules, was used as a measure of non-word reading accuracy. These two measures combined provide a measure of non-word reading fluency.

Verbal Short-Term Memory

A Forward Recall Digit Span procedure was adopted to assess verbal short-term memory. This was based on typical procedures in the literature, such as in the Wechsler Intelligence Scale for Children (Wechsler, 1992), the Working Memory Test for Children (Pickering & Gathercole, 2001), and the Bangor Dyslexia Test (Miles, 1993). The participants were asked to repeat a number of digits that were orally presented at half second intervals by the assessor. At

the beginning, the participant was given three practice trials, the first with one digit, the second with two digits and the third with three digits. Once the student completed successfully these trials, blocks of test items were presented. Each block comprised six trials of a set number of digits per trial. The number of digits presented in the sequences increased by one digit every six trials. If the participant answered four out of the six trials correctly, they moved on to the next block of trials. If they did not, testing was stopped. Testing continued until the student failed a block. The total number of trials performed correctly was used as the score for this test.

Rapid Naming task

A familiar object naming task was used to assess the students' naming speed. This task was included in order to understand the speed at which participants process information from their lexicon and was derived from similar measures in the literature (see also Wolf et al, 2000). The participant was presented with 2 charts, one at a time, with each chart containing 24 pictures/drawings of familiar objects. The first chart comprised repetitions of five different objects (*xiħ* [old man], *ċerva* [deer], *ballun* [ball], *serp* [snake], *ċavetta* [key]), whereas the second comprised repetitions of six different objects (*kelb* [dog], *xemx* [sun], *umbrella* [umbrella], *ankra* [anchor], *bieb* [door], *ktieb* [book]). In the 5-object card, three names were 1-syllable words, one name was a 2-syllable word, and the fifth was a 3-syllable word. In the 6-object card, four names were 1-syllable words, one name was a 2-syllable word, and the last was a 3-syllable word. The times that the participant took to name all items on each card were recorded, along with any naming errors. Given the small number of naming errors, analyses focused on the timing, with these being combined across trials to provide a single speed score for this task.

Listening Comprehension

Due to there being no standardized measure of listening comprehension available in the Maltese language, this measure was developed purposely for this research in a similar way to the reading comprehension measure. The test comprised four short sentences/passages that were read to the students twice – the second reading of each passage following immediately after its first reading. Pilot work determined that these passages were appropriate for the skill level of students assessed in the current study. The student did not see the written form, but was required to listen to comprehend. Once each passage was read and repeated, the participants were asked questions about the content of the sentence/passage. Questions required simple yes/no verbal answers to avoid written or detailed verbal responses interfering with the measure of comprehension. Answers to questions also required a degree of inference in order to ensure that the difficulty level was appropriate for the

group of students tested, that is, late primary/early secondary school students.

Syntactic Awareness

Again a measure of syntactic awareness was specifically developed for the current study, using a Jumbled-Sentences Test. Ten different sentences were selected from four different school books that were used across the relevant three different grade levels. Sentences varied in length from a few words that created simple sentences to a larger number of words that formed more complex sentences. The words were jumbled and students were asked to put the words in the correct order to make grammatically correct and meaningful sentences. A score was computed on the basis of the number of grammatically correct sentences produced (out of 10).

Non-verbal reasoning ability

The *Standard Ravens Progressive Matrices* (Raven, Court, & Raven, 1996) was selected to assess non-verbal ability levels of the participants. This test is often considered a measure of non-verbal reasoning skills that shows low correlations with word-level literacy, but is also related to IQ scores (see Kunda, McGreggor & Goel, 2010). Participants were given a detailed explanation and examples of what was expected from them. They were then given the matrices to work through on their own and at their own pace – no time limit was imposed. Each item comprised a sequence of abstract shapes that followed a logical order. The student's task was to select, from the multiple-choice items provided, the item that followed the sequence based on the logical order. The number of items in which the correct shape was selected constituted the score.

Results

Preliminary analyses revealed that the score distribution for the Maltese Reading Comprehension Test showed normality across all grades (Figure 1). The Shapiro Wilk test shows that all p-values exceed the 0.05 level of significance (Table II). This allows the use of parametric tests and regression analysis to analyse Maltese Reading Comprehension Measures.

Table II: Shapiro Wilk Test of Normality of Reading Comprehension scores by grade group

		Statistic	df	P-value
Maltese Reading Comprehension	Year 5	0.968	40	0.315
	Year 6	0.969	44	0.288
	Form 1	0.971	42	0.348

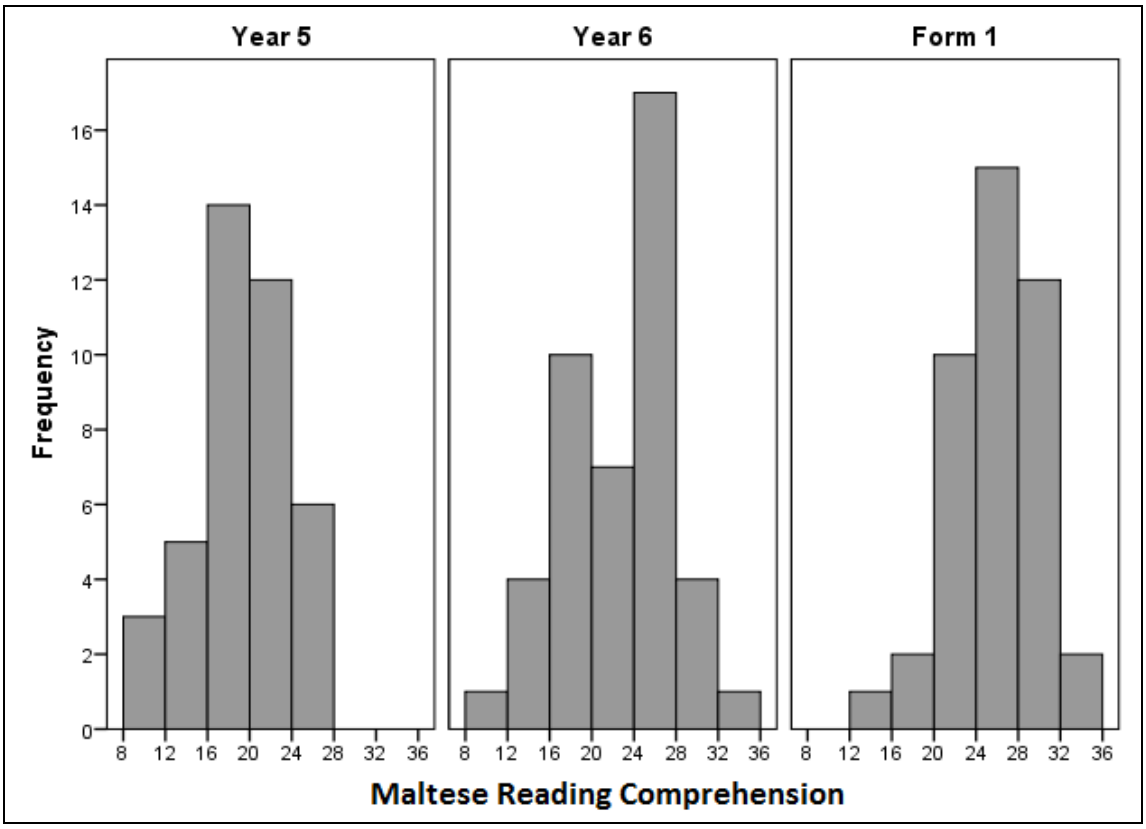

Figure 1: Histogram of distribution of Reading Comprehension scores for each grade group

The One-Way Anova test (see Table III) and the Tukey Post Hoc tests (see Table IV) reveal that the mean Maltese reading comprehension scores varied significantly between grades when compared pairwise.

Table III: One-Way ANOVA Test of Reading Comprehension scores obtained by the three grade groups

	N	Mean	Std. Dev.	Std. Error	Minimum	Maximum
Year 5	40	19.00	4.438	.702	10	27
Year 6	44	22.11	5.319	.802	8	34
Form 1	42	25.52	4.092	.631	14	33

$F(2, 123) = 20.112$, $p < 0.001$

Table IV: Multiple Comparisons (Tukey HSD) between the scores obtained by the three grade groups

(I) Class group	(J) Class group	Mean Difference (I-J)	Std. Error	P-value
Year 6	Year 5	3.114	1.018	0.008
Form 1	Year 5	6.524	1.030	0.000
Form 1	Year 6	3.410	1.005	0.003

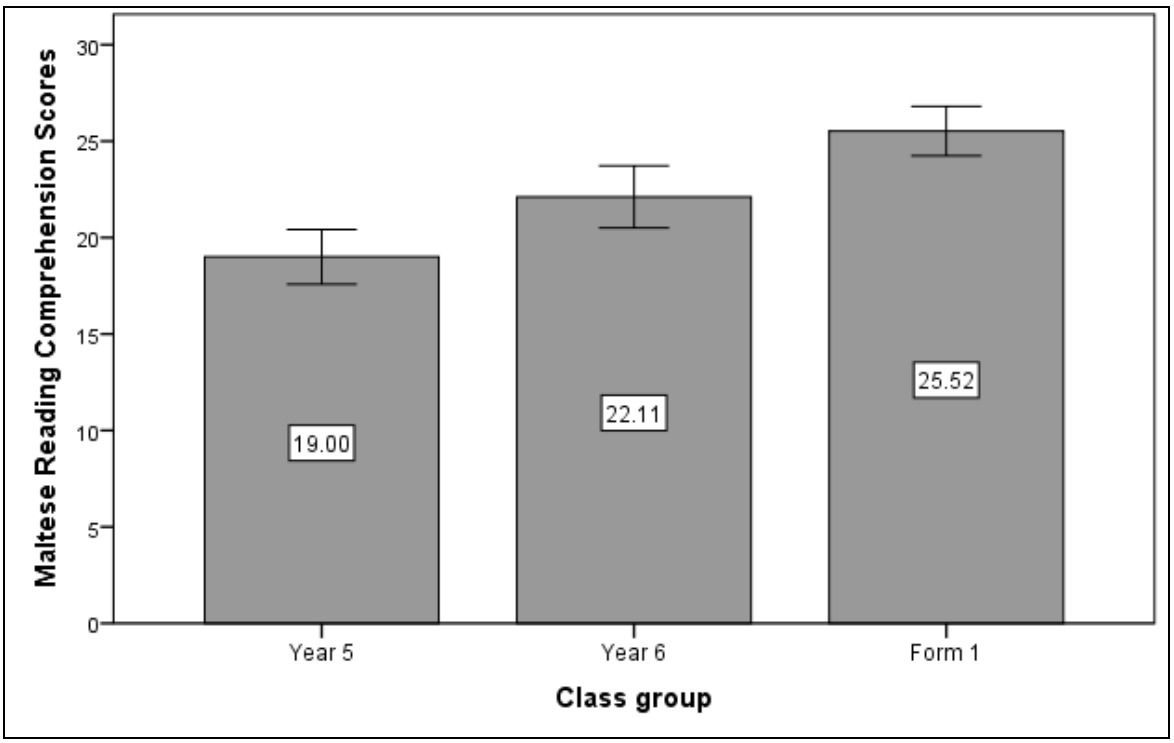

Figure 2: Error bar graph of the Reading Comprehension scores obtained by the three grade groups

Figure 2 presents an error bar graph displaying the 95% confidence interval of the actual mean Maltese reading comprehension scores for each class group. This provides a range of values where the mean score would lie, with 95% degree of confidence, if the whole student population was assessed. The fact that the confidence intervals are disjoint indicates that the improvement recorded each year in Maltese reading comprehension is significant at the 0.05 level of significance.

Table V: Participants' mean scores on Maltese Comprehension and on each subtest by year group

		Year 5	Year 6	Form 1
Maltese text reading time	**Mean**	913.22	803.05	670.31
	SD	286.37	270.27	181.95
	Min	524	479	433
	Max	1571	1639	1146
Non-word reading	**Mean**	22.33	22.41	22.79
	SD	3.38	2.69	2.51

	Min	9	14	16
	Max	25	25	25
Rapid naming speed	**Mean**	44.02	43.05	38.31
	SD	10.36	8.03	7.60
	Min	0	30	26
	Max	57	68	60
Rapid naming errors	**Mean**	0.05	0.11	0.05
	SD	0.22	0.39	0.22
	Min	0	0	0
	Max	1	2	1
Digit span	**Mean**	39.93	40.00	41.12
	SD	5.37	6.62	8.31
	Min	28	26	22
	Max	49	50	51
Listening comp	**Mean**	21.78	21.77	21.48
	SD	2.37	2.42	3.13
	Min	15	14	10
	Max	26	26	25
Syntactic awareness	**Mean**	7.15	7.07	7.90
	SD	1.00	1.74	1.51
	Min	5	1	5
	Max	9	10	10
Non-verbal ability	**Mean**	34.53	35.68	38.60
	SD	7.81	7.68	8.39
	Min	14	11	15
	Max	46	50	52

Descriptive statistics of the scores on each of the measures are presented in Table V. The results comply with the expected progression of the scores when using grade level.

Predictors of reading comprehension

First-order correlations and partial correlations controlling for age, Year/Form and gender of participant for the cohort as a whole were calculated (see Table VI). Overall, these analyses suggested a stronger relationship between reading comprehension and understanding-level processes, with both the Listening Comprehension and Syntactic Awareness measures showing larger partial correlations than the ord-level measures.

The major limitation of correlation analysis is that it investigates solely the relationship between a dependent variable and a single continuous predictor. However, the goal of many research studies is to estimate collectively the quantitative effect of the predictors upon the dependent variable that they influence. It is well known that a lone predictor could be rendered a very important contributor in explaining variations in the responses, but would be

rendered unimportant in the presence of other predictors. In other words, the suitability of a predictor in a model fit often depends on what other predictors are included with it. To resolve this problem, regression analysis was conducted to assess the collective contribution of word-level and understanding-level processes in explaining variation in reading comprehension scores.

Table VI: First order correlations (lower diagonal) and partial correlations (controlling for age, year/ Form and gender) between the measures in the study for all participants in Year 5, Year 6 and Form 1

	Rd Comp	Rd Speed	NW Acc	NW Spd	RN Spd	RN Err	Dig Span	List Com	Syn Aw	NV Abil
Rd Comp		-.292	.265	-.272	-.207	-.019	.242	.348	.406	.156
Rd Speed	-.416		-.530	.729	.107	.027	-.171	-.265	-.313	-.203
NW Acc	.234	-.508		-.508	.034	-.024	.081	.128	.268	.169
NW Spd	-.396	.752	-.483		.202	.004	-.027	-.166	-.178	-.178
RN Spd	-.300	.202	.018	.261		.048	-.108	-.203	-.225	-.147
RN Err	-.002	.034	-.035	-.008	.059		-.128	.080	-.093	.019
Dig Span	.316	-.251	.093	-.097	-.178	-.136		.181	.206	.206
List Com	.252	-.237	.131	-.121	-.202	.052	.182		.257	.173
Syn Aw	.422	-.372	.254	-.206	-.298	-.118	.272	.281		.378
NV Abil	.224	-.270	.177	-.217	-.210	-.002	.260	.186	.432	

Key: Rd Comp = Reading Comprehension, Rd Speed = Reading Speed, NW Acc = Non-Word Reading Accuracy, NW Spd = Non-Word Reading Speed, RN Spd = Rapid Naming Speed, RN Err = Rapid Naming Errors, Dig Span = Verbal Short-Term Memory, List Com = Listening Comprehension, Syn Aw = Syntactic Awareness, NV Abil = Non-Verbal Ability.

By considering the Reading Comprehension measure as the dependent variable and the word-level and understanding-level measures as predictors, a regression model was fitted after controlling for age, year/form and gender. Two entry sequences were used: one where the word-level measures preceded the understanding-level measures, and a second where the word-level measures followed the understanding-level measures (subscripts (i) and (ii) in Table VII respectively). These alternate entry sequences were performed to assess any unique contributions to Maltese reading comprehension. For both models, the R-squared value was used to assess goodness of fit.

In the regression analyses, the understanding-level measures predicted roughly an additional 9% of variability in reading comprehension scores over-and-above the word-level measures, whereas the word-level measures increased the level of prediction over the understanding-level measures by 4%. These results were consistent with existing findings showing greater

influences from understanding-level processes on reading comprehension skills.

Table VII: Results of regression analyses investigating predictors of Reading Comprehension scores by age, gender and grade group in Years 5, Year 6 and Form 1

	Variables	**R^2**	**R^2change**	**Sig R^2 change**	**Final Beta***
1	Age, gender and year/ Form	.278	.278	F(3,122)=15.63, p<.001	age .444; gender -.123; year/form -.022
(i)					
2	Word-level processes	.401	.123	F(5,117)=4.81, p<.001	NWA .085; NWS -.117; RNS -.065; RNE .014; Digit Span .125
3	Understanding-level processes	.486	.085	F(3,114)=6.32, p=.001	ListComp .183; SyntAw .263; NVAbil -.060
(ii)					
2	Understanding-level processes	.443	.166	F(3,119)=11.79, p<.001	
3	Word-level processes	.486	.043	F(5,114)=1.92, p=.097	

Key: NWA = Non-Word Reading Accuracy; NWS = Non-Word Reading Speed; RNS = Rapid Naming Speed; RNE = Rapid Naming Errors; ListComp = Listening Comprehension; SyntAw = Syntactic Awareness; NVAbil = Non-Verbal Ability

*The beta coefficients are standardized regression coefficients so that the variances of the dependent variable and predictors are 1. Standardization of these regression coefficients is essential to identify which predictors have the larger effect on the dependent variable, particularly when the predictors' values have different ranges or are measured in different units. Predictors with larger beta coefficients have larger impact on Maltese Reading Comprehension scores.. The beta coefficients are identical for analyses (i) and (ii), as the order of entry does not affect their size.

Further analyses were performed focusing on the different grade groups. Correlations between Reading Comprehension scores and the other measures in the study were calculated for each group separately. For Year 5 students, Maltese Reading Comprehension scores are positively and significantly related to Syntactic Awareness and Non-Word Speed and negatively and significantly related to Reading Speed and Non-Word Speed scores. Other

pairwise relationships with Maltese Reading Comprehension are not significant at the 0.05 level of significance.

For Year 6 students, Maltese Reading Comprehension scores are positively and significantly related to Listening Comprehension scores. Other pairwise relationships with Maltese Reading Comprehension are not significant at the 0.05 level of significance.

For Form 1 students, Maltese Reading Comprehension scores are positively and significantly related to listening comprehension, non-verbal ability, and syntactic awareness and negatively and significantly related to reading time and time Rapid naming scores. Other pairwise relationships with Maltese reading comprehension are not significant at the 0.05 level of significance.

Table VIII: Correlation analysis of Reading Comprehension scores with each of the independent variables

	Year 5		Year 6		Form 1	
	Correlation	P-value	Correlation	P-value	Correlation	P-value
Reading time	-0.434	0.005	-0.154	0.318	-0.336	0.029
Total number of reading error	-0.036	0.838	-0.118	0.464	-0.184	0.256
Listening Comprehension	-0.117	0.472	0.421	0.004	0.569	0.000
Non-verbal ability	0.018	0.910	0.040	0.798	0.400	0.009
Syntactic awareness	0.479	0.002	0.295	0.052	0.462	0.002
Non word reading	0.394	0.012	0.078	0.615	0.246	0.116
Non word time	-0.463	0.003	-0.169	0.274	-0.287	0.065
Time rapid naming	-0.105	0.519	-0.202	0.188	-0.359	0.030
Rapid naming errors	0.026	0.873	-0.108	0.485	0.248	0.114
Digit recall	0.058	0.724	0.166	0.280	0.296	0.040

Regression analyses following the same procedures as for the whole cohort were performed for each grade cohort. These analyses were most consistent with a change in processing influence across the school years. Thus, the youngest group (the Year 5 students) showed more influence of word-level processes (Non-Word Reading Accuracy produced the largest partial correlation value for this group - see Table VIII) compared to the two older groups (Year 6 and Form 1), for whom in turn Listening Comprehension produced the largest partial correlation with reading comprehension. The regression analysis conducted on the Year 5 cohort shows that word-level and understanding-level measures explain comparable portions of the reading comprehension score variability (Table IX). On the other hand, the regression

analyses carried out on the Year 6 and Form 1 cohorts show that understanding-level measures explain a larger portion of the reading comprehension score variability than word-level measures (Table X and Table XI).

Table IX: Results of regression analyses investigating predictors of reading comprehension for the students in Year 5

	Variables	**R^2**	**R^2change**	**Sig R^2 change**	**Final Beta**
1	Age, gender and year/ Form	.302	.302	F(2,37)=8.02, p=.001	age .317; gender -.182;
(i)					
2	Word-level processes	.531	.228	F(5,32)=3.11, p=.021	NWA .285; NWS -.327; RNS -.074; RNE .207; Digit Span .055
3	Understanding-level processes	.652	.121	F(3,29)=3.57, p=.032	ListComp -.229; SyntAw .310; NVAbil -.312
(ii)					
2	Understanding-level processes	.467	.165	F(3,34)=3.50, p=.026	
3	Word-level processes	.652	.185	F(5,29)=3.08, p=.024	

Key: NWA = Non-Word Reading Accuracy; NWS = Non-Word Reading Speed; RNS = Rapid Naming Speed; RNE = Rapid Naming Errors; ListComp = Listening Comprehension; SyntAw = Syntactic Awareness; NVAbil = Non-Verbal Ability

Table X: Results of regression analyses investigating predictors of reading comprehension for the students in Year 6

	Variables	**R^2**	**R^2change**	**Sig R^2 change**	**Final Beta**
1	Age, gender and year/ Form	.023	.023	F(2,41)<1	age .358; gender .026;
(i)					
2	Word-level processes	.190	.167	F(5,36)=1.48, p=.220	NWA -.27; NWS -.29; RNS -.027; RNE -.177; Digit Span .235
3	Understanding-level processes	.362	.172	F(3,33)=2.97, p=.046	ListComp .428; SyntAw .168;

					NVAbil .059
(ii)					
2	Understanding-level processes	.276	.252	F(3,38)=4.41, p=.009	
3	Word-level processes	.362	.087	F(5,33)<1	

Key: NWA = Non-Word Reading Accuracy; NWS = Non-Word Reading Speed; RNS = Rapid Naming Speed; RNE = Rapid Naming Errors; ListComp = Listening Comprehension; SyntAw = Syntactic Awareness; NVAbil = Non-Verbal Ability

Table XI: Results of regression analyses investigating predictors of reading comprehension for the students in Form 1

	Variables	**R^2**	**R^2change**	**Sig R^2 change**	**Final Beta**
1	Age, gender and Year/ Form	.014	.014	F(2,39)<1	age .069; gender -.313;
(i)					
2	Word-level processes	.326	.312	F(5,34)=3.15, p=.019	NWA .048; NWS -.206; RNS -.166; RNE .226; Digit Span .120
3	Understanding-level processes	.547	.221	F(3,31)=5.04, p=.006	ListComp .549; SyntAw .095; NVAbil .007
(ii)					
2	Understanding-level processes	.440	.426	F(3,36)=9.14, p<.001	
3	Word-level processes	.547	.107	F(5,31)=1.46, p=.231	

Key: NWA = Non-Word Reading Accuracy; NWS = Non-Word Reading Speed; RNS = Rapid Naming Speed; RNE = Rapid Naming Errors; ListComp = Listening Comprehension; SyntAw = Syntactic Awareness; NVAbil = Non-Verbal Ability

Discussion

The results of the present study indicated relationships between Maltese reading comprehension and measures of listening comprehension and syntactic awareness in typically developing Maltese late primary/early

secondary school students. These relationships argue for Maltese reading comprehension at this level to be mainly a facet of linguistic processing, or understanding-level rather than word-level skills. However, in contrast to the older two school groups, the results also indicated that the youngest cohort of Maltese students showed roughly equivalent prediction from both understanding-level and word-level measures. These data were consistent with a grade or experience influence on predictors of Maltese reading comprehension.

Processing of individual words is an important factor in successful reading comprehension. According to Nagy & Scott (2000), accessing the meaning of about 90% of individual words in a text is necessary for a reader to understand a passage. Hence, word-level decoding processes are important. However, the current results illustrate that measures that required text processing beyond the individual word were stronger predictors of comprehension for typically developing Maltese readers, particularly in the older cohorts tested. A move from word-level to understanding-level influences would suggest that comprehension is becoming more sophisticated during this period of development, which may argue for decoding skills to exert a greater influence on early reading compared to later reading comprehension in Maltese.

This conclusion is consistent with the views of Catts et al. (2005) who proposed that phonological skills used in decoding processes are more important in the initial stages of reading, whereas for skilled comprehension to develop, higher level language skills need to be involved. Indeed, a similar pattern of change in major influence from word recognition/decoding to language/linguistic processing has been argued as being characteristic of English speaking cohorts about the same age range as targeted in the present Maltese study (cf. Wilson & Rupley, 1997; see also Muter et al., 2004). These data, therefore, argue for the same process of development to be occurring within this Maltese speaking cohort learning to be literate in the Maltese orthography as that found in first-language English speaking students, despite differences in the level of transparency of the two orthographies. It might be expected that, because Maltese has a much more regular orthography than English, word decoding skills would remain the primary predictor of literacy acquisition for longer than found in English (see similar arguments for the Arabic orthography by Abu-Rabia & Taha, 2006). Although the current data cannot totally refute this possibility, the data were not consistent with this hypothesis. Overall, these findings point towards the need for a modification of the simple model of reading to allow for different influences of the two basic processes in reading occurring at different points in the acquisition of reading comprehension skills, and that these influences can be relatively consistent across varying levels of orthographic transparency.

Overall, the data from these Maltese students argue that models of reading comprehension derived from English-language samples can be applied to understand the processes involved in text reading and reading disabilities in this relatively more regular orthography. Both the simple model, with the caveat that different aspects of the model can influence reading comprehension at different ages/levels of experience, and the phonological deficit model seem consistent with the data produced by these end of primary/early secondary Maltese school students. While further research is necessary to confirm these findings, they provide a basis on which to develop models of skilled and disabled reading in this orthography upon which assessment and intervention procedures can be developed. The findings highlight the need to give equal attention to linguistic understanding skills as to decoding skills for readers at all levels of proficiency (Allington & McGill-Franzen, 2017; Goodman, Goodman, & Allen, 2017).

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References

Abu-Rabia, S., & Taha, H. (2006). Phonological errors predominate in Arabic spelling across grades 1-9. *Journal of Psycholinguistic Research, 35*, 167-188.

Adlof, S.M., Perfetti, C., & Catts, H.W. (2011). Development changes in reading comprehension: Implications for assessments and instruction. In J.S. Samuels & A.E. Farstrup (Eds.), *What research has to say about reading instruction (pp 186–214)*. Newark DE: International Reading Association.

Alderson, J.C. (2000). *Assessing reading*. Cambridge: Cambridge University Press.

Allington, R.L., & McGill-Franzen, A. (2017). Comprehension difficulties and struggling readers. In S.E. Israel (Ed.), *Handbook of research on reading comprehension (2nd ed.) (pp. 271-292).* New York: Guilford Press.

Baldacchino, A. (1996). *L-Uzu tal-Malti u l-Ingliz fl-Iskola Primarja: Analizi ta' Klassi*. Malta: University of Malta.

Castles, A., & Coltheart, M. (2004). Is there a causal link from phonological awareness to success in reading? *Cognition*, 91, 77-111.

Cain, K., Oakhill, J. & Bryant, P. (2004). Children's reading comprehension ability: Concurrent prediction by working memory, verbal ability and component skills. *Journal of Educational Psychology, 96*, 31-42.

Cain, K. (2010). *Reading development and difficulties.* Chichester, West Sussex, U.K.: BPS Blackwell.John Wiley.

Catts, H,W, Adlof, S,M, & S,E Weismer (2006) Language deficits in poor comprehenders: A case for the simple view of reading. Journal of Speech, Language, and Hearing Research 49 (2), 278-293

Catts, H.W., Hogan, T.P. & Adolf, S.M. (2005). Developmental changes in reading and reading disabilities. In H.W. Catts & A.G. Kamhi (Eds.). The connections between language and reading disabilities. Mahwah, NJ: Erlbaum.

Cutting, L. E., Clements-Stephens, A., Pugh, K. R., Burns, S., Cao, A., Pekar, J. J &Rimrodt, S. L. (2013). Not all reading disabilities Are dyslexia: Distinct neurobiology of specific comprehension deficits. *Brain Connectivity*, *3*(2), 199–211.

Cutting, L.E. & Scarborough, H.S. (2006). Prediction of reading comprehension: Relative contributions of word recognition, language proficiency, and other cognitive skills can depend on how comprehension is measured. *Scientific Studies of Reading, 10*, 277-299.

Eason SH, Sabatini J, Goldberg L, Bruce K & Cutting LE. Examining the relationship between word reading efficiency and oral Reading rate in predicting comprehension among different types of readers. *Scientific Studies of Reading*. 2013;17:199–223.

Elbeheri, G., Everatt, J., Mahfoudhi, A., Al-Diyar, M.A. & Taibah, N. (2011) Orthographic processing and reading comprehension among Arabic speaking mainstream and LD children. *Dyslexia* 17(2): 123-142.

Firman, C. (2007). *The Study of Word-Level Decoding Skills of 7 Year Old Maltese Children in a Bilingual Environment.* Malta: University of Malta.

Fricke, S., Bowyer-Crane, C., Haley, A.J.., Hulme, C. & Snowling, M.J. (2013) 'Efficacy of language intervention in the early years.' *Journal of Child Psychology and Psychiatry*, 54, 3, 280-90.

Gathercole, S.E., Brown, L. & Pickering, S.J. (2003). Working memory assessment at school entry as longitudinal predictors of national curriculum attainment levels. *Educational and Child Psychology, 20*, 109-122.

Gathercole, S.E. & Pickering, S.J. (2000). Working memory deficits in children with low achievement in the national curriculum at 7 years of age. *British Journal of Educational Psychology, 70*, 177-194.

Georgiou, G.K., Parrila, R. & Liao, CH. Read Writ (2008) 21: 885.

Gentaz, E., Sprenger-Charolles, L., & Theurel, A. (2015). Differences in the predictors of reading comprehension in first graders from low socio-economic status families with either good or poor decoding Skills. *PLoS ONE*, *10*(3).

Geva, E., & Farnia, F. (2012). Developmental changes in the nature of language proficiency and reading fluency paint a more complex view of reading comprehension in ELL and EL. Read. Writing. 25, 1819–1845.

Goodman, K.S., Goodman, Y.M., & Allen, K.L. (2017). Research on helping readers make sense of print. In In S.E. Israel (Ed.), *Handbook of research on reading comprehension (2nd ed.) (pp. 84-106)*. New York: Guilford Press.

Goswami U. (2000). Phonological representations, reading development and dyslexia: Towards a cross-linguistic theoretical framework. *Dyslexia, 6*, 133-151.

Gottardo A, Mueller J. (2009) Are first- and second-language factors related in predicting second-language reading comprehension? A study of Spanish-speaking children acquiring English as a second language from first to second grade. Journal of Educational Psychology. 101:220–233.

Gough, P. B. & Tunmer, W. (1986). Decoding, reading and reading disability. *Remedial and Special Education, 7*, 6-10.

Goulandris, N. (Ed.) (2003). *Dyslexia in different languages: Cross linguistic comparisons*. London: Whurr Publishers Ltd.

Hoffman, J.V. (2017). Comprehension is *not* simple: Considering the persisting dangers in the Simple view of reading comprehension. In S.E. Israel (Ed.), *Handbook of research on reading comprehension (2nd ed.) (pp. 57-69)*. New York: Guilford Press.

Hoover, W.A. & Gough, P.B. (1990). The simple view of reading. *Reading and Writing: An Interdisciplinary Journal, 2*, 127-160.

Hulme, C., Bowyer-Crane, C., Carroll, J.M., Duff, F.J. & Snowling, M.J. (2012) 'The causal role of phoneme awareness and letter knowledge in learning to read: combining intervention studies with mediation analyses', Psychological Science, 23, 6 572-7.

Kahmi, A. G., & Catts, H. W. (2012). Language and reading: Convergences and divergences. In A .G. Kahmi & H. W. Catts (Eds.), Language and reading disabilities (3rd ed.) (pp. 1-23). Boston: Pearson

Keenan, J.M., Betjemann, R.S., Wadsworth, S.J., DrFries, J.C. & Olson, R.K. (2006). Genetic and environmental influences on reading and listening comprehension. *Journal of Research in Reading, 29*, 75-91.

Keenan, J.M. & Betjemann, R.S. (2006). Comprehending the Gray Oral Reading Test without reading it: Why comprehension tests should not include passage-independent items. *Scientific Studies of Reading, 10*, 363-380.

Kirby, J.R., Parrila, R.K. & Pfeiffer, S.L. (2003). Naming speed and phonological awareness as predictors of reading development. *Journal of Educational Psychology, 95*, 453-464.

Kunda, M., McGreggor, K., & Goel, A. (2010). Taking a Look (Literally!) at the Raven's Intelligence Test: Two visual solution strategies. In Proceedings of the 32nd Annual Conference of the Cognitive Science Society, pp. 1691-1696.

Lesaux, N.K., & Kieffer, M.J. (2010). Exploring sources of reading comprehension difficulties among language minority learners and their classmates in early adolescence. American Educational Research Journal.

Leikin, M. (2002). Processing syntactic functions of words in normal and dyslexic readers. *Journal of Psycholinguistic Research, 31*, 145-163.

Long, D. L., Johns, C. L., & Morris, P. E. (2006). Comprehension ability in mature readers. In M. Traxler & M. Gernsbacher (Eds.), Handbook of psycholinguistics (pp. 801–834). Burlington, MA: Academic Press.

Lynn, R. & Mikk, J. (2009). National IQs predict educational attainment in math, reading and science across 56 nations. *Intelligence, 37*, 305-310.

Miles, T.R. (1993). *Dyslexia: The pattern of difficulties, second edition*. London: Whurr.

Minagawa-Kawai, Y., Cristià, A., & Dupoux, E. (2011). Cerebral lateralization and early speech acquisition: A developmental scenario. *Developmental Cognitive Neuroscience, 1*(3), 217-232.

Muter, V., Hulme, C., Snowling, M.J. & Stevenson, J. (2004). Phonemes, rimes, vocabulary, and grammatical skills as foundations of early reading development: Evidence from a longitudinal study. *Developmental Psychology, 40*, 665-681.

Nagy, W.E. & Scott, J.A. (2000). Vocabulary processes. In M.L. Kamil, P.B. Mosenthal, P.D. Pearson & R. Barr (Eds.), *Handbook of reading research*. Mahway: NJ: Erlbaum.

Nakamoto J, Lindsey A, Manis R. A cross-linguistic investigation of English language learners' reading comprehension in English and Spanish. Scientific Studies of Reading. 2008;12(4):351–371.

Nation, K. & Snowling, M.J. (2000). Factors influencing syntactic awareness skills in normal readers and poor comprehenders. *Applied Psycholinguistics, 21*, 229-241.

Neale, M.D. (1989). *Neale Analysis of Reading Ability*. UK: NFER-NELSON.

Norton, E.S., & Wolf, M. (2012) Rapid Automatized Naming (RAN) and Reading Fluency: Implications for understanding and treatment of reading disabilities. Annual Review of Psychology. 63:427-452.

Oakhill, J.,Cain, K., & Elbro, C. (2014). *Understanding and teaching reading comprehension: a handbook*. London: Routledge.

Oakhill, J. (1994). Individual differences in children's text comprehension. In M.A. Gernsbacher (Ed.), Handbook of Psycholinguistics. San Diego, CA: Academic Press.

Ouellettte, G., & Beers, A. (2010). A not-so-simple view of reading: How oral vocabulary and visual-word recognition complicate the story. Reading and Writing, 23, 189 – 208

Perfetti, C.A., Landi, N. & Oakhill, J. (2005). The aquisition of reading comprehension skill. In M.J. Snowling & C. Hulme (Eds.), *The Science of Reading: A Handbook*. Oxford: Blackwell.

Perfetti, C & Stafura, J (2014) Word knowledge in a theory of reading comprehension, Scientific Studies of Reading, 18:1, 22-37.

Pickering, S. & Gathercole, S. (2001). *Working Memory Test Battery for Children (WMTB-C)*. London: The Psychology Corporation.

Rathvon, N. (2004). *Early reading assessment: A practitioners handbook*. New York: The Guilford Press.

Raven, J.C., Court, J.H. & Raven, J. (1996). *Manual for Raven's Progressive Matrices and Vocabulary Scales: Section 3. Standard Progressive Matrices.* Oxford, UK: Oxford Psychologists Press.

Savage, R.S. & Frederickson, N. (2005). Further evidence of a link between rapid naming and text reading rate. *Brain and Language, 93*, 152-159.

Shiotsu, T. (2007). The relative significance of syntactic knowledge and vocabulary breadth in the prediction of reading comprehension test performance. *Language Testing, 24*, 99-128.

Smythe, I., Everatt, J., Al-Menaye, N., He, X., Capellini, S., Gyarmathy, E., & Siegel, L. (2008). Predictors of word level literacy amongst Grade 3 children in five diverse languages. *Dyslexia, 14*, 170-187.

Smythe, I. & Everatt, J. (2004). Dyslexia – a cross linguistic framework. In I. Smythe, J. Everatt, & R. Salter (Eds.), *The International Book of Dyslexia, Part 1*. London: Wiley.

Snowling, M.J., Stothard, S.E. & McLean, J. (1996). *Graded Nonword Reading Test*. Bury St. Edmonds: Thames Valley Test.

Snowling, M. J., & Hulme, C. (2012). Interventions for children's language and literacy difficulties. *International Journal of Language & Communication Disorders*, *47*(1), 27–34.

Spooner, A.L.R., Gathercole, S.E. & Baddeley, A.D. (2006). Does weak reading comprehension reflect an integration deficit. *Journal of Research in Reading, 29*, 173-193.

Wechsler, D. (1992). *The Wechsler Intelligence Scale for Children III*. Sidcup: Psychological Corporation.

Wiederholt, J.L. & Bryant, B. (Eds.). (2001). *Gray Oral Reading Test (GORT-4)* (4th Edition). Austin, Texas: PRO-ED.

Wilson, V.L. & Rupley, W.H. (1997). A structural equation model for reading comprehension based on background, phonemic, and strategy knowledge. *Scientific Studies of Reading, 1*, 45-63.

Wolf, M., Bowers, P.G. & Biddle, K. (2000). Naming speed processes, timing, and reading: a conceptual review. *Journal of Learning Disabilities, 33*, 387-407.

Zeigler, J.C. & Goswami, U. (2005). Reading acquisition, developmental dyslexia, and skilled reading across languages: A psycholinguistic grain size theory. *Psychological Bulletin, 131*, 3-29.