Letter Knowledge and Phonological Processing Skills:

First- and Second-Language Learners

Zahra Esmaeeli

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Abbreviations used in the present study

High-LS children: Children with high oral language performance.

Low-LS Children: Children with low oral language performance.

High-LS vs. Low-LS: Children with high oral language performance versus Children with low oral language performance.

L1 learners: A participant was considered an L1 learner if Norwegian was first language for both of his/her parents.

L2 learners: A participant was considered an L2 learners when a language other than Norwegian was the first language for both of his/her parents.

TROG: Test for Reception of Grammar, Version 2.

IL-basis: is a Norwegian measure prepared to investigate *Letter Knowledge and Phonological Processing Skills* in Norwegian words.

KiSP (Kunnskapsgenerering i det spesialpedagogiske praksisfeltet)**:** It is a project about "Knowledge generation in the practice field of special needs education" at the Department of Special Needs Education, University of Oslo.

Abstract

Teachers in many countries face the challenge of teaching classrooms with students in increasingly diverse ethnic, cultural and linguistic backgrounds due to increasing social and economic globalization, and mobility across the world (United Nations Educational, Scientific and Cultural Organization; UNESCO, 2012). According to *Norwegian Ministry of Education and Research* (2007), a portion of L2 learners of Norwegian do not fare well at schools especially in the area of reading and writing, and a high drop-out rate has been reported among them rather than L1 learners.

The purposes of present study were to examine differences of the *letter knowledge and phonological processing performances* between (a) High-LS children and Low LS children and between (b) L1 and L2 learners. The participants were divided into two groups of L1 learners and L2 learners based on their language background. L1 and L2 learners were again divided into two groups according to their *level of language skill* (High-LS vs. Low-LS) measured by TROG. The present study was written in connection with KiSP project "Knowledge generation in the practice field of special needs education" at the Department of Special Needs Education, University of Oslo.

The results of the present study were in line with the previous research (Lonigan & et al., 1998; Puranik & Lonigan, 2012) and revealed that children with high language skill outperformed children with low language skill in *letter knowledge and phonological processing tasks.* The results for L1 and L2 learners also revealed that by taking into account the level of oral language skills (High vs. Low LS), no statistically significant differences observed in performances between L1 and L2 learners. These findings suggest that L2 learners with High-LS can develop emergent literacy skills including *letter knowledge and phonological processing skills* in Norwegian words at the same level as L1 learners. Thus, the same instructional methods as L1 learners can also foster the development of literacy for L2 children (Chiappe, Siegel & Wade-Woolley, 2002b; Chiappe, Siegel & Gottardo, 2002a). More emphasis on oral language instruction, of course, is needed to improve L1 and L2 learners' proficiency in Norwegian literacy. Last but not least, divers' language background of our participants suggests the study's findings are applicable to all L2 learners of Norwegian regardless of their first learnt language.

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Table of Content

List of Tables

1 BACKGROUND OF THE STUDY

1.1 Introduction

With the United Nations Educational, Scientific and Cultural Organization (UNESCO, 2010) reporting an increase in social and economic globalization and mobility across the world, teachers in many countries face the challenge of having children in their classrooms from increasingly diverse ethnic, cultural and linguistic backgrounds as well as children with special needs. In Norway, a large and growing number of students come from homes where languages other than Norwegian are spoken. To illustrate, Freeman, Guidikova and Wood (2010) reported that over 125 different languages were registered among minority students in and around Oslo.

According to *Norwegian Ministry of Education and Research* (2007), some minority students/second-language learners (L2 learners) are not faring well in school. Fewer L2 learners begin upper secondary education than those with Norwegian as their first language. Moreover, among students who attend upper secondary education, the drop-out rate is higher for minority students/L2 learners regardless of the different strategies and legislation designed to increase participation and learning of L2 learners (i.e., mother tongue language teachers, and equal education in practice). Aside from mother tongue teaching to facilitate language development and learning in general (*Norwegian Ministry of Education and Research,* 2007), what else can be done to improve learning in L2 learners', perhaps to develop their reading and writing skills in Norwegian? Another critical question to ask is whether the same instructional methods L1 learners use, can foster the development of literacy for L2 learners. Addressing this question is imperative to policy makers and practitioners dealing with the second-language education, as well as researchers working the area of literacy development.

Lack of a comprehensive theory which can explain how L2 learners acquire literacy skills in a second language (L2) or other language than first language (L1), results in researcher and practitioner reliance on reading models developed for L1 learners (Chiappe, Siegel & Wade-Woolley, 2002b). Considering these reading models, *Letter Knowledge and Phonological Processing Skills* as an emergent literacy knowledge plays a crucial role in reading and writing development (Muter, Hulme, Snowling & Stevenson, 2004; Siegel, 1993; Snow, Burns & Griffin, 1998). For example, Rack, Hulme, Snowling, and Wightman (1994)

demonstrated that 5-year-old children, who were at a very early reading stage, were sensitive to the relationship between phonological and written forms of words. The study argued that the most crucial tasks for learning to read were to acquire *letter knowledge and phonological processing skills*. When children mastered these skills by using letter-sound connections to read words, they acquired the alphabetic principles to 'crack' the alphabetic code.

There is also considerable evidence indicating that early *letter knowledge and phonological processing skills* can be used as powerful predictors for latter reading skills (Carroll, Snowling, Hulme & Stevenson, 2003; Nation, Marshall& Snowling, 2001; Snowling & Hulme, 2005). Muter and Snowling (1997b) reported supporting results for a follow-up study of 34 children at the age of 9 years. These children had participated earlier in a longitudinal study of phonological and literacy development between the ages of 4 and 6 years. The findings of this follow-up study confirmed that phonological processing skills played a central role in spelling acquisition through primary school years. Analyses of the concurrent predictors of spelling also showed that measures of phonological processing skills could be used as a strong predictor for latter reading skills, especially in the sub-measure of phoneme awareness. Therefore, *letter knowledge and phonological processing skills* can be considered a crucially important predictor for children at risk of developmental dyslexia (Siegel, 1993; Snow et al., 1998; Snowling & Hulme, 2005).

According to the International Dyslexia Association (2011), developmental dyslexia or in short-term dyslexia, is a specific learning difficulty (SLD) that is neurological in origin. It is characterized by difficulties with accurate and/or fluent word recognition and by poor spelling and decoding abilities. These difficulties typically result from a deficit in the phonological component of language that is often unexpected in relation to other cognitive abilities and the provision of effective classroom instruction. Secondary consequences may include problems in reading comprehension and reduced reading experience that can hinder growth of vocabulary and background knowledge. A substantial growing body of evidence indicates reading difficulties and poor reading skills can be traced to *phonological deficits*. This is well-documented in literature as *phonological deficit theory* (Siegel, 1993; Snow et al., 1998; Snowling, 1995; Snowling & Hulme, 2005) and stems from evidence that individuals with poor reading skills often show phonological processing difficulties. Based on *phonological deficit theory*, letter knowledge and phonological processing skills can be used as early identification of children at risk for reading difficulties. Based on empirical research, it can

also be used as early intervention to improve the efficacy of reading instruction in L1learners (Carroll et al., 2003; Snow et al., 1998; Snowling & Hulme, 2005). Emergent literacy skills, such as *letter knowledge and phonological processing skills* represent the best predictors of later achievement in reading.

There is also substantial evidence that oral language is highly correlated with emergent literacy knowledge. Support for this view may be found from the research on children with speech-language impairments (Catts, 1993; Puranik & Lonigan, 2012; Snowling, Adams, Bishop & Stothard, 2001), and children with low oral language (Low-LS) skill without a history of speech-language impairments (Lonigan, Burgess, & Anthony, 2000; Puranik & Lonigan, 2012; Spira, Bracken, & Fishel, 2005). For example, a longitudinal study from kindergarten to fourth grade by Spira et al. (2005) showed that childrens' reading development was strongly related to their individual oral language skill: Children with High-LS performed better than children with Low-LS on emergent literacy tasks including *phonological processing skills*. Puranik and Lonigan (2012) also confirmed that children with Low-LS lag behind their peers with High-LS in emergent writing-related skills including *phonological processing skills*.

For L1 learners, the crucial role of *letter knowledge and phonological processing skills,* as emergent literacy-related skills, is apparent. What is less clear is the outcome for L2 children; their *letter knowledge and phonological processing* skills in the second-language, and the differences or similarities between their performance, and performance of L1 learners of that language. Given the available evidence, answers to such questions are still controversial. One aspect of this controversy relates to the fact that when children learn to read in a second-language (L2), their phonological processing skills related to their first-language (L1) may differ from their L2's phonological processing. Thus, they will not be able to perform as well as L1 learners on phonological processing tasks until they master the phonological representations of that second-language. L2 learners will perceive the sounds and syllables structures of that second-language in terms of the structures of their first-language until they acquire phonological structure appropriate to that second-language (Chiappe, et al., 2002b; Wade-Woolley & Siegel, 1997; Wagner & Torgesen, 1987). L1 learners may also have much more experience with the language as they are just involved with developing only one language at the time while L2 learners are simultaneously exposed to two languages. Thus, poorly defined or inaccurate phonological representations of L2 learners could interfere with,

or delay, the development of their phonological processing skills in the second-language; They would experience difficulties in phonological processing tasks in the second-language words until they developed appropriate phonology (Chiappe, et al., 2002b). Cisero and Royer (1995) found some differences between the performances of L1- and L2-learners due to the fact that L1 learners performed better on phonological processing tasks. Their findings supported the notion that L2 learners did not performed as well as L1 learners on phonological processing task.

In contrast, it has been hypothesized that exposure to more than one language(s) can increase the metalinguistic ability (Vygotsky, 1962). The subsequent empirical research has supported this theory (Rubin & Turner, 1989; Chiappe, et al., 2002b); as a sub-skill of metalinguistic ability, it can be assumed that L2 learners may perform equally as well or even better on phonological processing tasks than L1 learners. Chiappe and colleagues (2002b) compared phonological processing performances between (131) L2 learners of English from linguistically diverse backgrounds and (727) L1 learners. The study showed that at the conclusion of first grade, L2 learners who were typically learning to read, performed equally as well as typically developing L1 learners on all phonological processing tasks of English.

In different languages including Norwegian, a substantial growing body of evidence shows the crucial role of early phonological processing skills on later success of literacy development in addition to the high relationship between oral language and these emergent literacy-related skills of L1 learners (Puranik & Lonigan, 2012; Snowling & Hulme, 2005; Vaughn, Linan-Thompson & Hickman, 2003). Moreover, the Cummins's (1979) *linguistic interdependence hypothesis* suggests that there is a high relation between children skills in developing first and second languages (Chiappe & et al., 2002b). Thus, one would expect that similar to the first language, a high relation could be found between oral language and the emergent literacy-related skills in second language: Similar to L1 learners, L2 learners with high LS would outperform L2 children with low LS skill on phonological processing tasks. Therefore, L2 learners would perform as well as L1 learners on tasks of *Letter Knowledge and Phonological Processing Skills* if their level of oral language skills would be also taken into account.

Empirical research has also revealed that letter knowledge and phonological processing skills are the most critical literacy-related skills in Norwegian language development (Furnes & Samuelsson, 2009; Furnes & Samuelsson, 2010; Furnes & Samuelsson, 2011; Høien, Lundberg, Stanovich & Bjaalid, 1995; Lervåg & Aukrust, 2010; Lervåg, Bråten & Hulme, 2009; Lervåg & Hulme, 2011). These skills have been also used as early identification and intervention for L1 learners of Norwegian at risk for reading difficulties (Lyster, 1995; 2002). However, little is known about phonological processing performance of L2 learners of Norwegian, and whether their performance in Norwegian *letter knowledge and phonological processing tasks* differs (better or poorer from that of L1 learners. The present study aims to explore *letter knowledge and phonological processing skills* of L1 and L2 learners of Norwegian whilst their levels of Norwegian oral language skill are taken into account. The various theories and key empirical findings in relation to *letter knowledge and phonological processing skills* and *oral language skills*, and their contribution to early reading skills will also discussed.

The present study is written in connection with the project "Knowledge generation in the practice field of special needs education (KiSP)" at the Department of Special Needs Education, University of Oslo.

1.2 Purpose of the Study

The purposes of the present study are first to examine *letter knowledge and phonological processing performances* of High-LS children and Low LS children and then, to find out how L1 and L2 learners would perform in *letter knowledge and phonological processing performances* in Norwegian words. To achieve this, *letter knowledge and phonological processing skills* were measured by IL-basis, and oral language skills were assessed by TROG. The measure of Raven was also used for *nonverbal skill* of participants as a control variable. All of these measures were administrated in the Norwegian language.

1.3 Research Hypotheses

Cummins's (1979) *Linguistic Interdependence Hypothesis* suggests that there is a high relationship between children's skills in developing first and second languages (Chiappe & et

al., 2002b; Cummins, 1979). In addition, substantial evidence indicates that there is a high relation between oral language skills of L1 learners and their performance on phonological processing tasks: Children with High-LS outperform children with Low-LS on phonological processing tasks (Chiappe et al., 2002a; Puranik & Lonigan, 2012; Lonigan, Burgess, Anthony & Barker, 1998).

Thus, one would assume that because there is a high relation between the oral language skill and *phonological processing performance* in children's first language, according to Cummins's (1979) *Linguistic Interdependence Hypothesis*, a similar relation would also be found in a second language: Similar to L1 Learners, L2 Learners with High-LS would outperform L2 Learners with Low-LS on phonological processing tasks. Therefore, by taking into account the level of oral language skill (High versus Low) L2 learners would perform similar to L1 learners on tasks of *Letter Knowledge and Phonological Processing Skills*. It means, similar to L1 learners, oral language skills of L2 learners in the Norwegian language may impact on L2's phonological processing skills. If so, then, performance of L2 Learners would be similar to L1 learners' performance on letter knowledge and phonological processing tasks in Norwegian words by taking into account their level of oral language skill in Norwegian.

Accordingly, it is hypothesized that children with high oral language skill (High-LS) would perform better than children with low oral language skill (Low-LS) in phonological processing tasks. Based on Cummins's (1979) Linguistic Interdependence Hypothesis, it is also hypothesized that there would be no statistically significant difference in performance on letter knowledge and phonological processing tasks between L1 and L2 learners by taking into account the level of oral language skill (High-LS vs. Low-LS).

1.4 Research Questions

This study is designed to determine:

Main Questions:

I. Would children with High oral language skill (High-LS) perform better or worse than children with Low oral language skill (Low-LS) in *Letter Knowledge and Phonological Processing Skills* in Norwegian words?
II. Would there a statistically significant difference in the performance of L1 and L2

learners on *Letter Knowledge and Phonological Processing tasks* in Norwegian in either High LS or Low LS groups?

Sub-questions:

III. Would L1 learners (High-LS group) perform better or worse than L1 learners (Low-LS group) on task performance in *Letter Knowledge and Phonological Processing Skills* or any of its sub-measures or components?

IV. Would L1 learners (High-LS group) perform better or worse than L2 learners (Low-LS group) on task performance in *Letter Knowledge and Phonological Processing Skills* or any of its sub-measures or components?

V. Would L1 learners (High-LS group) perform better or worse than L2 learners (High-LS group) on task performance in *Letter Knowledge and Phonological Processing Skills* or any of its sub-measures or components?

VI. Would L1 learners (Low-LS group) perform better or worse than L1 learners (Low-LS group) on task performance in *Letter Knowledge and Phonological Processing Skills* or any of its sub-measures or components?

1.5 Personal Motivation for the Study

The rationale of the study is also based upon eight years of direct experience working in the area of reading and writing difficulties. I had interesting and challenging experiences of working with L1 and L2 learners in reading and writing difficulties, and students with diverse language backgrounds. This motivated me to apply for Master of Philosophy program in Special Needs Education as a second masters to then conduct the study in the field of emergent literacy-related skills of L1 and L2 learners.

1.6 Structure of the Thesis

This thesis is divided into five chapters as outlined below:

Chapter 1- Introduction

This chapter introduces the study with the rationale of the thesis, research hypothesis and related questions.

Chapter 2- Theoretical Framework

This chapter provides explanation for terms used in the study. It continues with a theoretical overview and current research findings in field of phonological processing and letter knowledge skills.

Chapter 3- Methodology

This chapter focuses on the research design and the evaluation characteristic of the research. This chapter also describes the thematic analyze techniques used for analyzing the data. It demonstrates the ethical considerations and validity that threat the research.

Chapter 4- Results

This chapter presents the results that emerged from the data. The hypotheses are investigated by finding answers to the research questions.

Chapter 5- Discussion and Conclusion

This chapter shows connections of the findings with research hypothesis and questions, and research aims. The results are discussed in relation with the theoretical framework of the study and previous empirical findings. The limitation of the study and recommendations are made for development of further study and also draws conclusions of the study.

2 THEORETICAL FRAMEWORK

2.1 Introduction

In this chapter, the process of reading is reviewed to clarify the prerequisite role of *letter knowledge and phonological processing skills* as emergent literacy-related skills. Based on a growing body of evidence, pre-schooling years are critical to the development of emergent literacy-related skills which will help prevent later reading problems (Siegel, 1993; Snow et al., 1998; Snowling, 1995; Snowling & Hulme, 2005; Snowling & Hulme, 2012). These emergent literacy-related skills can be considered to play the same critical role in word-decoding skills in all alphabetic languages. Much is known about word-reading development in L1 learners applied to L2 learners. However there is no comprehensive theory that can explain how L2 learners acquire reading skill in a second language (L2) or language other than the first-language (Bialystok, 2002; 2007; Chiappe & Siegel, 1999; Chiappe, et al., 2002b).

A developmental perspective on reading is first presented to explain how children use these emergent skills to develop reading and become skilled readers. Following this, *letter knowledge and phonological processing skills* will be more discussed according to literature and earlier empirical research in the field of L1 and L2 learners.

2.2 Reading: A Developmental Perspective

Before we can address what we mean by reading development, we must first deal with what we mean by reading. Reading is defined as using skills to decode, encode, and comprehend written symbols and texts (Tracey & Mandel, 2006). Reading is a complex skill involving many other skills that have been developed for other purposes. Other skills include spoken language, perception (vision, hearing), motor systems, memory, learning, reasoning, problem solving, motivation, interest, and so forth. Among these, the most important is the child's proficiency in oral language which provides the basic foundations for reading development (Rayner, Foorman, Perfetti, Pesetsky & Seidenberg, 2001). Thus, reading development is an ongoing, continuous, and gradual process which begins long before school years and is based on oral language.

2.2.1 Stage Models of Reading

In stage models as children's reading skills develop, they increase both the number and types of strategies that they can use during reading experience. According to stage model theory, each of these different strategies develops in a serial manner but not necessarily in a linear fashion. This means children do not necessarily master one skill before developing the next skill. By developing all these strategies, children become successful readers (Tracey & Mandel, 2006). Stage model of reading developments have been proposed by a number of educators throughout literature (Chall, 1996; Ehri, 1991; Rayner & et al., 2001; Tracey & Mandel, 2006). Ehri (1991) describes the learning in reading stages as four phases (stages) that will be described due to their helpful ad explicit nature.

Stage 1 (Pre-Alphabetic Phase):

Prerequisite skills: *Letter knowledge and phonological processing skills* in spoken words should develop, to enable the child to distinguish the individual sounds of spoken words but not yet in print form. For instance, children may find the first sound of the spoken words (e.g., if we ask them about the first sound of "Stop", they can say /s/) without being able to recognize the written symbol of S.

In this phase, the ability to form letter-sound connections to read words is not yet developed. Moreover, children do not have much knowledge of specific letters and are therefore unable to decode. Children perceive written words like pictures, and read a word by remembering one or two distinctive visual cues in or around the word (predicting). All other cues including alphabetic cues are overlooked in this stage. Children use *logos* (visual cues reading) to read print in the environment. A "stop sign" can be read by the shape or its red colour rather than by the S or O (letters of the word 'stop'). This phase is also known as the *logographic phase* in reading (Chall, 1996). In pre-alphabetic phase of reading, because *visual cue reading* is the only present strategy for use, children can read a limited number of words. When 'reading' the *Stop sign*, if children see "Stop" as a distinct word on a piece of paper (not on the shape of traffic sign), they may not be able to read it in the absence of the *visual cue*, for instance.

Stage 2 (Partial Alphabetic Phase):

Prerequisite skills: By learning some letters and achieving some skills of phonological processing, children will move to the next stage of reading.

In the Partial Alphabetic Phase, children are only being able to segment words into the most salient sounds because they have only achieved some skills of phonological processing skill. This means children are able to read a written word by making connection between one or a few salient letters and corresponding sounds. The strategy to read a word identified by Ehri (1991) is named *phonetic cue reading* vs. *visual cue reading* and is used during *stage 1*. To remember how to read "BREAD"; the learner will need to find at least one letter in this word which can be linked to the sound of the word in its pronunciation. For this purpose, first and final letters are often selected as the best cues to remember because they are especially salient. In the case of "BREAD," B (initial letter) and initial sound of /b/, and D (last letter) and final sound of /d/ can be linked to sounds of the word. Identifying of these connections can also be facilitated by the *names* of these letters as they contain the relevant sounds (i.e., "bi" and "di"). Because *phonetic cue reading* is a strategy that distinguishes a partial connection between some letters and some sounds of a word, children mistake similarly spelled words: If children only remember the initial and final *letter-sound connections* for the "BREAD", they may misread other similarly spelled words like "BIRD, BEARD, and so forth. At this stage, a child cannot yet segment the whole letters of a word and make complete letter-sound correspondences because their knowledge of phonological processing skills relating to the spelling system of the language is still incomplete. Children begin to develop decoding strategies to read words by making a partial connection between letters and sounds to provide *phonetic cue reading* but they continue using visual cues and predicting strategies as well.

Stage 3 (Full Alphabetic Phase):

Prerequisite skills: Children move into the full alphabetic phase of reading when they master the major knowledge of letter-sound or grapheme-phoneme correspondences in the spelling system.

Children can map graphemes to phonemes in the words by reading new words and developing decoding strategies. Now they can read words by making complete connections between letters/graphemes in the written forms, and phonemes detected in its pronunciation.

In the example of "BREAD", children at this stage can now recognize how these five letters (b, r, e, a, and d) correspond to four phonemes (/b/, /r/, /e/ and /d/) in the word which is to be pronounced as /bred/. Thus, at this stage, they may not misread other similarly spelled words like "BIRD" or "BEARD" because they can recognize complete grapheme-phoneme correspondences of each word. By achieving the complete correspondence between the graphemes and phonemes in written words, children also distinguish when letters do not correspond to any phonemes in words (e.g.: "W" in WRITE): Some children may consider these graphemes as silent letters that should be learned as a feature characterizing a particular word while some others may think "WR" in "WRITE" is a digraph. Ehri (1991) argues it is not important that all children have the same connections in learning to read a particular word. The most important issue is that they have a systematic way of analyzing graphemes into phonemes to form complete connections of grapheme-phoneme correspondences in the spelling system. By retaining this systematic method in their memory, they can read similar words later. For example, a child may read a word like "WRONG" by remembering "WR" grapheme-phoneme connection that have learned for "WRITE".

At *full alphabetic phase,* children have full access to the knowledge of the spelling system (*letter knowledge and phonological skills*) and can read unfamiliar/unknown words. They also have the ability to decode words that have never read before by transform unfamiliar spellings of words into a recognizable pronunciation. Learners can then move to the final stage of reading that will help them to read as skilled readers; both easily and quickly.

Stage 4 (Consolidated Alphabetic Phase):

Prerequisite skills: Much more reading and spelling practices are required to move into this final phase of reading development. Reading and spelling practice helps children become familiar with the spelling of different words and provide more opportunities in detecting more common patterns.

Decoding strategies are automatized through re-reading (practicing) words which have already been read and by reading new words that have not been read before. These automatized decoding strategies help children detect letter patterns that repeat across words. These letter patterns are not as simple grapheme-phoneme as used in former stages; they are now multi-letter units (chunking letters) representing morphemes, syllables, or sub-syllabic units such as onset and rimes. These chunking letters (e.g.: EST, TION, ING, CH, SH, and so

on) are consolidated and become part of children's generalized knowledge of the spelling system with more practice. Using this system to chunk develops automatized decoding strategies that help children read easier and faster. For example, when exposed to multi-syllabic words, they can break down these words into some smaller units, above letter level: “CHEST” can be identified as CH, and EST linked to /t□/ and /est/ if the child has consolidated these chunking letters by practicing them in different words before. While, the learning child may need to recgonise “CHEST” as CH, E, S, and T related to /□/, /□/, /s/, and /t/ if they want to use decoding strategy to find grapheme-phoneme correspondences.

Sight word reading develops at this stage and children read as quickly and easily as skilled readers. Skilled readers can read words, even new and complex words that never have read before, as soon as encountering these words with *Sight word reading* skill based on automatized decoding skills. Other strategies are, of course, applicable in case of necessity.

Summary

Reading development is an ongoing and complex process which is complicated to portray. Ehri’s stage model of reading (1991) used to depict reading development in brief claims that different strategies are used across stages of reading development to establish a *sight word vocabulary*. *Sight word reading* is central to reading development and it is necessary to read more quickly and more accurate. It is also mentioned with great emphasis, that *sight word reading* does not only mean memorizing the shapes of words or other visual features without considering the grapheme-phoneme correspondences. *Sight word reading* is based on alphabetical and phonological knowledge which requires *letter knowledge and phonological processing skills* to detect phonological patterns which repeat across words.

At early reading stages, children may use the visual features of words (*visual cue*) for limited reading but eventually becomes is an insufficient strategy. Learners need to detect grapheme-phoneme connections in order to read words accurately. By practicing grapheme-phoneme detections in different words, decoding strategies will be automatized and multi-letters units (chunking letters) will also be developed and consolidated. These automatized and consolidated skills become a part of children's generalized knowledge of the spelling system to develop *sight words reading skills* which in turn, help children read these *sight words* upon encounter. As a result, children become skilled readers who can read and more accurate and quickly. Skilled readers can continue developing the *sight word vocabulary* by

practicing automatized and consolidated skills in the spelling system. *Sight word vocabulary* assists skilled reading in both accuracy and speed. Skilled readers may continue applying other strategies of reading, especially decoding methods to make more automatized decoded *sight words*. Decoding strategy requires development of *letter knowledge and phonological processing skill*:

2.3 Letter Knowledge and Phonological Processing Skills

It is now widely accepted that phonological processing skill, which form part of oral language skills, is critically related to successful reading. It is the skill which makes mental connection of the sounds and letters (phoneme-grapheme correspondences) in a word. It is an understanding of the phonological structure of words since words consist of syllables, rhymes, and sounds (August & Shanahan, 2006; Carroll, et al., 2003; Carroll & Snowling, 2004). *Phonological processing skills* develop during the preschool and early school years through a theory involving three levels of awareness (Goswami and Bryant, 1990): *Awareness of syllables, awareness of onsets and rimes*, and *phoneme awareness*. According to this theory, each of these different skills in word segmentation develops serially but not necessarily in a linear fashion. In other words, children do not necessarily masterone skill before developing the next skill. After learners develop all of these awareness skills, they can complete learning in *phonological processing skills*. *Phonological processing skills* have been considered as an umbrella term to describe the overall awareness of how words can be divided into smaller units. Stackhouse (1997) refines this definition and suggests the sequences as the following:

2.3.1 Syllable Awareness Skill

Syllable Segmentation*:* Children can identify the number of syllables in a spoken word by tapping or clapping each syllable (e.g.: One clap for the word of CAT and two for the word of FOOTBALL).

Syllable Blending: Children can state the word that is given to them as segmented syllables. If we ask a child 'what word am I trying to say; "*foot, ball"',* the child will reply: football.

Deleting of Syllables: Children can delete a syllable from a word and state what remain after that. If we ask a child, for instance, tell me what will be remain after deleting *foot* from the word of FOOTBALL, the child will reply: BALL.

Manipulating of Syllables: Children can manipulate syllables in a word to make another word, which can be used to create nonsense words. If we ask a child to replace *–ball* with *-ally* in the word of FOOTBALL, the child will answer: FOOTALLY.

2.3.2 Rhyming Awareness Skill

Rhyme as a Vocal play: Children start to play in rhyme without awareness of what a rhyme is. It is only a vocal play for them as they say: CAT, MAT, PAT, and so forth.

Rhyme Identification: Children can state whether words that have been previously said to them are in rhyme or not. For instance, GAIN and PAIN are in rhyme but not GAIN and GUN.

Rhyme Generation: If we give children a word, they can say a word rhyme with this given word. For example, when asked to rhyme something with CAT, the child may rhyme the corresponding word with FAT.

2.3.3 Phoneme Awareness Skill

Phoneme/Sound Blending: Learners can state what a word is after providing its segmented sound. If children hear a segmented sound like (/k/, /æ/, /t/) they will be able to blend the sounds to spell "cat".

Phoneme/Sound Segmentation: Children can segment a word to its sounds. CAT is composed of these sounds: /K/, /æ/, and /t/.

Deleting of Phoneme: Children can delete the sound/phoneme of a word even if a nonsense word remains. /K/, /æ/ or (CA) will be remain after the deletion of last sound in the word, CAT.

Phoneme/Sound Manipulation: Children can manipulate sounds of a word by substituting, changing and transporting a sound to create a new word. When substituting the

first sound of CAT with the sound of /m/ children are able to manipulate the original word to form, MAT.

In another definition, development of phonological processing skill includes the development from lower level of phonological processing complexity to higher level of complexity (Anthony et al. 2002; Lonigan & et al., 1998). Lower level of phonological processing includes word segmentation at large phonological units of sounds such as syllables and rhyme segmenting. In contrast, higher level of phonological processing involves segmenting words to the smaller phonological units of sounds like phoneme segmenting namely known as *phonemic awareness* that is included phoneme blending, phoneme segmentation, and phoneme manipulation skills. From this perspective, *phonemic awareness* represents the higher level of phonological processing skill as it is where the phoneme segmenting skills of *phonological processing* are required. At this higher level of phonological processing skill (*phonemic awareness*), graphemes can correspond to speech sounds in reading.

Developing of phonological processing skill from lower (syllables and rhyme segmenting) to higher (phoneme segmenting) level of processing has been examined in some studies (Anthony et al., 2002; Lonigan, et al., 1998; Smith & Tager-Flushberg, 1982). All of these aforementioned studies have found age-related differences from lower to higher levels of *phonological processing skills*. Lonigan and his colleagues (1998) reviewed research on the developmental of *phonological processing skills* and found most of these studies had been limited by both small sample size at each age level, and by the use of the number of measures of phonological processing. To address limitations of previous research, studies examined development of phonological processing skills in 2- to 5-year-old children comprising 238 children from middle- to upper-income families and 118 children from lower-income families. Children were divided into two subgroups of socioeconomic class to control for socio-economic influenced predictors of reading and writing performance of their children at first-grade of school (Lonigan & et al., 1998). From socioeconomic point of view, a significant social class differences before and after controlling the performance of children on IQ measure was discovered. Results of the study in preschool-age children discovered a large-scale difference in complexity levels of phonological processing tasks (*rhyme oddity detection, alliteration oddity detection, blending, and elision*) which were also used as main measures of phonological processing skills. Children also took standardized oral language

test; Peabody Picture Vocabulary Tests-Revised (PPVT–R) for receptive language and Expressive One-Word Picture Vocabulary Test-Revised (EOWPVT–R) and the Grammatical Closure subtest of the Illinois Test of Psycholinguistic Abilities (ITPA–GC) for expressive language. The study's findings suggested lower levels of phonological processing skills (i.e., *syllables detection*) were developmental precursors to higher levels of phonological processing skills (i.e., *phoneme detection*). It was reported that scores on all of the phonological processing tasks were correlated with children's ages (rs = .38, .43, .60, and .66 for *rhyme oddity*, *alliteration oddity, blending, and elision respectively*; all ps < .001.). Accordingly, performance of youngest participants indicated lowest scores although some of these 2- and 3-year-old children demonstrated phonological processing skills at all levels of linguistic complexity.

It was also reported that children from middle-income families performed significantly better when compared with children from the lower-income families on the *rhyme oddity* task, $F(1, 353) = 17.58$, $p < .001$, the *alliteration oddity* task, $F(1, 353) = 7.11$, $p = .008$, the *blending* task, $F(1, 353) = 64.64$, $p < .001$, and the *elision* task, $F(1, 353) = 57.77$, $p < .001$, with chronological age used as a co-variant.

Generally speaking, the results of the study by Lonigan and his colleagues (1998) revealed a strong developmental trend of phonological processing skill on performance of children from 2 to 5 years from middle-income families. In addition, their results indicated the socioeconomic status differences in growth of phonological processing skills can be found in children from the earlier age of 5 even when their cognitive and language skills were also controlled. While, Raz and Bryant (1990), and Bowey (1994) had reported significant socioeconomic status differences in groups of 5- and 6-year old children before and after controlling for cognitive and language skills.

In conclusion, study by Lonigan and his colleagues (1998) on English speaking children gave evidence for: (a) A strong developmental trend in phonological processing skills from the lower level of complexity (e.i., syllables and rhyme) to the higher level of complexity (e.i., phoneme awareness). (b) A faster rate of growth on phonological processing skills in children from middle-income families resulting in increased differences between performance of children from both lower and middle-income families. That is, there is a relation between growth of phonological processing skills of children and socioeconomic status of their families. (c) A higher correlation between phonological processing skills and oral language in

older children (4- and 5-years) than younger children (2- and 3-years). This correlation was only significant for older children from middle-income families but the trend of growth was the same in children from lower-income families. (d) Phonological processing skills are significant predictors of children's' later word reading skills. Lonigan and his colleagues' found lent support to the crucial role of phonological processing development at preschool age for the development of later reading skill. This was consistent with other former studies (Rack, Hulme, Snowling, & Wightman, 1994; Snow & et al., 1998; Wagner & et al., 1997; Wagner & et al., 1993; Wagner & Torgesen, 1987). Given later research related to L1 learners of English, there is also a substantial body of evidence indicating a strong relationship between oral language and phonological processing skills as emergent literacy-related skills playing a critical role in development of later reading and writing (Anthony & et al., 2002; Lipka, Lesaux & Siegel, 2006; McCardle, Scarborough & Catts, 20011; Puranik & Lonigan, 2012; Snowling & Hulme, 2011; Snowling & Hulme, 2005).

Puranik and Lonigan (2012) investigated a group of 293 preschool children assessed by a battery which included measures to examine oral language, nonverbal cognition, emergent reading, and writing. Children were divided into four groups based on their language and nonverbal skill; (1) children with language impairments (LI) including children with deficit only in oral language skill, not in nonverbal skill, (2) Children with nonspecific language impairments (NS-LI) including children with deficits in both language and nonverbal skill, (3) Typically developing children (TD), and (4) Children with only low nonverbal skill or IQ (LNIQ). Puranik and Lonigan (2012) showed that children with low oral language skill lagged behind peers who possessed high oral language skill in writing-related tasks: Children with LI had lower scores, compared to their typically developing peers (TD) on all emergent writing and emergent reading measures, Fs $(3, 289) \geq 17.73$, ps $\leq .001$. Children with oral language and cognitive deficits (NS-LI) also performed more poorly than children whose deficits were confined to oral language (LI): Differences between the LI and NS-LI groups were statistically significant for Write Letters ($p < .01$), Write Name ($p < .05$), Print-Related Knowledge ($p < .05$), and the Letter-Naming task ($p < .05$) but differences were not statistically significant for the Blending, Elision, or Spelling tasks. In addition, the child's cognitive skill had an impact on emergent writing skills, but it was moderated by oral language skill because comparison of the performance on literacy-related measures for the TD and LNIQ groups yielded a different pattern. Although the means for the LNIQ group were lower than the means for the TD group for all reading and writing measures, none of those

differences were statistically significant in the study. Overall, Puranik and Lonigan (2012) claimed their obtained results were consistent with past research documenting relationships between preschool oral language and emergent reading.

There is also a growing body of research conducted in other alphabetic languages indicating the crucial relation of phonological processing skills in development of reading and writing skills (e.g, Dutch: Patel, Snowling & de Jong, 2004; German: Wimmer, 1993; Norwegian: Furnes & Samuelsson, 2009; Furnes & Samuelsson, 2010; Furnes & Samuelsson, 2011; Hagtvet, 1997; Høien, Lundberg, Stanovich & Bjaalid, 1995; Lervåg & Aukrust, 2010; Lervåg, Bråten & Hulme, 2009; Lervåg & Hulme, 2010; Lyster, 1995; 2002; Swedish: Furnes & Samuelsson, 2009; Furnes & Samuelsson, 2010; Furnes & Samuelsson, 2011; Lundberg, Olofsson & Wall, 1980). A selection of the aforementioned studies conducting in Norwegian as the language of interest will be briefly discussed in the present study.

Lyster (1995) showed the advantages of phonological training as an early intervention before the formal instruction of reading. In another study (2002), effects of morphological awareness training on meta-linguistic awareness and reading development compared to the phonological training were addressed. 273 Norwegian children participated in the study from kindergarten age through to first grade. Two experimental groups received either phonological processing training ot morphologic training while a control group received no training. The results of the study indicated both experimental groups (phonology, and morphology) outperformed the controls on word reading tasks, and both trainings had long lasting effects on reading measured upon school entrance and at the end of first grade. The morphological group even outperformed the phonological group on "word reading". "Phonological coding" was the only task in which no differences were found between all groups. Lyster (2002) argued that findings might be attributed to the transparency of the Norwegian language, and that formal teaching methods in Norwegian schools are based on phonics. The results of the study in L1 learners of Norwegian confirmed L1 learners of English from previous studies found the role of early phonological processing skills crucial on later reading skills.

Lervåg et al. (2009) also determined that letter knowledge and phoneme processing skills were best predictors of early reading skills in L1 learners of the Norwegian language. Lervåg claimed the pattern of this prediction as equivalent to that of L1 English learners. In another longitudinal study, Lervåg and Hulme (2010) examined the growth of spelling skills in a large

sample of Norwegian children (N = 228) over the first 3 years in school. Their findings in L1 learners of Norwegian were also consistent with the results of other prior studies indicating the crucial role of letter knowledge and phoneme awareness in development of reading skill.

Høien-Tengesdal and Tønnessen (2011) also examined the relationship between word decoding ability and three different phonological skills. Phonemic awareness, verbal short-term memory (V-STM), and rapid automatic naming (RAN) in 1007 Scandinavian third- and fifth-graders including a Norwegian sample (269 participants from Grade 3 and 278 from Grade 5) and a Swedish sample (262 third graders and 198 participants from Grade 5). The purpose of the study was to investigate the relationship between *phonological processing skills* and *word decoding efficiency* where most previous studies explore the relationship between *phonological processing skills* and *word decoding accuracy*. Investigating the influence of three phonological skills on word decoding ability showed that *phonemic awareness* was the most powerful phonological skill among average readers in word decoding skill that was accounted for by variance. Among children with poor decoding skills, however, RAN was the most important factor in Grade 3, whilst V-STM was the main contributor to decoding ability in children at Grade 5 level. They also examined the relationship between poor phonological processing skills and word decoding ability; the results were consistent with earlier research conducted on L1 learners of English. It was revealed that within Scandinavian language development, children with severe word decoding difficulties had poor phonemic awareness and restricted V-STM.

As discussed earlier, it is now well-documented how L1 children learn to read and write but how L2 learners do it in the second-language, is still controversial. Given studies related to the first-language, children typically go through different stages, and there is a consensus that *phonological processing skill* as emergent literacy-related skills play a crucial role in literacy development. There is also substantial evidence indicating factors such as age, nonverbal and oral language skill and children's socioeconomic status impact on phonological processing performance, and other emergent skills related to reading and writing tasks. Although, there is a general lack of agreement on how reading and writing are developing in L2 learners. In addition, oral exposure in two languages and experience with formal reading and writing instruction in one or two languages demonstrate affect on reading and writing development in second-language. In the case of *phonological processing skills*, the key factor

distinguishing learning methods in L2 learners' from the L1 learning model, depends on phonological structure of the two languages that L2 learners have been orally involved in (Chiappe et al., 2002b). According to empirical research, there is substantial evidence indicating that L2 learners use their first-language phonemic structures in the perception of second-language speech. In other words, *phonological processing skills* acquired in one language (first-language, L1) would transfer to another language (second-language, L2). The cross-language transfer of *letter knowledge and phonological processing skills* concept has been replicated across a growing body of research from preschool through primary grades (San Francisco, Carlo, August & Snow; 2006). For example, Dickinson, McCabe, Clark-Chiarelli, and Wolfe (2004) assessed *phonological processing skills* of bilingual children by using English and Spanish versions of the Early Phonological Awareness Profile (including deletion detection and rhyming tasks). The results from the study confirmed that the levels of phonological skills in each language were strongly related to development of phonological skills in the other language. Furthermore, it has been stated that there is a significance cross-language correlation for *phonological processing skills* among L2 learners of English.

According to Chiappe et al. (2002b), the reported transfers of *phonological processing skills* are also consistent with *linguistic interdependence hypothesis* that suggested by Cummins (1979): There is a high relationship between children's skills acquired in first language and second language. Based on Cummins' (1979) *linguistic interdependence hypothesis*, it predicts that L2 learners perform similar to L1 learners on phonological processing tasks as there is high relation between acquired skill in first and second language. In addition, based on empirical research, phonological processing performance of children is highly correlated to oral language skill. It can be therefore be assumed that similar to L1 children, L2 children with high LS would outperform L2 children with low LS skill on phonological processing tasks. Therefore, L2 learners would perform similar to L1 learners on tasks of *Letter Knowledge and Phonological Processing Skills* if their level of oral language skills is also accounted for.

Generally speaking, little is known about *letter knowledge and phonological performance* of L2 learners compared to L1 learners of a language. There are qualified studies which consider performances in L1 and L2 learners of English:

Chiappe, Siegel and Gottardo (2002a) examined emergent reading-related skills of L1- and L2 learners of English. One of their research aims was to find out whether these

measures, similar to L1 learners, would be used to identify L2 learners from diverse language backgrounds who were at-risk for reading problems. They assessed literacy, phonological and language processing of the participants at the beginning (fall) and end of (spring) kindergarten. The participants in their study included: 540 L1 learners of English (L1 learners), 59 L2 learners of English (L2 learners) and 60 children whose initial exposure to English was when they began school: *novice language speaker of English* (NL learners). MANOVA on the six measures of *phonological processing* (GFW sound mimicry raw scores: repeating pseudo-words, rhyme detection, syllable identification, phoneme identification, phoneme deletion, and RAN rate: rapid naming speed) at the beginning of kindergarten (fall), and on the four *phonological processing* (repeating pseudo-words, rhyme detection, phoneme deletion, and RAN rate) at the end of kindergarten (spring) were calculated. The results showed significant effect of *language group* in both fall, F (12, 1,234) = 3.84, $p < .001$, $\eta 2 = .036$, and spring, $F(8, 1{,}258) = 5.75$, $p < .05$, $\eta 2 = .035$. A subsequent series of ANOVAs using the Bonferroni adjustment for multiple comparisons confirmed significant differences between the *language groups* on *rhyme detection* in the fall, $F(2, 625) = 11.87$, $p < .001$, $\eta 2 = .073$, and the spring, $F(2, 632) = 21.29$, $p < .001$, $\eta 2 = .063$, and on RAN rate in the fall, $F(2, 625) = 6.61$, $p < .001$, $\eta 2 = .021$. Scheffés post hoc tests indicated that L1 children obtained higher scores than the NL children in rhyme detection and RAN rate in the fall. In the spring the L1 children had higher scores in *rhyme detection* than the L2 children, who obtained higher scores than the NL children. None of the other *phonological measures* revealed significant effects of *language group* at this time. Chiappe, et al. (2002a) concluded *language (groups)/backgrounds* influenced the proficiency in manipulating and remembering English sounds and words: the children with the greatest proficiency in English (L1 learners of English) had the highest scores in *rhyme detection*, whereas the children with the least exposure to English (NL learners) had the lowest *rhyme detection* scores. Furthermore, the differences between the children from the three *language groups* on measures of *phonological processing* were stable throughout kindergarten. They suggested these differences might be expected, because L2 learners and NL children are acquiring a new phonology with new phonemic contrasts.

Chiappe et. al. (2002b) also examined the performance of 858 kindergarten children on tasks of *phonological processing skills* in English words. 131 of these kindergarten children were L2 learners of English from linguistically diverse backgrounds and 727 of them were L1 learners of English. In each group of L1 and L2 learners, 2 sub-groups of at-risk and non-at-

risk children in reading difficulties were formed, based on children's performances on *Rhyme Detection Task*. In total, 140 children of 858 kindergarten children were identified to be at-risk; L2 learners (32 of 131) were more likely to be classified at risk than L1 learners (108 of 727). The findings showed that L2 learners of English in kindergarten were disadvantaged in one task; *phonological processing* (rhyme detection). Additionally, not-at-risk children (in both groups of L1 and L2 learners) showed greater skill in *phonological processing tasks* of English words than at-risk children (in both groups of L1 or L2 learners of English). It was also found that at the conclusion of first grade, L2 learners of English who were also average readers, performed at the same level as those of typically developing L1 learners on all *phonological processing tasks* of English words overall. L2 learners of English who were identified as having reading difficulties had scores on *phonological processing tasks* in English words, scored significantly lower than those of English L1 learners from the same class (who were classified as average readers). However, L2 learners with reading difficulties showed scores similar to those of L1 learners of English who were also identified with reading difficulties. Accordingly, Risk status (at-risk or non-at-risk for reading difficulties based on *Rhyme Detection Performance* in kindergarten) was the only early significant effect, not the language background (L1 or L2 learners) found to be relevant for later reading skills at the end of first-grade. Finally, because the participants studied in the L2 learners group indicated tremendous heterogeneity in language background, Chiappe and her colleagues (2002b) suggested findings could not be discounted as language specific; thus, results could be applicable for L2 learners of English from diverse language backgrounds.

Although a growing body of research is conducting in the Norwegian language, little is known about L2 learners learning Norwegian language, their performances on *letter knowledge and phonological processing tasks* in Norwegian words, and whether their performance differs from the L1 learners' performance.

Lervåg and Aukrust (2010) examined the role of *decoding* and *vocabulary skills* as the early predictors of *reading comprehension* in 198 L1 and 90 L2 learners of Norwegian. A large number of measures were used in the study to examine different skills of children. (a) *Reading comprehension*: a Norwegian translation of the Woodcock Reading Mastery Test- R, Passage Comprehension (WRMT-PC) and the Neale Analysis of Reading Ability II (NARA II). (b) *Word decoding:* a Norwegian translation of the Test of Word Reading Efficiency

(TOWRE) forms A and B. (c) *Vocabulary breadth:* a Norwegian translation of the first 144 words of the Peabody Picture Vocabulary Test III (PPVT) forms A and B. In addition, an Urdu translation of the British Picture Vocabulary Scale II) was administered only for the L2 sample. (d) *Vocabulary definition:* the Vocabulary test from the Norwegian translation of Wechsler Intelligence Scale for Children III (WISC III), and the Word definition test from the Danish Ability Scales (DEP). (e) *Nonverbal abilities:* Raven Standard Progressive Matrixes sets A, B, and C. (f) *Maternal education:* by asking the mothers to rate their educational level in the following categories: no formal education (score = 0), 1–6 years (score = 1), 7–9 years/junior high school (score = 2), 10– 12 years/senior high school (score = 3), 1–4 years of collage/university (score = 4) and 5 years of more at a university (score = 5). Results of the study revealed that L1 learners obtained higher scores than L2 learners of Norwegian in all measures of the study (vocabulary, non-verbal abilities and maternal education) except for those measuring *decoding skills*. In overall, L1 learners had also better *initial reading comprehension skills* in addition to faster growth of these skills over time. Based on findings by Lervåg and Aukrust (2010), both of these differences were fully attributed to initial differences in *vocabulary skills* between L1 and L2 learners. Moreover, *vocabulary skill* was a critical predictor of the early development of *reading comprehension skills* in both L1 and L2 learners of Norwegian. Thus, it was suggested that *oral vocabulary training* should be given higher priority, especially for L2 learners.

The study by Lervåg and Aukrust (2010) aimed to investigate *the reading comprehension skills* between L1 and L2 learners. Measures used in *Word decoding*, comprised TOWRE (forms A and B) in which children were asked to read as many words as they could in 45 seconds from a list of 104 words. No measure was used to investigate *letter knowledge and phonological processing skills* as *reading comprehension skill* was of concern, not emergent literacy-relate skills. Findings revealed there was a crucial relationship between *oral language (*as vocabulary skill) and *reading comprehension skill* for both L1 and L2 learners of Norwegian.

2.4 Summary

As reviewed, a substantial growing body of evidence in different alphabetic languages including Norwegian (Hagtvet, 1997; Høien-Tengesdal & & Tønnessen, 2011; Lervåg & Aukrust, 2010; Lervåg & et al. 2009; Lervåg & Hulme, 2011; Lyster, 1995; 2002) indicates

phonological processing skills, as emergent literacy-related skills, play a crucial role in literacy development of L1 learners (Furnes & Samuelsson, 2011; Muter & et al., 2004; Snow & et al., 1998; Snowling & Hulme, 2011; Wagner & et al.,1994). Moreover, there is a high relationship between *oral language* proficiency and *phonological processing skills* that suggests children with Low-oral language skills (Low-LS) lag behind their peers with high oral language skills (High-LS) in terms of emergent literacy-related skills such as *phonological processing skills* (Anthony & et al., 2002; Puranik and Lonigan, 2012; Snowling & Hulme, 2005). There is also substantial evidence indicating some factors like *age*, *nonverbal skill*, and Children's *family socioeconomic status* impact on their performance of *phonological processing*, and other emergent skills related to reading and writing development.

However, there is a lack of agreement on literacy development of L2 learners of a language in general (Chiappe et al., 2002b), and little is known about L2 learners of Norwegian. In the case of *phonological processing skills*, there is considerable evidence of cross-language transfer indicating taht *phonological processing skills* acquired in the first-language can transfer to the second-language (Chiappe et al., 2002a; Dickinson & et al., 2004; Durgunoglu & et al., 1993; San Francisco & et al., 2006). These replicated reported for transfer of *phonological processing skills*, is consistent with *linguistic interdependence hypothesis of Cummins* (1979) that suggested there is a high relationship between children's skills acquired in first and second languages (Chiappe et al., 2002b). According to *linguistic interdependence hypothesis*, it would predict that L2 learners would perform similar to L1 learners on *phonological processing tasks,* and because of a high relationship between *phonological processing skills* and *oral language skill:* (High LS) L2 learners would perform similar to (High LS) L1 learners, and (Low LS) L2 learners would perform similar to (Low LS) L1 learners.

Therefore, ***it is hypothesized that children with high oral language skill (High-LS) would perform better than children with low oral language skill (Low-LS) in phonological processing tasks. Based on Cummins's (1979) Linguistic Interdependence Hypothesis, it is also hypothesized that there would be no statistically significant difference in performance on letter knowledge and phonological processing tasks between L1 and L2 learners by taking into account the level of oral language skill (High-LS vs. Low-LS).***

3 METHODOLOGY

This chapter considers research design, choice of method for conducting the study, and how to analyze the result. The participants, instruments, and validity and reliability are also discussed. In this study, a descriptive-analytical approach (Gall, Gall & Borg, 2007) was used to examine the hypothesis by answering the research questions.

3.1 Research Design

The present study is a quantitative, non-experimental design, in which *Letter Knowledge and Phonological Processing skills* are compared in different groups without change (Gall & et. al., 2007). In fact, no manipulation or change has been made to these skills. The present study can also be considered as a cross-sectional (comparative) research design, according to De Vaus (2001).

Cross-sectional (comparative) research is a type of study which utilizes different groups of participants who differ in the variable(s) of interest, but share other characteristics such as socioeconomic status, educational background, and so forth. De Vaus (2001) discussed in cross-sectional designs, researchers collect measures from at least two groups at one point in time and compare whether the two groups differ in dependent variable(s). Like non-experimental designs, cross-sectional studies face problems identifying causal relationship. Yet, cross-sectional studies are highly recommended for studying problems in education and social sciences because these kind of design give researchers an opportunity to analyze the relationships by using a large number of variables within a single study (De Vaus, 2001; 2002). Accordingly, cross-sectional designs have four distinctive features: (a) reliance on existing variations in the independent variable(s) in the sample: the existing variations are *Language Group* (L1 or L2 learners) and *Language Skill* (High- or Low-LS) (b) At least one independent variable with at least two categories: four groups based on 2 independent variables. *Language Group* and *Language Skill:* 1. High-LS, L1-learners, 2. High-LS, L2-learners, 3- Low-LS, L1-learners, and 4. Low-LS, L2-learners (c) Collection of data is at one point in time: in the beginning of first grade, and (d) no random group allocation: Participants were divided up based on the two independent variables: *Language Group* (L1 or L2 learners of Norwegian) and Language Skill (High-LS or Low-LS).

3.2 Methodological Issues

3.2.1 Validity

Internal Validity: The internal validity of a study is the extent to which confounding variables have been controlled by the researchers (Gall, Gall & Borg, 2007). The main threat to the internal validity of cross-sectional designs is whether the observed relationship between variables reflects a causal relationship. Even though groups may differ in outcome variables, these differences between the variables may not necessarily be share a causal link (De Vaus, 2001; 2002). In fact, many factors can impact on *Letter Knowledge and Phonological Processing Skill*. According to August and Shanahan (2006), age, nonverbal skill, other disabilities or problems, certain socioeconomic variables, and classroom and/or school factors can be considered the most important factors. These factors as the most important confounding variables, with capacity to affect *Letter Knowledge and Phonological Processing Skills* of participants, and need to be controlled:

Nonverbal Skill: Measure of Raven as the *background variable* used to control *Nonverbal Skill* of the participants.

Other related Problems/disabilities: No neurological problems or injuries, no syndromes, no hearing impairments or other visible problems should have been reported in participants.

Age: The age range is between 5 years and 8 months to 6 years and 9 months which identifies participants at "the early stage of reading" and is based on the target age used in hypothesis.

Socioeconomic Status: All participants live in predominantly middle-class neighborhoods in Oslo; socioeconomic status of participants' families can therefore be considered at an equivalent level.

All of these variables except *Nonverbal Skill* are controlled before analyzing data to discern whether the joint effect of Language Skill (High-LS or Low-LS), and Language Group (L1 or L2 learners) would impact on *Letter Knowledge and Phonological Processing Skills* in participants. The result for measure of Raven is presented in Chapter 4.

External Validity: External validity is the extent to which the findings of a study can be applied to individuals and settings beyond those that were studied (Gall & et. al., 2007). A

representative sample is necessary to generalize the results obtained in this sample to the wider population. Cross-sectional studies enjoy more success than other studies in achieving these representations because they do not have a time dimension that results in bias being introduced by sample attrition. As long as the initial sample is well selected, the cross-sectional study should yield results that are reflective of the population from which they were drawn (De Vaus, 2001). For this reason, cross-sectional designs have become popular for the studies where accurate description is required (De Vaus, 2001). However, the results obtained from the present study may need to be generalized conservatively due to its small sample size, which results in small and unequal group sizes. Sample size and the group sizes of the study are explained in further detail in Chapter 4.

3.2.2 Reliability of Measures

The obtained score from a measure always includes some degree of measurement error, and thus, measure reliability refers to the consistency, stability, and precision of the obtained scores (Gall & et. al., 2007). It is important to consider the reliability of measures because measures with low reliability weaken the power in tests of statistical significance and estimates of population parameters (De Vaus, 2002). One of the most commonly used tests of reliability for internal consistency is Cronbach's alpha coefficient which measures the overall reliability of a measure and always moves between 0 and 1. Measures yielding scores with a reliability of .80 or higher are sufficiently reliable for most research purposes (De Vaus 2002). Cronbach's alpha coefficients in the present study are reported in Chapter 4.

3.2.3 Ethical Issues

Ethical risk: As part of the project "Knowledge generation in the practice field of special needs education (KiSP)", parents of students were informed in advance with a permission letter and a brief description of the study. Since parents may feel that their children could be at risk if the results of assessment or other information would be revealed to others -like their classmates or teachers, they were assured that the identities of their children would be concealed from assessment through to the data analyses and also in the final report. Demographic data about the students and schools included in the sample are reported but in a way that not identifiable to others.

Approved by the Institutional Review Board: The present study forms part of the KiSP's project and so designated procedures by the Norwegian Social Science Data Service (NSD) obtained by KiSP has also been followed in the present study.

3.3 Participants of the study

L1 and L2 learners participating in this study were selected from participants in the KiSP project. The KiSP project functioned at two schools in the center of Oslo. To investigate the performance of *Letter Knowledge and Phonological Processing Skill* at an early reading stage, only 90 first-grade students attending one of these two schools were used as participants in the present study. Participants were divided up as either L1- or L2-learners based on their *Language Group:* A participant was considered an L1 learner if Norwegian was first language for both of his/her parents, while a participant was considered an L2 learners when a language other than Norwegian was the first language for both of his/her parents. Thus, one students was excluded from the study because he did not fit the criteria; the first language of one parent was Italian while the first language for his mother was Norwegian. 89 first-grade students (46 male and 43 female) participated in this study; who were further then divided into two more groups according to Language Skill (High-LS vs. Low-LS) based on their performance on the language measure of the study (TROG). In total, 83 students participate in all sessions of study included 42 boys and 41 girls living in the same, predominantly middle-class neighborhoods with an age range between 5 years and 8 months to 6 years and 9 months.

3.4 Instruments

3.4.1 Test for Reception of Grammar, Version 2 (TROG)

TROG-2 enables the examiner to compare the performance of a student with that of others at the same age and to pinpoint specific areas of difficulty. It is a multiple choice test in which the participant selects a picture (of four) that fits to a sentence given by the examiner andit measure the comprehension of grammar skill. In the present study, TROG-2 is the Norwegiann translation and administrated in Norwegian for divideding the participants into two groups of language skill (High-LS or Low-LS).

3.4.2 Measure of IL-basis

IL-Basis is a Norwegian measure prepared to investigate *Letter Knowledge and Phonological Processing Skills* (Frost & Nielsen, 2000). It is not standardized, but can be used as a diagnostic testing and teaching tool to find students who are in need of early reading/writing intervention, according to the manual description. It consists of 12 items:

1. Listening Comprehension1: It is a multiple choice test. After listening to a short story told by the examiner, the child should choose a picture (of four) that answers to a question related to that story. There are 5 series of pictures and 5 related stories. Each correct answer scores 1 point; the maximum total points which can be accumulated is 5.

2. Listening Comprehension2: It given in a Yes/No choice format followed by four series of pictures about a story that are told by examiner. The child should answer (Yes/No) to a question after listening to that short story. There are 5 series of pictures and 5 related stories. Each correct answer score 1 point; where the maximum total points which can be accumulated is 5.

3. Rhyme Detection: There is one picture on the left side, and 6 pictures on the right side of a piece of paper. The examiner gives the word shown on the picture on the left side, and then gives the words of all 6 pictures on the right side. The task is to match the picture on the right side with the word that rhymes in the left-sided picture. There are 6 series of pictures and each correct answer has 1 point; the maximum total point is 6.

4. First Phoneme Identification: There is one picture on the left side, and 4 pictures on the right side of a piece paper. The examiner gives the word shown on the picture on the left side, and then, provides the words of all 5 pictures on the right side. The child should match the pictures on the right side with a word sharing the same initial phoneme on the picture on the left side. There are 11 series of pictures and each correct answer scores 1 point with a maximum total of 11 points.

5. Phoneme Identification Counting 1: The examiner gives a word shown by a picture. The participant should count how many phonemeses that word has, and mark on the provided booklet for each phoneme. There are 6 pictures and each correct answer scores 1 point with a maximum total of 6 points.

6. Phoneme Identification Counting 2: The examiner provides a word shown by a picture. The participant should count how many phonemes the word has and mark the booklet

for each phoneme detected. There are 12 pictures and each correct answer earns 1 point with a maximum total of 12 points.

7. Compound Word Identification: There are 5 pictures on the top and 5 pictures on the bottom of a page. First, the examiner gives the words that have shown by the 5 pictures on the top; then, provides the words of the 5 pictures on the bottom. The child should create a compound word by combining of one picture from the top of the page with another picture from the bottom of the page. (Like sun & glasses = sunglasses). There are 5 pairs of pictures and each correct answer earns 1 point with a maximum total of 5 points.

8. First Letter Identification: There is a picture on the left side and 3 alphabet letters on the right side of a piece of paper. Each of these 3 alphabets is written in both upper and lower-case (eg. L l, N n, U u and A a). The examiner gives the word shown on the left-sided picture; while the child should draw a circle around the letter matching the first letter of that picture. There are 24 pictures representing the Norwegian alphabet (24 letters); but the alphabets is not presented in their common, chronological order. Each correct answer scores 1 point; with a maximum total of 24 points.

9. First Letter Writing: The examiner provides a word and the child should write down the first letter of that word. There are 24 words; each begins with one letter in the 24-letter Norwegian alphabet (not presented in chronological order). Each correct answer scores 1 point; the maximum total point is 24.

10. Simple Word Writing 1: There is a picture and the examiner gives the word shown by that picture; the child should write that word down. There are 6 pictures and each correct answer scores 1 point with a maximum total of 6 points.

11. Simple Word Writing 2: The examiner provides a word that has shown by a picture; the child should write it down. There are 8 pictures and each correct answer scores 1 point with a maximum total of 8 points.

12. Simple Word Writing 3: The examiner provides a word that has shown by a picture; the child should write it down. There are 6 pictures and each correct answer scores 1 point with a maximum total of 6 points.

Some of these items intended to assess the same skills at different levels, thus, for statistical purposes, these items were combined with each other to decrease the amount of examined items; from12 items to 8 items. Then, the risk of a *Type I error* was avoided by conducting several analyses (Tabachnick & Fidell, 2007). Then, **Measure of IL-basis *(Maximum points = 118)*** consisted of 3 sub-measures and 8 items in the present study:

I. Listening Comprehension Skill (Maximum point = 10):

Listening Comprehension 1 & 2 *(Maximum Point = 10).*

II. Phonological Processing Skill (Maximum point = 64):

Rhyme Detection *(Maximum point = 6)*

First Phoneme Identification *(Maximum point = 11)*

Phoneme Identification Counting 1&2 *(Maximum point = 18)*

Compound Word Identification *(Maximum point = 5)*

First Letter Identification *(Maximum point = 24)*

III. Simple Writing Skill/Letter Knowledge (Maximum point = 44):

First Letter Writing (*Maximum* point = *24)*

Simple Word Writing 1, 2 & 3 *(Maximum point = 20).*

3.4.3 Measure of Raven (Standard Progressive Matrixes Sets)

This measure is known as the Norwegian translation of Raven. Nonverbal skills of participants are measured according to the standard group administration in the test manual. Nonverbal skill is the *background variable* in the present study.

3.5 Data Analysis

The data is analyzed through the statistical program "Statistical Package for the Social Sciences" (SPSS) to conduct descriptive and analytical statistical calculations. Two-way analysis of variance (ANOVA), and two-way multivariate analysis of variance (MANOVA) were used to investigate the joint effect of two independent variables (*language skills:* High-LS or Low-LS, and *language group:* L1 or L2 learners) on dependent variable(s) (*letter knowledge and phonological processing skill* as measured by IL-basis). ANOVA and MANOVA were used to determine any effects of interaction between the independent variables, and to avoid the risk of Type I error by running a series of T-test analysis (Tabachnick & Fidell, 2007). Further discussion can be found in part 4-2 of Chapter 4; Statistical Approaches.

4 ANALYSIS OF DATA

4.1 Introduction

This chapter provides an overview of research results through descriptive and analytical statistics. SPSS program is used to summarize and analyze data to investigate hypothesis of the study and the related questions: ***''It is hypothesized that children with high oral language skill (High-LS) would perform better than children with low oral language skill (Low-LS) in phonological processing tasks. Based on Cummins's (1979) Linguistic Interdependence Hypothesis, it is also hypothesized that there would be no statistically significant difference in performance on letter knowledge and phonological processing tasks between L1 and L2 learners by taking into account the level of oral language skill (High-LS vs. Low-LS)''.***

Main Questions:

1. Would children with High oral language skill (High-LS) perform better or worse than children with Low oral language skill (Low-LS) in *Letter Knowledge and Phonological Processing Skills* in Norwegian words?

2. Would there a statistically significant difference in the performance of L1 and L2 learners on *Letter Knowledge and Phonological Processing tasks* in Norwegian in either High LS or Low LS groups?

Sub-questions:

3. Would L1 learners (High-LS group) perform better or worse than L1 learners (Low-LS group) on task performance in *Letter Knowledge and Phonological Processing Skills* or any of its sub-measures or components?

4. Would L1 learners (High-LS group) perform better or worse than L2 learners (Low-LS group) on task performance in *Letter Knowledge and Phonological Processing Skills* or any of its sub-measures or components?

5. Would L1 learners (High-LS group) perform better or worse than L2 learners (High-LS group) on task performance in *Letter Knowledge and Phonological Processing Skills* or any of its sub-measures or components?

6. Would L1 learners (Low-LS group) perform better or worse than L1 learners (Low-LS group) on task performance in Letter Knowledge and Phonological Processing Skills or any of its sub-measures or components?

The first part of this chapter presents participants of the study, how they are classified into a *Language group* (L1 or L2 learners), and how they are divided according to *Language Skill* (High-LS or Low-LS). The second part will discuss about statistics approaches used in the present study as well as its validity and power. The third part deals with the background variable of the study (*nonverbal skill* of the participants measured by the Raven). Investigations for hypotheses of the study and research questions are discussed in the fourth, fifth and sixth parts of the chapter. A summary of the results will also presented in the final part of the chapter.

4.2 Participants

Participants in the present study were children enrolled in the first grade in one of two primary schools in Oslo, Norway. All participants lived in predominantly middle-class neighborhoods. Out of the 90 total students, 83 students participated in all sessions of study and comprised 42 boys and 41 girls with an age range of 5 years and 8 months to 6 years and 9 months (n =83, M = 74.14, SD = 3.19).

4.2.1 Language Group

Language Group was the first *independent variable* for present study and the participants were divided into two language groups of L1 or L2 learners based on their *language background*. As mentioned before, for the present study, participants were either placed in a group of *L1 learners* (Norwegian is first language for both parents of a participant) or *L2 learners* (a language other than Norwegian is first language for both parents of a participant, where the child also spoke this language).

Of the students who participated in present study, 66 were identified L1 learners, and 17 students were identified L2 learners. In the group of L2 learners, 11 languages other than Norwegian were reported: Persian (4 children), Arabic (3 children), Urdu (2 children), Spanish (2 children), and Polish, Panjabi, Russian, Flemish, Tamil, English and German (one

child each). Because of the diversity in language found in L2 learners, the homogeneity of the group may be of concern. Of course, an ideal study would have a group of L2 learners who spoke one certain language other than Norwegian, especially when the comparison one certain language with Norwegian is the aim of the study. However, the present study chose to have such diversity in the group of L2 learners for two reasons: Firstly, selecting one certain language requires a larger sample which is hard to achieve in practice. Secondly, based on literature there is high-qualified research suggesting the diverse samples to investigate the same research hypothesis (e.g., Chiappe, et al., 2002; Chiappe, Siegel & Gottardo, 2002). The present study intends to follow the same aims as these studies: To find out how L1 and L2 learners perform on *phonological processing skills* regardless of L2 learners' language backgrounds.

4.2.2 Language Skill

Language Skill is the *second independent variable* in the present study and considers the level of language skill in Norwegian. Participants are classified either High-S or Low-LS based on their performances on a Language-Skill measure (TROG-2) that was administered in Norwegian. Children who obtained TROG-2 scores 1 *SD* below the sample mean were classified as Low-LS. Overall, the 17 children (8 L1 and 9 L2 learner) who obtained scores lower than 7 were classified Low-LS. 66 children (58 L1 and 8 L2 learners) were classified as High-LS children. In general, L2 children were more likely to be classified Low-LS than L1 children. The result of Chi-Square Test for *language skills* are presented in Table 4-1.

Table 4-1- Chi-Square Test, N=83

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	13.83	1	.000

Table 4-1 shows $\chi 2(1, N = 83) = 13.83$, and $p < 0.001$. This confirms that more L2 children are classified to the group of Low-LS in the present study.

In summary, participants were identified L1 or L2 learners regarding to their language background; they were then divided into two groups depending on *Language Skill* (High-LS vs. Low-LS) based on their language performance measured by TROG-2. This was conducted

to explore the impact of *Language Group* and *Language Skill* on *letter knowledge and phonological skills* of L1 and L2 learners as measured by IL-basis.

4.3 Statistics Approaches

All participants were divided into 4 groups according to *language Group* (L1 or L2 learners) and *language skill* (High-LS or Low-LS)*:* (n=58) L1 and (n=8) L2 learners were identified in the group of High-LS, and (n=8) L1 and (n=9) L2 learners were identified in the group of Low-LS. Now the question is it is possible to compute a valid test with such small sizes and unequal group sizes. This question is discussed in chapter 5. Accordingly, parametric techniques of *two-way analysis of variance (ANOVA)* are used to analyze data and the alpha level considers 0.01 in the present study.

4.4 Background Variable: "Nonverbal Skills"

Raven measure obtained *nonverbal skills* of the participants to be ensured any differences between the performances of L1 and L2 learners found in *letter knowledge and phonological processing tasks* would not be related to the differences between their *nonverbal skills*.

A two-way between-groups *ANOVA* is conducted to explore the impact of *Language Skill* and Language *Group* on *nonverbal Skill*, as measured by the Raven Test. The result is presented in Table 4-2.

Table 4-2- Tests of Between-Subjects Effects (Dependent Variable: Raven)

Source	Type II Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Language Skill	135.903	1	135.903	10.381	.002	.116
Language Group	76.054	1	76.054	5.809	.018	.068
Language Skill * Language Group	.421	1	.421	.032	.858	.000

Table 4-2 reveals the interaction effect between *Language Skill* and *Language Group* was not statistically significant, F (1, 79) = 0.03, p = 0.86, > 0.01. It indicates that by taking into account the language skills, High-LS L1 learners did not significantly perform better than Low-LS L2 learners in the nonverbal skill measured by Raven. In addition, the same trend

can be seen in the group of Low-LS children. A subsequent series of *ANOVA* also confirmed this pattern: No statistically significant differences were found between the nonverbal skill of L1 and L2 learners in either groups: High-LS group: F (1, 64) = 2.82, p = 0.1, and Low-LS group: F (1, 15) = 3.86, P = 0.07. Thus, any differences between the performances of L1 and L2 learners would found for the main variable, IL-basis, would not be related to the differences between *nonverbal skills* in participants.

4.5 Measure of IL-basis

Measure of IL-basis was the main research measure in the present study to investigate *Letter Knowledge and Phonological Processing Skills* of participants in both groups of L1 and L2 learners. The distribution of scores obtained by the IL-basis measure assessed and it was of normal distribution (chapter 5). According to the result obtained from Levene's Test, the assumption of homogeneity of variances was also met in the IL-basis measure (Sig.= 0.84; p > 0.05). Then, the two-way *ANOVA* procedure was applicable and the type II SS Method of *ANOVA* was used due to unequal group sizes (Tabachnick & Fidell, 2007).

4.5.1 Main ANOVA Analysis for Measure of IL-basis

Table 4-3 shows descriptive statistics and Table 4-4 presents Test of Between-Subjects Effect of *ANOVA* to explore whether *Language Skill* and *Language Group* have any impacts on *letter knowledge and phonological processing skills*. These tables are discussed along with the first parts of sub-questions of the study:

Table 4-3- Descriptive Statistics for measure of IL-basis in the group of L1 Learners and L2 Learners, respectively for High-LS and Low-LS children

Language Group	Language Skill	Mean	Std. Deviation	N
L1 Learners	High-LS children	91.91	25.38	58
	Low-LS children	75.38	28.21	8
	Total	89.91	26.08	66
L2 Learners	High-LS children	71.75	25.3	8
	Low-LS children	40.78	23.82	9
	Total	55.35	28.59	17
L1 &L2 Learners (All participants)	High-LS children	89.47	26.04	66
	Low-LS children	55.35	28.59	17
	Total	82.83	29.93	83

Table 4-4- Tests of Between-Subjects Effects (Dependent Variable: IL-basis)

Source	Type II Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Language Skill	5435.23	1	5435.23	8.37	.005	.096
Language Group	7377.27	1	7377.27	11.36	.001	.126
Language Skill * Language Group	550.61	1	550.61	0.85	.360	.011

(Sub-Q3) <u>Would L1 learners (High-LS group) perform better or worse than L1 learners (Low-LS group) on task performance in Letter Knowledge and Phonological Processing Skills</u> or any of its sub-measures or components?

According to Table 4-3, in the group of L1 learners, High-LS children (n = 58, $M = 91.91$, $SD = 25.38$) scored higher than Low-LS children (n = 8, $M = 75.38$, $SD = 28.21$). Table 4-7 shows this difference is statistically significant because main effects for *Language Skill:* $F(1, 79) = 8.37$, $p < 0.01$ is significant. The present study suggests High-LS L1 learners perform significantly better than Low-LS L1 learners.

(Sub-Q4) Would L1 learners (High-LS group) perform better or worse than L2 learners (Low-LS group) on task performance in *Letter Knowledge and Phonological Processing Skills* or any of its sub-measures or components?

Table 4-4 shows that there is statistically significant main effects for *Language Skill: F* (1, 79) = 8.37, $p < 0.01$. It confirms the same trend of difference in the group of L2 learners: High-LS L2 learners (n = 8, *M* = 71.75, *SD* = 25.3) also scored significantly higher than Low-LS L2 learners (n = 9, *M* = 40.78, *SD* = 23.82) on *letter knowledge and phonological processing tasks.*

(Sub-Q5) Would L1 learners (High-LS group) perform better or worse than L2 learners (High-LS group) on task performance in *Letter Knowledge and Phonological Processing Skills* or any of its sub-measures or components?

(Sub-Q6) Would L1 learners (Low-LS group) perform better or worse than L1 learners (Low-LS group) on task performance in *Letter Knowledge and Phonological Processing Skills* or any of its sub-measures or components?

Table 4-4 presents statistically significant main effects for *Language Group: F* (1, 79) = 11.35, $p < 0.01$. It means that when the oral language skills of participants are not taken into account, L1 learners (n = 66, *M* = 89.91, *SD* = 26.08) perform significantly better than L2 learners (n = 17, *M* = 55.35, *SD* = 28.59) in present study.

As shown in the Table 4-3, the interaction effect between *Language Skill * Language Group* is not statistically significant, *F* (1, 79) = 0.85, $p = 0.36$. By taking into account the level of oral language skills, results indicate L1 learners did not perform significantly better or worse than L2 learners: High-LS L1 children (n = 58, *M* = 91.91.35, *SD* = 25.38) did not perform significantly better or worse than High-LS L2 children (n = 8, *M* = 71.75, *SD* = 25.3), and Low-LS L1 children (n = 8, *M* = 75.38, *SD* = 28.21) did not perform significantly better or worse than Low-LS L2 children (n = 9, *M* = 40.78, *SD* = 23.82). A subsequent series of *ANOVA* confirm this pattern: There were no significant differences between the performances of *Letter knowledge and phonological processing* in L1 and L2 learners, in the group of High-LS children: *F* (1, 64) = 4.44, $p = 0.04$, or in Low-LS group: *F* (1, 15) = 7.52, *P* = 0.02.

In summary, a two-way between-groups *ANOVA* was conducted to investigate the impact of *Language Skill* and *Language Group* on *letter knowledge and phonological processing*

skills, as measured by IL-basis. Participants were divided into two groups according to their *level of language skill* (High-LS vs. Low-LS), and then identified as L1 or L2 learners regarding to their *Language Group:*

1. There was statistically significant main effect for *Language Skill: F* (1, 79) = 8.37, $p <$ 0.01: That means in general, High-LS children performed better than Low-LS children on tasks of *Letter Knowledge* and *Phonological Processing* in Norwegian words.
2. There was statistically significant main effect for *Language Group: F* (1, 79) = 11.35, $p < 0.01$: That means when the level of *Language Skill* (High-LS vs. Low-LS) was not accounted for, L1 learners performed significantly better than L2 learners on tasks of *Letter Knowledge and Phonological Processing* in Norwegian words.
3. The interaction effect between *Language Skill* and *Language Group* was not statistically significant, *F* (1, 79) = 0.85, $p = 0.36$: That means by taking into account the level of oral language skills in Norwegian (High vs. Low LS), L1 learners performed not significantly better than L2 learners on tasks of *Letter Knowledge and Phonological Processing* in Norwegian words. Then, in the present study:

- High-LS, L1 learners did not perform significantly better or worse than High-LS, L2 learners on tasks of *Letter Knowledge and Phonological Processing* in Norwegian words.

- Low-LS L1 learners did not perform significantly better or worse than Low-LS L2 learners on tasks of *Letter Knowledge and Phonological Processing* in Norwegian words.

4.6 Sub-Measures of IL-basis: MANOVA

The IL-basis measures comprised three sub-measures in the present study: ***Listening Comprehension Skill, Phonological Processing Skill*** and ***Simple Writing Skill***. To answer second parts of the each sub-questions (sub-measures), a multivariate *ANOVA (MANOVA)* was used. MANOVA was used instead of conducting a series of ANOVA separately to avoid the risk of *Type I error* (Tabachnick & Fidell, 2007): There were 3 dependent variables (*Listening Comprehension Skill, Phonological Processing Skill* and *Simple Writing Skill/Letter Knowledge*) and 2 independent variables (*Language Skill* and *Language Group).* Before proceeding with the main MANOVA analysis, the data was investigated whether they satisfied assumptions required to use a MANOVA:

4.6.1 Sample Size in MANOVA Analysis

In a MANOVA analysis, more participants in each group than the number of dependent variables is needed (Tabachnick & Fidell, 2007). Three sub-measures of IL-basis were dependent variables so the minimum required number of participants in each group is three and this assumption was satisfied.

4.6.2 Normality

Both univariate normality (e.g.: Kolmogorov-Smirnov Test) and multivariate normality are required. However, MANOVA is reasonably robust to modest violation of normality except where the violations are due to outliners (Tabachnick & Fidell, 2007). The information about the distributions of sub-measures of IL-basis's scores in the groups of L1 and L2 learners regarding to their Language Skill (High-LS vs. Low-LS) is presented in The Table7-1 as the appendix 1. Accordingly, L1 learners regarding in the Low-LS group (n = 8, p = .2000) met the assumption of normal distribution. Scores for L2 learners in both groups of High-LS and Low-LS (*sig.* = .200) also met the assumption of univariate normality in all of its sub-measures. Only scores for High-LS L1 learners in the three sub-measures of IL-basis, reached statistical significant (*sig.* = .000). The group size (n = 58) is sufficient to be considered a normally distribution (Tabachnick & Fidell, 2007). Then, univariate normality was not seriously violated. In addition, Calculating *Mahalanobis distance* using Regression in SPSS, no multivariate outliners were found in the values being to use in a MANOVA analysis. The Maximum value obtained for Mahalanobis *distance* was 14.85, which was smaller than the *critical value* (16.27) provided by Tabachnick and Fidell (2007). No multivariate outliners were identified and MANOVA analysis is reasonably robust tool even in modest violation of normality in this study (Tabachnick & Fidell, 2007).

4.6.3 Multicollinearity and Singularity

According to Tabachnick and Fidell (2007), MANOVA is optimal when the dependent variables are moderately correlated. When dependent variables are very highly correlated (0.90 and above), it suggests multicollinearity. This can occur when the variables are redundant; one of the variables is a combination of two or more of other variables and would be considered a case of singularity. Running a correlation analysis to confirm the strength of the correlation among dependent variables, is the most straightforward way for the check of

assumption. According to Pearson correlations obtained among sub-scales of IL-basis, none of the dependent variables were highly correlated ($r < 0.9$). The correlation table (Table 7-2) is presented as appendix 2.

4.6.4 Homogeneity of Variance-Covariance Matrices

According to the *MANOVA* for sub-measures of IL-basis, statistical significant was not found for Box's Test of Equality of Covariance Matrices (*sig.* = 0.04) > 0.001. Thus, the assumption of Equality of Covariance was also satisfied (Tabachnick & Fidell, 2007).

A two-way MANOVA was then used to investigate the individual and joint effect of two independent variables (*Language Skill* and *Language Group*) on the dependent variables (*Listening Comprehension skill, Phonological Processing Skill* and *Simple Writing Skill/Letter Knowledge*). A Type II SS Method of MANOVA was used due to unequal group sizes, and a conservative alpha level of 0.01 was used (Tabachnick & Fidell, 2007):

4.6.5 Main MANOVA Analysis for Sub-Measures of IL-basis

Table 4-5 shows Multivariate Tests of MANOVA for sub-measures of IL-basis (dependent variables). Tabachnick and Fidell (2007) recommended Pillai's Trace Test because it is more robust in the case of small sample size, unequal group sizes and violation of assumptions.

Table 4-5- Multivariate Tests b: Sub-measures of IL-basis

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Language Skill	Pillai's Trace	0.16	5.013a	3.000	77.000	.003	0.16
Language Group	Pillai's Trace	0.16	4.873a	3.000	77.000	.004	0.16
Language Skill * Language Group	Pillai's Trace	0.01	.496a	3.000	77.000	.686	0.02

Table 4-5 indicates there are significant main effects ($p < 0.01$) for both *Language Skill:* $F(3, 77) = 5.01$, $p = 0.003$; Pillai's Trace = 0.16, and *Language Group:* $F(3, 77) = 4.87$, $p = 0.004$; Pillai's Trace = 0.16. The effect sizes for both are large by the use of Cohen's (1988) criterion (Tabachnick & Fidell, 2007). While, the interaction effect of *Language Skill/*

Language Group is not statistically significant (*Language Skill * Language Group*: F (3, 77) = 0.5, p = 0.69; Pillai's Trace = 0.01. The effect size is small (Partial Eta Squared = 0.02).

Because of significant main effects for *Language Skill* and *Language Group* on the multivariate test, Test of Between-Subjects Effects is used for further investigation. Due to a number of separate analyses used in the test, it is suggested that a higher alpha level should be set to reduce the likelihood of a *type I error*. The most common way is to apply a Bonferroni adjustment; dividing the original *alpha level* by the number of analyses intended to be conducted (Tabachnick & Fidell, 2007). Here, there are three dependent variables to investigate; 0.01 was divided by 3, giving a new *alpha level* of 0.003. Table 4-6 provides information about main effects of *Language* Skill and *Language Group,* as well as interaction effect of *Language Skill * Language Group* separately on each sub-measures of IL-basis.

Table 4-6- Tests of Between-Subjects Effects for sub-measures of IL-basis obtained from MANOVA

Source	Dependent Variable	Type II Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Language Skill	Listening Comprehension Skill	33.08	1	33.08	8.36	.005	.096
	Phonological Processing Skill	1577.09	1	1577.09	10.16	.002	.114
	Simple Writing Skill/Letter Knowledge	798.62	1	798.62	3.75	.056	0.05
Language Group	Listening Comprehension Skill	24.13	1	24.13	6.1	.016	.072
	Phonological Processing Skill	1818.98	1	1818.98	11.72	.001	.129
	Simple Writing Skill/Letter Knowledge	1469.12	1	1469.12	6.9	.010	.080
Language Skill * Language Group	Listening Comprehension Skill	1.07	1	1.07	0.27	.604	.003
	Phonological Processing Skill	204.38	1	204.38	1.32	.255	.016
	Simple Writing Skill/Letter Knowledge	66.15	1	66.15	0.31	.579	.004'

(Sub-Q3) ***Would L1 learners (High-LS group) perform better or worse than L1 learners (Low-LS group) on task performance in Letter Knowledge and Phonological Processing Skills or any of its sub-measures or components?***

(Sub-Q4) ***Would L1 learners (High-LS group) perform better*** *or worse* ***than L2 learners (Low-LS group) on task performance in Letter Knowledge and Phonological Processing Skills or any of its sub-measures or components?***

Table 4-6 shows that main effect of Language Skill: F (1, 79) = 10.16, p = .002 < .003) is significant for sub-measure of *Phonological Processing Skill*. The effect size (Partial Eta Squared) was also large, 0.114 according to Cohen's (1988) criterion. Main effects on sub-measures of *Listening Comprehension Skill and Simple Writing Skill/Letter knowledge* were not statistically significant (p > .003). The group comprising only L1 learners: High-LS children scored significantly higher than Low-LS children, and the same trend can be observed for L2 learners group as High-LS, L2 learners performed significantly better than Low-LS, L2 learners.

(Sub-Q5) ***Would L1 learners (High-LS group) perform better*** *or worse* ***than L2 learners (High-LS group) on task performance in Letter Knowledge and Phonological Processing Skills or any of its sub-measures or components?***

(Sub-Q6) ***Would L1 learners (Low-LS group) perform better or worse than L1 learners (Low-LS group) on task performance in Letter Knowledge and Phonological Processing Skills or any of its sub-measures or components?***

Table 4-6 indicates that main effect of Language Group (F (1, 79) = 10.16, p = .002 < .003), is only signifiant for sub-measure of *Phonological Processing Skill.* The effect size (Partial Eta Squared) is also large (0.129) according to Cohen's (1988) criterion. The main effect for sub-measures of *Listening Comprehension Skill* and *Simple Writing Skill/Letter knowledge* is not of statistical significance ($p > .003$). When the level of oral language skills of L1 and L2 learners (High-LS vs.Low-LS) was not taken into account, L1 learners scored higher than L2 learners only in the *Phonological Processing Skill sub-measure.*

After accounting for the level of language skills, the interaction effect of *Language Skill*Language Group* was not statistically significant ($p > .003$) on any sub-skills of *Letter Knowledge and Phonological Processing skill* (Table 4-6): High-LS L1 learners did not perform significantly better or worse than High-LS L2 learners on any sub-measures of *Letter Knowledge* and *Phonological Processing Skills.* Low-LS L1 learners did not perform significantly better or worse than Low-LS L2 learners, either.

In summary, a two-way between-group *MANOVA* was performed to examine the impact of *Language Group* and *Language Skill* on sub-measures of IL-basis. Three independent variables were used: *Listening Comprehension Skill, Phonological Processing Skill* and *Simple Writing Skill/Letter knowledge.* The independent variables were *Language Group* (L1

or L2 learners) and *Language Skill* (High-LS or Low-LS). Preliminary assumption testing was conducted to check for normality, linearity, univariate and multivariate outliners, homogeneity of variance-covariance matrices, and multicollinearity, with no serious violations noted. The interaction effect between *Language Group* and *Language Skill, F* (3, 77) = 0.5, $p > 0.01$; Pillai's Trace = 0.01 was not statistically significant. Statistically significant main effects were observed for both *Language Skill: F* (3, 77) = 5.01, $p = 0.003$; Pillai's Trace = 0.16 and *Language Group: F* (3, 77) = 4.87, $p = 0.004$; Pillai's Trace = 0.16. The effect sizes for both were large. When the results for the dependent variables were considered separately by using Bonferroni adjusted alpha level of .003, the interaction effect between *Language Group* and *Language Skill* was not statistically significance on any sub-measures of IL-basis (*Listening Comprehension Skill, Phonological Processing Skill* and *Simple Writing Skill/Letter knowledge).* This non-signifiant result for *Language Group* Language Skills* confirmed that by account for the level of language skill (High-LS vs. Low-LS) L1 learners did not perform significantly better or worse than L2 learners on any sub-measures of IL-basis (*Listening Comprehension Skill, Phonological Processing Skill* and *Simple Writing Skill).* The Only differences that observed statistical significance were separately examined main effects in *Language Skill,* and *Language Group*, both on the *Phonological Processing Skill*. No statistically significance differences were fund for main effects in *Language Group* and *Language Skill* on the other two sub-measures of IL-basis: *Listening Comprehension Skill* and *Simple Writing Skill/Letter knowledge.*

The follow-up univariate analyses were conducted to determine where the significance differences lie. The results of these subsequent series of one-way *ANOVA* to compare the performance of L1 and L2 learners separately on sub-measures of IL-basis, in the group of High-LS and Low-LS group, respectively, are presented in the following:

4.6.6 Main subsequent series of ANOVA for Sub-Measures of IL-basis

First, according to *Language Skill,* measured by TROG, all participants were divided into two groups of High-LS or Low-LS. Then, a series of one-way between-groups *ANOVAs* were conducted to explore the impact of *Language Group* (L1 or L2 learners) on each sub-measure of IL-basis:

1. Listening Comprehension Skill:

A one-way between-groups *ANOVA* was conducted to examine the impact of *Language Group* (L1 or L2 learners) on *Listening Comprehension Skill* in the groups of High-LS and Low-LS. The results are presented in Table 7-3 and Table 7-4 as appendix 3. High-LS (n=66) and Low-LS children (n = 17) were identified as L1 or L2 learners according to their *Language Group*. Preliminary assumption testing was conducted to check for normality and homogeneity of variance with no serious violations noted. According to Table 7-3 and Table 7-4, no significance differences observed between the *Listening Comprehension Skill* of L1 learners (n = 58, *M = 8*.22, *SD* = 1.76) and L2 learners (n = 8, *M = 7*, *SD* = 2.39) in the group of High-LS: *F* (1, 64) = 3.12, *p* = 0.08. The effect size, using Cohen criterion (Tabachnick & Fidell, 2007), was small (Partial Eta Squared = 0.05). In addition, L1 learners (n = 8, *M = 6*.75, *SD* = 1.67) did not significantly performed better than L2 learners (n = 9, *M = 4*.89, *SD* = 3.1) in the group of Low-LS: *F* (1, 15) = 2.28, *p* = 0.15. The effect size, using Cohen criterion (Tabachnick & Fidell, 2007), was relatively large (Partial Eta Squared = 0.13). The results suggested that by accounting the level of Language Skill (High-LS vs. Low-LS), L1 learners did not perform significantly better or worse than L2 learners on *Listening Comprehension Task.*

2. Phonological Processing Skill:

A one-way between-groups *ANOVA* was conducted to examine the impact of *Language Group* (L1 or L2 learners) on sub-skill of *Phonological Processing* in the groups of High-LS and Low-LS. The results are presented in Table 7-5 and Table 7-6 as appendix 4. High-LS (n=66) and Low-LS children (n = 17) were identified as L1 or L2 learners according to their *Language Group*. Preliminary assumption testing was conducted to check for normality and homogeneity of variance with no serious violations noted. According to Table 7-5 and Table 7-6, L1 learners (n = 58, *M* = 55.28, *SD* = 11.65) did not perform significantly better or worse than L2 learners (n = 8, *M =45*.88, *SD* = 14.42) in the group of High-LS: *F* (1, 64) = 4.32, *p* = 0.04. The effect size using Cohen criterion (Tabachnick & Fidell, 2007) was medium (Partial Eta Squared = 0.06). No statistically significant differences were observed between *Phonological Processing Skills* of L1 learners (n = 8, *M = 46*.75, *SD* = 13.44) and that skill of L2 learners (n = 9, *M = 28.56*, *SD* = 15) in the group of Low-LS: *F* (1, 15) = 6.86, *p* = 0.02. The effect size using Cohen criterion (Tabachnick & Fidell, 2007) was pretty large

(Partial Eta Squared = 0.31). The results suggested that by accounting the level of Language Skill (High-LS vs. Low-LS), L1 learners did not perform significantly better or worse than L2 learners on *Phonological Processing Tasks*.

3. Simple Writing Skill/Letter knowledge:

A one-way between-groups ANOVA was conducted to examine the impact of *Language Group* (L1 or L2 learners) on *Simple Writing Skill/Letter knowledge* in the groups of High-LS and Low-LS. The results are presented in Table 7-7 and Table 7-8 as appendix 5. High-LS children (n=66) and Low-LS children (n = 17) were identified as L1 or L2 learners according to their *Language Group*. No serious violations were noted by running preliminary assumption testing to check for normality and homogeneity of variance. According to Table 7-7 and Table 7-8, L1 learners (n = 58, *M = 28*.41, *SD* = 15.04) did not perform significantly better or worse than L2 learners (n = 8, *M* =18.88, *SD* = 15.45) in the group of High-LS: *F* (1, 64) = 2.81, *p* = .099. The effect size using Cohen criterion (Tabachnick & Fidell, 2007) was small (Partial Eta Squared = 0.04). L1 learners (n = 8, *M = 21*.88, *SD* = 15.75) did not either performed better or worse than L2 learners (n = 9, *M = 7*.33, *SD* = 8.03) on *Simple Writing Skill/Letter knowledge Task* in the Low-LS group: *F* (1, 15) = 5.96, *p* = .027. The effect size using Cohen criterion (Tabachnick & Fidell, 2007) was pretty large (Partial Eta Squared = 0.284). The results suggested that by accounting the level of Language Skill (High-LS vs. Low-LS), L1 learners did not perform significantly better or worse than L2 learners on *Simple Writing Skill/Letter knowledge Tasks.*

4.6.7 Summary

In summary, the results obtained from follow-up series of one-way *ANOVA* for sub-measures of IL-basis did confirm the results obtained from *MANOVA* for the interaction effect between *Language Skill* (High-LS vs. Low-LS) and *Language Group* (L1 or L2 learners). According to subsequent series of *ANOVA*, by taking into account the level of Language Skill (High-LS vs Low-LS), L1 learners did not perform significantly better or worse than L2 learners on any sub-skills of *Listening Comprehension, Phonological processing, and Simple Writing Skill/Letter knowledge*. These results were consistent with the *MANOVA's* result for interaction effect between *Language Skill* and *Language Group,* where it was not statistically significant in *MANOVA.*

4.7 Components in regard to the Measure of IL-basis: MANOVA

The IL-basis measure consists of 12 different components but in the present study, these components were reduced to 8 components according to their common similarity. For example, 2 components of *Listening Comprehension1* and *Listening Comprehension 2* were considered as one component: *Listening Comprehension 1&2* (Chapter 3). A multivariate *ANOVA (MANOVA)* was used to answer third part of sub-questions.

In this part, there were eight dependent variables: *Listening Comprehension 1&2, Rhyme Detection, First Phoneme Identification, Phoneme Identification Counting 1&2, Compound Word Identification, First Letter Identification, First Letter Writing,* and *Simple Word Writing 1,2 &3* and two independent variables *Language Group* (L1 or L2 learners) and *Language Skill* (High-LS or Low-LS). Then, to avoid the risk of *Type I error* (Tabachnick & Fidell, 2007), *MANOVA* was used rather than conducting a series of *ANOVA* separately. Before proceeding with the main *MANOVA* analysis, the data was investigated to determine whether it conformed to the assumptions required to use a MANOVA:

4.7.1 Sample Size in *MANOVA* Analysis

In *MANOVA* analysis, there is a requirement for more participants in each group than the number of dependent variables (Tabachnick & Fidell, 2007). 8 components of IL-basis were our dependent variables. Thus, the minimum required number of participants in each group is 8; this assumption is relatively satisfied.

4.7.2 Normality

Both univariate normality (e.g.: Kolmogorov-Smirnov Test) and multivariate normality is required. However, MANOVA is reasonably robust to modest violation of normality, except where the violations are due to outliners (Tabachnick & Fidell, 2007). Results obtained by Kolmogorov-Smirnov Test revealed no serious violations of normality in all 8 components of IL-basis for L1 learners or L2 learners in both groups of High-LS and Low-LS. Accordingly, *MANOVA* analysis was considered reasonably robust to modest violation of normality in this study at alpha level of 0.01 (Tabachnick & Fidell, 2007).

4.7.3 Multicollinearity and Singularity

MANOVA works best when the dependent variables are moderately correlated (Tabachnick & Fidell, 2007). When dependent variables are very high correlated (0.90 and above), it would be multicollinearity. This can occur when the variables are redundant; one of the variables is a combination of two or more of other variables, and it would be the case of singularity. A correlation analysis used to check the strength of the correlation among dependent variables. According to Pearson correlations obtained among 8 components of IL-basis, none of the dependent variables were highly correlated ($r < 0.9$). The correlation table is presented in the Table 7-9 as appendix 6.

4.7.4 Homogeneity of Variance-Covariance Matrices

According to the *MANOVA* conducted for 8 components of IL-basis, Box's Test of Equality of Covariance Matrices were not statistically significant ($p > 0.001$). Thun, the assumption of Equality of Covariance was satisfied (Tabachnick & Fidell, 2007).

4.7.5 Main MANOVA Analysis for 8 Items regarding to the Measure of IL-basis

A two-way MANOVA was used to examine the individual and joint effect of two independent variables (*Language Skill* and *Language Group*) on 8 dependent variables (*Listening Comprehension 1&2, Rhyme Detection, First Phoneme Identification, Phoneme Identification Counting 1&2, Compound Word Identification, First Letter Identification, First Letter Writing,* and *Simple Word Writing 1,2 &3*). Again, Type II SS Method of *ANOVA* was used due to unequal group sizes and a conservative alpha level of 0.01 was used due to modest violation of assumptions (Tabachnick & Fidell, 2007). Table 4-7 shows the result obtained from *MANOVA* for 8 components regarding to the measure of IL-basis. This test provided information about interaction effect *(Language Skill * Language Group)* and main effects of *Language Skill* and *Language Group* among the groups based on dependent variables. Tabachnick and Fidell (2007) recommended Pillai's Trace Test because the test is more robust in the case of small sample size, unequal group sizes and that observed a moderate violation of assumptions.

Table 4-7- Multivariate Tests b:8 items of IL-basis

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Language Skill	Pillai's Trace	.257	3.11a	8.000	72.000	.004	.257
Language Group	Pillai's Trace	.182	2a	8.000	72.000	.058	.182
Language Skill * Language Group	Pillai's Trace	.104	1.05a	8.000	72.000	.410	.104

Table 4-7 indicates a statistically significant difference ($p < 0.01$) for main effect of *Language Skill: F* (3, 77) = 3.11, $p = 0.004$; Pillai's Trace = 0.26. The effect size, using Cohen criterion (Tabachnick & Fidell, 2007), was fairly large (Partial Eta Squared = 0.26). While, main effect for *Language Group: F* (3, 77) = 2, $p = 0.058$; Pillai's Trace = 0.18 was not statistically significant; The effect size using Cohen criterion (Tabachnick & Fidell, 2007) was also large (Partial Eta Squared = 0.18).

The interaction effect between *Language Skill* and *Language Group* was not shown to be statistically significant, either. *Language Skill * Language Group*: *F* (3, 77) = 1.05, $p = 0.41$; Pillai's Trace = .104. Using Cohen criterion (Tabachnick & Fidell, 2007), the effect size was relatively large (Partial Eta Squared = 0.1).

Due to the significance in the main effect for *Language Skill* on the multivariate test, a Test of Between-Subjects Effects was used for further investigation. As a number of separate analyses were used, a higher alpha level (.003) via a Bonferroni adjustment was set to reduce the likelihood of a *type I erro*r (Tabachnick & Fidell, 2007). The information about main effects of *Language* Skill and *Language Group,* as well as the separate interaction effect on each components of the IL-basis measure are presented in the Table 7-10, Appendix 7. Accordingly, main effects for *Language Skill* were significant in the components of *Rhyme Detection* and *Phoneme Identification Counting 1&2* ($p \leq .003$). Main effect for *Language Group* was also signifiant for components of *First Phoneme Identification* and *First Letter Identification* ($p \leq .003$). The interaction effect of *Language Skill*Language Group* was not statistically significance for any items.

A two-way between-groups *MANOVA* was performed to investigate the impact of *Language Group* and *Language Skill* on each components of IL-basis. Eight dependent variables were used: *Listening Comprehension 1&2, Rhyme Detection, First Phoneme Identification, Phoneme Identification Counting 1&2, Compound Word Identification, First*

Letter Identification, First Letter Writing, and *Simple Word Writing 1, 2 &3.* The independent variables were *Language Group* (L1 or L2 learners) and *Language Skill* (High-LS or Low-LS). Preliminary assumption testing was conducted to check for normality, linearity, univariate and multivariate outliners, homogeneity of variance-covariance matrices, and multicollinearity, with no serious violations noted. The interaction effect between *Language Group* and *Language Skill* was not statistically significant. The only statistically significant was found for main effect for *Language Skill: F* (3, 77) = 3.11, p = 0.004; Pillai's Trace = 0.26. Main effect for *Language Group* did not observe statistical significance. When the results for the dependent variables were considered separately in Bonferroni adjusted alpha level of .003, the interaction effect between *Language Group* and *Language Skill* was not statistically significance in any components of IL-basis. Statistical significance was only observed in the main effect of *Language Skill* present in components of *Rhyme Detection* and *Phoneme Identification Counting*. Main effects of *Language Group* also observed statistical significance in *First Phoneme Identification* and *First Letter Identification* components.

Therefore, the follow-up univariate analyses conducted to determine where the significance differences lay. The results of these subsequent series of one-way *ANOVA* to separately compare the performance of L1 and L2 learners respective of their groups (High-LS or Low-LS) on each components of IL-basis are presented in the following:

4.7.6 Main subsequent series of ANOVA Analyses for Components relating to the Measures of IL-basis

First, according to *Language Skill,* measured by TROG, all participants were divided into two groups of High-LS and Low-LS. Then, a series of one-way between-groups ANOVAs was conducted to examine the impact of *Language Group* (L1 or L2 learners) on each components of IL-basis:

1- Listening Comprehension1&2:

A one-way between-groups *ANOVA* was conducted to examine the impact of *Language Group* (L1 or L2 learners) on *Listening Comprehension Skill* in the groups of High-LS and Low-LS. The results are presented in the Table 7-11 and Table 7-12 as appendix 8. High-LS children (n=66) and Low-LS children (n = 17) were identified as L1 or L2 learners according

to their *Language Group* (L1 or L2 learners). Preliminary assumption assessed for normality and homogeneity of variance and noted no serious violations. According to the Table 7-11 and Table 7-12, no statistically significant differences were found between *Listening Comprehension Skill* of L1 (n = 58, *M* = *8*.22, *SD* = 1.76) and L2 learners (n = 8, *M* = *7*, *SD* = 2.39) in the group of High-LS: *F* (1, 64) = 3.12, *p* = 0.08. The effect size, using Cohen criterion (Tabachnick & Fidell, 2007), was small (Partial Eta Squared = 0.05). No statistically significant differences were observed between *Listening Comprehension Skill* of L1 learners (n = 8, *M* = *6*.75, *SD* = 1.67) and L2 learners' *Skill* (n = 9, *M* = *4*.89, *SD* = 3.1) in the group of Low-LS: *F* (1, 15) = 2.28, *p* = 0.15. The effect size, using Cohen criterion (Tabachnick & Fidell, 2007), was relatively large (Partial Eta Squared = 0.13). The results suggested that by taking into account the level of Language Skill (High-LS vs. Low-LS), L1 learners did not perform significantly better or worse than L2 learners on *Listening Comprehension Tasks*.

2- Rhyme Detection:

A one-way between-groups *ANOVA* was conducted to examine the impact of *Language Group* (L1 or L2 learners) on *Rhyme Detection Skill* in the groups of High-LS and Low-LS. The results are presented in the Table 7-13 and Table 7-14 as appendix 9. High-LS children (n=66) and Low-LS children (n = 17) were identified as L1 or L2 learners according to their *Language Group*. Preliminary assumption assessed normality and homogeneity of variance, and no serious violations noted. According to the Table 7-13 and Table 7-14, L1 learners (n = 58, *M* = *5.6*, *SD* = 0.8) did not perform on *Rhyme Detection Task* significantly better or worse than L2 learners (n = 8, *M* =*5.5*, *SD* = 1.07) in the group of High-LS: *F* (1, 64) = 0.08, *p* = 0.78. The effect size using Cohen criterion (Tabachnick & Fidell, 2007) was very small (Partial Eta Squared = 0.001). No statistically significant differences were found between *Rhyme Detection Skill* of L1 learners (n = 8, *M* = *4*.88, *SD* = 1.64) and that skill of L2 learners (n = 9, *M* = *3.11*, *SD* = 1.69) in the group of Low-LS: *F* (1, 15) = 4.73, *p* = 0.05. The effect size using Cohen criterion (Tabachnick & Fidell, 2007) was quite large (Partial Eta Squared = 0.24). The results suggested by taking into account the level of Language Skill (High-LS or Low-LS) L1 learners did not perform significantly better or worse than L2 learners on *Rhyme Detection Task.*

3- First Phoneme Identification:

A one-way between-groups *ANOVA* was conducted to examine the impact of *Language Group* (L1 or L2 learners) on *First Phoneme Identification Skill* in the groups of High-LS and Low-LS. The results are presented in the Table 7-15 and Table 7-16 as appendix 10. High-LS children (n=66) and Low-LS children (n = 17) were identified as L1 or L2 learners according to their *Language Group*. Preliminary assumption assessed normality and homogeneity of variance and no serious violations noted. According to the Table 7-15 and Table 7-16, L1 learners (n = 58, *M = 9.22*, *SD* = 2.44) did not perform significantly better or worse than L2 learners on the component of *First Phoneme Identification* (n = 8, *M =7.38*, *SD* = 3.93) in High-LS group: F (1, 64) = 3.45, p = 0.07. The effect size using Cohen criterion (Tabachnick & Fidell, 2007) was almost close to medium (Partial Eta Squared = 0.05). No statistically significant differences were found between *First Phoneme Identification Skill* of L1 (n = 8, *M = 8*.13, *SD* = 2.95) and L2 learners (n = 9, *M = 4.56*, *SD* = 2.88) in the group of Low-LS: F (1, 15) = 6.37, p = 0.02. The effect size, using Cohen criterion (Tabachnick & Fidell, 2007), was small (Partial Eta Squared = 0.05). The results suggested that taking into account the level of *Language Skill* (High-LS or Low-LS), L1 learners did not perform significantly better or worse than L2 learners on *First Phoneme Identification Task.*

4- Phoneme Identification Counting 1&2:

A one-way between-group *ANOVA* was conducted to examine the impact of *Language Group* (L1 or L2 learners) on component of *Phoneme Identification Counting 1&2* in the groups of High-LS and Low-LS. The results are presented in the Table 7-17 and Table 7-18 as appendix 11. High-LS (n=66) and Low-LS children (n= 7) were identified as L1 or L2 learners according to their *Language Group*. Preliminary assumption assessed normality and homogeneity of variance and no serious violations noted. According to the Table 7-17 and Table 7-18, L1 learners (n = 58, *M = 14.75*, *SD* = 4.84) did not perform significantly better or worse than L2 learners (n = 8, *M =10.75*, *SD* = 5.78) in component of *Phoneme Identification Counting (1&2)* in the group of High-LS: F (1, 64) = 4.62, p = 0.04. The effect size using Cohen criterion (Tabachnick & Fidell, 2007) was medium (Partial Eta Squared = 0.067). No statistically significant differences were also found between *Skill of Phoneme Identification Counting (1&2)* in L1 learners (n = 8, *M = 10.25*, *SD* = 5.68) and L2 learners (n = 9, *M = 5.89*, *SD* = 4.78) in the group of Low-LS: F (1, 15) = 2.96, p = 0.11. The effect size using Cohen criterion (Tabachnick & Fidell, 2007) was fairly large (Partial Eta Squared = 0.165).

The results suggested that by taking into account the level of *Language Skill* (High-LS or Low-LS), L1 learners did not perform significantly better or worse than L2 learners in *Task of Phoneme Identification Counting 1&2*.

5- Compound Word Identification:

A one-way between-group *ANOVA* was conducted to examine the impact of *Language Group* (L1 or L2 learners) in performance of *Compound Word Identification* in the groups of High-LS and Low-LS. The results are presented in the Table 7-19 and Table 7-20 as appendix 12. High-LS (n=66) and Low-LS children (n =17) were identified as L1 or L2 learners according to their *Language Group*. Preliminary assumption assessed for normality and homogeneity of variance, and no serious violations noted. According to the Table 7-19 and Table 7-20, no L1 learners (n = 58, *M = 4.41*, *SD* = 1.14) did not performed significantly better or worse than L2 learners (n = 8, *M =4.25*, *SD* = 1.39) in *Compound Word Identification* task in the group of High-LS: F (1, 64) = 0.14, p = 0.71. The effect size using Cohen criterion (Tabachnick & Fidell, 2007) was quite small (Partial Eta Squared = 0.002). No statistically significant differences were also found between *Compound Word Identification* performance of L1 learners (n = 8, *M = 3.5*, *SD* = 1.69) and L2 learners (n = 9, *M = 2.67*, *SD* = 1.8) in the group of Low-LS: F (1, 15) = 0.96, p = 0.34. The effect size using Cohen criterion (Tabachnick & Fidell, 2007) was medium (Partial Eta Squared = 0.06). the results suggested that by taking into account the level of *Language Skill* (High-LS or Low-LS), L1 learners did not perform significantly better or worse than L2 learners on *Compound Word Identification Task*.

6- First Letter Identification:

A one-way between-groups ANOVA was conducted to examine the impact of *Language Group* (L1 or L2 learners) in *First Letter Identification* performance in the groups of High-LS and Low-LS. The results are presented in the Table 7-21 and Table 7-22 as appendix 13. High-LS (n=66) and Low-LS children (n =17) were identified as L1 or L2 learners according to their *Language Group*. Preliminary assumption assessed for normality and homogeneity of variance, and no serious violations noted. According to the Table 7-21 and Table 7-22, L1 learners (n = 58, *M =21.29*, *SD* = 4.69) did not perform significantly better or worse than L2

learners (n = 8, *M =18*, *SD* = 7.45) in component of *First Letter Identification* in High-LS children: *F* (1, 64) = 2.97, *p* = .09. The effect size using Cohen criterion (Tabachnick & Fidell, 2007) was small (Partial Eta Squared = 0.044). No statistically significant differences were observed between *First Letter Identification Skill* of L1 learners (n = 8, *M = 20*, *SD* = 4.5) and that skill of L2 learners (n = 9, *M = 12.33*, *SD* = 6.95) in the group of Low-LS: *F* (1, 15) = 7.07, *p* = 0.018. The effect size using Cohen criterion (Tabachnick & Fidell, 2007) was quite large (Partial Eta Squared = 0.32). The results suggested that by taking into account the level of *Language Skill* (High-LS or Low-LS), L1 learners did not perform significantly better or worse than L2 learners in *Listening Comprehension Task*.

7- First Letter Writing:

A one-way between-groups ANOVA was conducted to examine the impact of *Language Group* (L1 or L2 learners) on *First Letter Writing Skill* in the groups of High-LS and Low-LS. The results are presented in the Table 7-23 and Table 7-24 as appendix 14. High-LS (n=66) and Low-LS children (n =17) were identified as L1 or L2 learners according to their *Language Group*. Preliminary assumption testing assessed for normality and homogeneity of variance, and no serious violations noted. According to the Table 7-23 and Table 7-24, L1 learners (n = 58, *M =16.74*, *SD* = 8.39) did not perform significantly better or worse than L2 learners (n = 8, *M =10.88*, *SD* = 9.48) on *First Letter Writing task* in the group of High-LS: *F* (1, 64) = 3.33, *p* = .07. The effect size using Cohen criterion (Tabachnick & Fidell, 2007) was small (Partial Eta Squared = 0.05). No statistically significant differences have found between *First Letter Writing Skill* of L1 learners (n = 8, *M = 12.63*, *SD* = 9.96) and that skill of L2 learners (n = 9, *M = 5.56*, *SD* = 6.67) in the group of Low-LS: *F* (1, 15) = 3.02, *p* = 0.1. The effect size using Cohen criterion (Tabachnick & Fidell, 2007) was quite large (Partial Eta Squared = 0.17). The results suggested that by taking into account the level of *Language Skill* (High-LS or Low-LS), L1 learners did not perform significantly better or worse than L2 learners on *First Letter Writing Task.*

8- Simple Word Writing 1, 2 &3:

A one-way between-groups ANOVA was conducted to examine the impact of *Language Group* (L1 or L2 learners) on performance of *Simple Word Writing 1, 2 &3* in the groups of High-LS and Low-LS. The results are presented in the Table 7-25 and Table 7-26 as appendix

15. High-LS (n=66) and Low-LS children (n = 17) were identified as L1 or L2 learners according to their *Language Group*. Preliminary assumption assessed normality and homogeneity of variance and no serious violations noted. According to the Table 7-25 and Table 7-26, L1 learners (n = 58, *M =11.67*, *SD* = 8.03) did not perform significantly better or worse than L2 learners (n = 8, *M =8*, *SD* = 6.91) on *Simple Word Writing 1, 2 &3 task* in the group of High-LS: F (1, 64) = 1.51, p = 0.22. The effect size using Cohen criterion (Tabachnick & Fidell, 2007) was small (Partial Eta Squared = 0.02). No statistically significant differences between *Simple Word Writing (1, 2 &3)* performance of L1 learners (n = 8, *M = 9.25*, *SD* = 7.36) and that of L2 learners (n = 9, *M = 1.78*, *SD* = 2.73) in the group of Low-LS: F (1, 15) = 8.08, p = 0.012. The effect size using Cohen criterion (Tabachnick & Fidell, 2007) was quite large (Partial Eta Squared = 0.35). The results suggested that by taking into account the level of *Language Skill* (High-LS or Low-LS), L1 learners did not perform significantly better or worse than L2 learners on *Simple Word Writing Task.*

4.7.7 Summary

In summary, the results obtained from follow-up series of one-way *ANOVA* for each components of IL-basis measure did confirm the results of *MANOVA* for the interaction effect between *Language Skill* (High-LS or Low-LS) and *Language Group* (L1 or L2 learners). According to subsequent series of *ANOVA*, by taking into account the level of *Language Skill* (High-LS or Low-LS), L1 learners did not perform significantly better or worse than L2 learners on any components of IL-basis*: Listening Comprehension, Rhyme Detection, First Phoneme Identification, Phoneme Identification Counting, Compound Word Identification, First Letter Identification, First Letter Writing,* and *Simple Word Writing*. These results were consistent with the *MANOVA's* result for interaction effect between *Language Skill* and *Language Group,* which was not statistically significant.

4.8 Reliability

Internal consistency is one of the main issues in aspects of reliability. This refers to the degree to which the items that composing a measure 'hang together,' and whether or not these items measure the same underlying construct. One of the most commonly used test of reliability for internal consistency is Cornbach's alpha coefficient which measures the overall

reliability of a measure and moves always between 0 and 1. Measures yieling scores with a reliability of .80 or higher are sufficiently reliable for the most research purposes (De Vaus 2002; Gall & et. al., 2007). Table 4-8 presents Cornbach's alpha coefficient for measure of the study.

Table 4-8- Reliability statistics for IL-basis measure in the present study

Language Background	Cornbach's alpha	Number of items
IL-basis	0.85	83

Table-4-8 shows that reliability values for IL-basis measure is 0.85, suggesting a very good internal consistency reliability for this measure with our sample. According to de Vaus 2002, values above 0.7 are considered acceptable and values above 0.8 are preferable.

4.9 Summary of the Results

Before data analysis, participants were identified as L1 or L2 learners regarding to their *Language Group.* Then, they were subsequently divided into two groups according to their *level of language skill* (High-LS or Low-LS) measured by TROG; Children who obtained TROG's scores that were 1 *SD* below the sample's mean were classified as Low-LS. Overall, the 17 children (n=8 L1 and n=9 L2 learner) who obtained scores lower than 7 were classified Low-LS and 66 children (5n=8 L1 and n=8 L2 learners) were classified as High-LS children. In general, L2 children were more likely to be classified as Low-LS than L1 children: $\chi 2(1, N = 83) = 13.83$ and $p < 0.001$. *Nonverbal skill* of these participants were investigated to ensure any differences between the performance of these children found on *letter knowledge and phonological processing tasks,* would not be related to their *nonverbal skill* differences: A two-way *ANOVA* was conducted to examine the impact of *Language Skill* and *Language Group* on levels of *nonverbal skill*, as measured by Raven. The interaction effect between Language *Skill* and *Language Group* was not statistically significant, $F(1, 79) = 0.03$, $p = 0.86$.

To determine the impact of *Language Skill* and *Language Group* on *letter knowledge and phonological processing skill*, as measured by IL-basis, a two-way between-groups *ANOVA*

revealed that the interaction effect between *Language Skill* and *Language Group* was not statistically significant, F (1, 79) = 0.85, p = 0.36, which suggested that by taking into account the level of *Language Skill* (High-LS or Low-LS), L1 learners did not perform significantly better or worse than L2 learners on *letter knowledge and phonological processing tasks* in present study. The same trend was also observed by conducting a *MANOVA* for the sub-measures of IL-basis: the interaction effect between *Language Group* and *Language Skill* was not statistically significance on any sub-measures of IL-basis (*Listening Comprehension Skill, Phonological Processing Skill* and *Simple Writing Skill/Letter knowledge).* Results obtained from another *MANOVA* for 8 components relating to the measure of IL-basis also confirmed that the interaction effect between *Language Group* and *Language Skill* was not statistically significance on any of these 8 components.

In conclusion, by taking into account the level of *Language Skill* (High-LS or Low-LS), L1 learners did not perform significantly better or worse than L2 learners on *Letter Knowledge and Phonological Processing Tasks* in this study. No significant differences were found between performances of L1 and L2 Learners, on any sub-measures or on any of 8 components of the measure of IL-basis by taking into account their level of language skill.

5 DISCUSSION AND CONCLUSION

The first part presents validation and power of the test. The second part discusses the results in relation with theoretical framework of the study, and previous empirical findings by considering the research hypotheses and questions. The third part provides conclusion of the study. At the end, the limitations of the study are considered, and some recommendations suggested for development of further study.

5.1 Statistical Approach

To examine the hypotheses, all participants were divided into 4 groups according to *language Group* (L1 or L2 learners) and *language skill* (High-LS or Low-LS)*:* (n=58) L1 and (n=8) L2 learners were identified in the group of High-LS, and (n=8) L1 and (n=9) L2 learners were identified in the group of Low-LS. But with such small sizes and unequal group sizes, was it possible to compute a valid test.

5.1.1 Validation of the Test

In the case of small group sizes, both parametric and nonparametric tests are valid under given assumptions (Gall & et. al, 2007). The assumption of normal distribution is of most concern in the use of parametric tests, especially for small sample sizes (Stevens, 2001; Tabachnick & Fidell, 2007). In the present study, scores on all of the dependent variables in each group were normally distributed (more information are presented in the following). Another reason is that the same result was obtained for the parametric test and the non-parametric test. In this case, parametric tests are recommended as they are potentially more powerful than non-parametric tests (Gall & et. al, 2007). In the present study, there were two independent variables: *language skills* (High-LS vs. Low-LS), and *language group* (L1 or L2 learners) in which the joint (interaction) effect of these variables on dependent variable (*letter knowledge and phonological processing skills*) was of concern. A *two-way ANOVA* (factorial *ANOVA*) was used rather than T-tests to examine the joint effects between the independent variables, and to avoid the risk of Type I error by running a series of T-test analysis (Tabachnick & Fidell, 2007). There are some assumptions associated with applying factorial ANOVA which have been discussed in the following:

1. Level of measurement: The parametric techniques assume that dependent variables are measured at interval or ratio level. All measure of Raven, TROG and IL-basis meet this assumption.

2. Random sampling: The parametric approaches assume that the scores are obtained by using a random sample from population although this is not often the case in real-life research (De Vaus, 2004). It is not applicable to present study because, as mentioned before, cross-sectional designs rely on existing variations in the independent variable(s) in the sample where the participants are divided up into different groups based on the exacting difference(s).

3. Normal distribution: It is generally assumed that the population from which the samples diverse, are normally distributed. In addition, scores on the dependent variables in the samples should also be normally distributed. A Test of Normality has been produced to determine how scores of study measures (Raven, TROG and IL-basis) were distributed within the two Language Skill groups (High-LS or Low-LS), regarding to their language Group (L1 or L2 learners). The results can be found in Table 5-1.

Table 5-1- Tests of Normality for all Measures (Raven, TROG and IL-basis)

Language Skill		Language Group	Kolmogorov-Smirnova		
			Statistic	*df*	*Sig.*
High-LS	Raven	L1 Learner	.101	58	.200*
		L2 Learner	.193	8	.200*
	TROG	L1 Learner	.080	58	.200*
		L2 Learner	.169	8	.200*
	IL-basis	L1 Learner	.197	58	.000
		L2 Learner	.220	8	.200*
Low-LS	Raven	L1 Learner	.209	8	.200*
		L2 Learner	.167	9	.200*
	TROG	L1 Learner	.220	8	.200*
		L2 Learner	.199	9	.200*
	IL-basis	L1 Learner	.202	8	.200*
		L2 Learner	.135	9	.200*

Table 5-1 shows statistical significance (*p <.05)* was found in the group of High-LS for L1 learners in the measure of IL-basis: D (58) = .197, p < .001. Although this suggests violation of the assumption of normality, the number of participants in this group is fairly sufficient (n = 58) for the test to be robust (Tabachnick & Fidell, 2007).

Overall, the assumption of normal distribution within groups dose not seriously violate in the groups of High-LS and Low-LS, respectively for L1 and L2 learners.

4. Homogeneity of variance: It is assumed that samples are obtained from population of equall variance; that is, the variability of scores for each group is similar. It was tested and reported earlier in chapter 4 in each measure of the study.

5.1.2 Power of the Tests:

A parametric test like *ANOVA* is valid as the required assumptions are met. Then, the second question is: Would such a test ever be able to have enough power to reject the null hypotheses?

The purpose of tests such as *ANOVA* is to test hypothesis of the study. With such small group sizes, dose *ANOVA* have enough power (valid and robust) to indicate a difference between the performances of L1 and L2 learners on *letter knowledge and phonological awareness tasks* in the present study?!

According to Stevens (2001) with this type of analysis, there is always a possibility of reaching the wrong conclusion by making two different errors referred to as: *Type I error* and *type II error. Type I error* occurs when it has been found an assumption of differences between groups that does not actually exist. By using appropriate *alpha level,* we can minimize this possibility. While, a *type II error* occurs when groups are found not to be differ when they actually do. These two errors are inversely related; trying to control *Type I error* will increase the possibility of doing *type II error.* Ideally, power of a test refers to a test that is able to correctly identify a difference between the groups. To achieve this purpose, some factors that can influence the power of a test in a given situation are provided below:

1. **Sample size:** The power of a test is dependent on the size of its sample. When the group size is small (e.g., n = 20 or less), there is a possibility that a non-significant

result would occur due to insufficient power of the test (Stevens, 2001). Then, results of present study should be conservatively reported because of the small group sizes.

2. **Effect Size:** A test like *ANOVA* indicates whether the difference between groups is ‘‘statistically significant" and not likely to have occurred by chance. Effect size provides information about the strength of the differences between groups (Tabachnick & Fidell, 2007). In fact, one way of assessing the importance of the finding is to provide the *effect size.* There are a number of different measure of effect size, the most commonly used are *eta squared* and *Cohen's d. Eta squared* is a rough estimate of effect size and available in any form of *ANOVA,* ranging from 0 to 1. Cohen (as cited in Tabachnick & Fidell, 2007) suggests the guidelines for interpreting the *e* value as: 0.01 = small effect, 0.06 = moderate effect and 0.14 = large effect.

In small group sizes like present study, non-significant findings with large effect size are important to report because it indicates the relative magnitude of the differences between the performances of the groups even though it might not be statistically significant due to the small sample sizes.

3. **Alpha level set by the researchers:** Alpha level usually set 0.05 or 0.00. In present study, the alpha level is considered 0.01 to be more conservative. This decision is made prior analyzing data because data collecting is based on group-testing.

5.1.3 Summary

Overall, parametric techniques of *two-way analysis of variance (ANOVA)* are used because:

- The violations of assumptions are not serious and *ANOVA* is robust to modest violations. Moreover, in small group sizes for present study, almost the same results have been obtained in parametric and nonparametric tests.
- The present study includes two independent variables: *language skills* (High-LS vs. Low-LS), and *language group* (L1 or L2 learners) and aims to investigate the joint (interaction) effect of these two independent variables on dependent variable (*letter knowledge and phonological processing skills*). As such, a *two-way ANOVA* (factorial *ANOVA*) is used rather than a T-test.

- Having unequal group sizes in a factorial *ANOVA* is a complex issue. From a technical perspective, it results in a dependency among the main effect and interaction estimates of variability (Stevens, 2001). Unequal group sizes in the present study are due the unequal numbers of L1 Learners vs. L2-learners as well as High-LS vs. Low-LS children in the population. This does not necessarily indicate a problem with our sampling, but rather reflects the underlying nature of the construct being measured. Equalizing group sizes by random deletion of cases is undesirable. According to Tabachnick & Fidell (2007), these unequal group sizes will be dealt with one of the methods provided by Overall and Spiegel (1969): Method 2 which is provided as Type II SS in SPSS is appropriate with present study as a non-experimental study.

5.2 Discussion

A growing body of research indicating that there is a high relation between phonological processing skills and oral language skill (Lonigan et al., 1998; Puranik & Lonigan, 2012). For example, Puranik and Lonigan, 2012 showed that children with Low-LS lagged behind their peers with High-LS in phonological processing skills. Accordingly, the level of language skill (High- vs. Low-LS) was taken into account as the second independent variable in present study. Whereas, language group (L1 or L2 Learners) was the first independent variable to compare *Letter Knowledge and Phonological Processing Skills* in L1 and L2 learners. All participants were identified as L1 or L2 learners with regard to their language background, and also divided into two groups of *Language Skill* (High-LS vs. Low-LS) based on their language performance measured by TROG that administered in Norwegian. The results showed that more L2 learners (9 out of 17) than L1 learners (8 out of 66) were grouped into the group of Low-LS (see Table 4-1). This could be expected, since L1 learners were exposed to only one language (Norwegian) and L2 learners were exposed to two: In the present study, Norwegian was the second language for L2 learners and both of their parents while both of L1 learners' parents were L1 speaker of Norwegian. In addition, these L2 learners were assessed by the language measure at the beginning of their first grade of school. Thus, they may perhaps have been orally be exposed to Norwegian less when compared with L1 learners; where both parents were L1 speaker of Norwegian. It should also be considered that TROG is a test for reception grammar and it is not a comprehensive test to assess oral language skill.

In addition to oral language skills, children's nonverbal skills and socioeconomic status of their parents are strongly correlated with *letter knowledge and phonological processing skills* (Lonigan et al., 1998; Puranik & Lonigan, 2012). All participates in the present study lived in the same, predominantly middle-class neighborhoods in Oslo, Norway at the time of study. The socioeconomic level of their parents was therefore assumed to be of an equivalent level. Nonverbal skills of these children were also controlled using the Raven measure as the background variable. All Participants were divided into two groups according to their *level of language skill* (High-LS vs. Low-LS), and also identified as L1 or L2 learners with regard to their *Language Group*. A two-way *ANOVA* was conducted to examine the impact of

Language Skills and *Language Group* on level of *nonverbal skill*, as measured by Raven. The results showed that there was a statistically significant main effect for *Language Skill* (*F* (1, 79) = 10.38, *p* = 0.002, < 0.01), and the effect size was moderately large (Partial Eta Squared = 0.12). As a result, High-LS children scored significantly higher than Low-LS children on the measure of Raven. This indicates that, regardless of the language backgrounds (L1 or L2 learners), children who scored higher on the language measure (TROG), also obtained greater scores on the measure of nonverbal skills (Raven). While, by taking into account the level of *Language Skills* (High-LS or Low-LS), no significant differences were found between *nonverbal skills* of L1 and L2 learners (*F* (1, 79) = 0.03, *p* = 0.86, > 0.01). A subsequent series of *ANOVA* also confirmed this pattern: No significant differences were found between the nonverbal skills of L1 and L2 learners either in the group of High-LS children: *F* (1, 64) = 2.82, *p* = 0.1, or in Low-LS group: *F* (1, 15) = 3.86, *P* = 0.07.

In summary, by taking into account the level of oral language skills in Norwegian (High orLow LS), any differences between the performances of these L1 and L2 Learners found in *Letter Knowledge and Phonological Processi*ng *Tasks* could therefore not be related to their *nonverba*l skills' differences.

To find evidence for Hypothesis of present study; first the research questions will answered and discussed:

5.2.1 Letter Knowledge and Phonological Processing Skills: High-LS children Versus Low-LS children

(Q1) Would children with High oral language skill (High-LS) perform better or worse than children with Low oral language skill (Low-LS) in *Letter Knowledge and Phonological Processing Skills* in Norwegian words?

In total, High-LS children (n = 66, *M* = 89.47, *SD* = 26.04) performed significantly better than Low-LS children (n = 17, *M* = 57.06, *SD* = 30.8) on *letter knowledge and phonological processing tasks (F (1, 79) = 8.37, p = 0.005, and Partial Eta Squared = 0.1).*

The results of present study were in line with the findings of Lonigan et al. (1998). Lonigan et al. (1998) found a strong and positive relation between *phonological processing*

skills and oral language in 4- and 5-year-old L1 learners of English. In the study by Lonigan et al., children with High-LS scored significantly higher than children with Low-LS on *phonological processing tasks*. Although participants in the present study were older (age range of 5- to 6-year-old), and from diverse language backgrounds, the results were consistent with Lonigan et al. (1998), suggesting a high relation between oral language skill and *phonological processing skills* in both groups of L1 and L2 learners.

In a recent study, Puranik and Lonigan (2012) also revealed that preschoolers with Low-LS lagged behind their peers with High-LS in the development of *letter knowledge and phonological processing skills*. Their results revealed that children with High-LS performed significantly better than children with Low-LS on *phonological processing tasks*. Similarly, in the present study, children with High-LS performed significantly better on phonological processing skills compared to children with Low-LS, despite that the participants in the present study were from diverse language backgrounds.

Findings of the present study were also consistent with the research by Chiappe and et al. (2002a) who investigated *phonological processing performance* of children from diverse language backgrounds in three groups: (a) L1 learners as a group with best proficiency in English (L1 learners), (b) Novice Language learners with the least exposure to English (Novice learners), and (c) L2 learners who had more experience with English than Novice learners. Their study revealed that L1 learners scored significantly highest score on *phonological processing tasks*, whereas Novice learners scored significantly lowest scores. L2 learners scored significantly higher than Novice learners but significantly lower than L1 learners. Accordingly, Chiappe and et al. (2002a) suggested that children who had greatest oral language skill in English, outperformed children with average skill, who performed better than children with lowest oral language skill.

Lervåg and Aukrust (2010) revealed that L1 learners obtained higher scores than L2 learners of Norwegian on vocabulary, and nonverbal skills although they did not mention the differences were significance or not. The present study's results also revealed that L1 learners scored higher than L2 learners on measure of Raven but the difference was not significance by taking into account their level of language skills (High vs Low). Lervåg and Aukrust used no measure to assess *letter knowledge or phonological processing skills* because they were

interested in comprehension reading skills rather than emergent literacy skills. Their study found oral language, in terms of vocabulary skill, was a critical predictor form the early development of reading comprehension skills in both L1 and L2 learners of Norwegian. Their findings were similar to past studies of reading comprehension skill and suggested oral vocabulary training should be given higher priority, especially for L2 learners of Norwegian, to prevent later reading comprehension problems. By using a different measure for oral language (TROG), the present study's results also confirmed the important role of oral language skill but from another perspective by suggesting a relation between oral language and emergent literacy skills, such as *letter knowledge and phonological processing skills:* High-LS children significantly performed better than Low-LS children on the tasks of *letter knowledge and phonological processing.*

Overall, findings of the present study were consistent with previous studies (Chiappe et al., 2002a; Puranik & Lonigan, 2012; Lonigan & et al., 1998) suggesting children with high oral language skills outperform children with low oral language skills on phonological processing tasks at the early stage of learning. These findings provided evidence for the first hypothesis of present study:

Children with high oral language skill (High-LS) would perform better than children with low oral language skill (Low-LS) in phonological processing tasks.

Phonological processing skills are related to the area of oral language, and are the ability to think about the sounds of words rather than just the meaning of them. These skills help the children to understand the structure of oral language that and the words. The words consist of syllables, rhymes, and sounds. Thus, it was not a big surprise that High-LS children outperformed Low-LS children on letter knowledge and phonological processing tasks in the present study. However, finding such a result for L2 learners where (High-LS) L2 learners also outperformed (Low-LS) L2 learners was interesting. Finding the same pattern for the relation between oral language and phonological processing skills in L2 learners, suggests that Norwegian-oral-language and phonological processing skills in Norwegian words have developed in L2 learners in the same way as L1 learners of Norwegian.

5.2.2 Letter Knowledge and Phonological Processing Skills: L1 Learners Versus L2 Learners

(Q2) Would there a statistically significant difference in the performance of L1 and L2 learners on *Letter Knowledge and Phonological Processing tasks* in Norwegian in either High LS or Low LS groups?

(a) When the level of *Language Skill* (High-LS vs. Low-LS) was not taken into account, L1 learners (n = 66, M = 89.91, SD = 26.08) scored significantly higher than L2 learners (n = 17, M = 55.35, SD = 28.59): F (1, 79) = 11.35, p = 0.001, Partial Eta Squared = 0.13.

(b) By taking into account the level of *Language skill,* L1 learners did not perform significantly better or worse than L2 learners F (1, 79) = 0.85, p = 0.36, and the effect size was small (Partial Eta Squared = 0.01).

The results of the present study showed that by account for the level of oral language skill (High-LS vs. Low-LS), there were no statistical differences between the performances of L1 and L2 learners on any sub-measures of IL-basis (*Listening Comprehension Skill, Phonological Processing Skill* and *Simple Writing Skill/Letter knowledge): F* (3, 77) = 0.5, p > 0.01; Pillai's Trace = 0.01. In addition, no statistically significance differences were found between the performances of L1 and L2 learners on any components of IL-basis measure after accounting for the level of oral language skill (High-LS vs. Low-LS).

However, Chiappe and et al. (2002b) revealed that L1 learners in kindergarten outperformed L2 learners of English from diverse language backgrounds on the one task of phonological processing (rhyme detection). In their study, there was no report about oral language skills of these children. In the present study oral language skill was one of the main factors, and by accounting for this, L1 learners did not perform significantly better or worse than L2 learners, even on the rhyme detection task. What is here of important concern is that Chiappe and et al. (2002b) examined preschool children while the present study examined first-grade children. Additionally, different measures were used to assess children's skills on *letter knowledge and phonological processing performances* in these two studies. Last but not least, the language target in the study by Chiappe and et al. (2002b) was English but the present study targeted the Norwegian language. Differences between these two languages

may impact on the results as Norwegian is a fairly transparent orthography which displays an easier structure for the phonology including *letter knowledge and phonological processing skills,* compared to the English language (Høien-Tengesdal and Tønnessen, 2011).

Therefore, the L1 learners demonstrated no advantage over L2 learners in their proficiency with *letter knowledge and phonological processing tasks* in Norwegian words. One explanation for this result is due to the transparency of the Norwegian language. In recent years, emerging data from cross-linguistic comparisons have shown that learning to read and spell proceeds more quickly in more transparent languages like Dutch, Finnish, German, Greek rather than English. It has been argued that transparent languages are generally more consistent and redundant in the correspondence between letters and sounds. Similar to Dutch (Bosman & van Orden, 1997; Verhagen, et al., 2010), German (Landerl & Wimmer, 2008; Moll, et al., 2009), and Greek (Protopapas & Vlahou, 2009), in Norwegian orthography grapheme-phoneme correspondences are also more predictable. Consequently, it can be expected that L2 learners develop *letter knowledge and phonological processing skills* relatively as easy as L1 learners at early reading stage in Norwegian. In fact, Norwegian belongs to the North-German group of the Indo-European languages and consists of about 40 phonemes, 29 letters of the alphabet (20 consonants, and 9 vowels). It is described as semi-regular, similar to German and Dutch, and located between Finnish and English (Elley, 1992). To illustrate, in Norwegian words like Land, Ball, Hage, and Katt the grapheme /a/ is normally pronounced in the same way, while in the corresponding English words hand, ball, garden, and cat the grapheme /a/ is pronounced differently. Although the Norwegian language is considered regular, there are some problematic structures for beginning readers and spellers. Within the Norwegian language, one grapheme may contain several letters: kj/tj [Ç], skj [ʃ], and ng [ŋ]. The principle for doubling consonants is also another problem for beginning spellers (e.g. hatt [hat]; katt [cat]; and buss [bus]). Typically, Norwegian has consonant clusters in the initial, middle and final position in words. This seems to be somewhat problematic for beginning readers. To illustrate, Hagtvet, Helland, and Lyster (2006), reported that combinations such as oftest [most often], nifst [scary], and kringkasting [broadcasting] were often misspelled by children early in school.

Overall, findings of the present study were consistent with previous studies (Chiappe & et al., 2002b) suggesting by taking into account oral language skill (High-LS vs. Low-LS),

(High-LS) L1 learners did not perform better or worse than (High-LS) L2 learners, and (Low-LS) L1 learners did not perform better or worse than (Low-LS) L2 learners on *letter knowledge and phonological processing tasks*. In other words, by taking into account oral language skill, (High-LS vs Low-LS) L1 learners did not perform significantly better or worse than L2 learners on *letter knowledge and phonological processing tasks* at the early stage of learning. These findings provided evidence for the second hypothesis of the present study:

Based on Cummins's (1979) Linguistic Interdependence Hypothesis, it is also hypothesized that there would be no statistically signifiant difference in performance on letter knowledge and phonological processing tasks between L1 and L2 learners by taking into account the level of oral language skill (High-LS vs. Low-LS).

Oral language and phonological processing skills are of crucial factors for reading development (Snow & et.al., 1998). Children who have well-developed phonological processing skills when they come to school have a better understanding of how sounds and letters are connected in the spoken language as well as in the writing language. In fact, the level of phonological processing skills at the end of kindergarten is one of the most powerful predictors of future reading success, in grade one and beyond (Carroll & et. al., 2003; Snowling & Hulme, 2005). These results have been found in L1 leaners but what is less clear is the outcome for L2 learners. This limitation leads the practitioner and the researchers to apply what have been found for L1 learners to L2 learners' context. In the present study, (High-LS) L2 learners of Norwegian statistically performed at the same level as (How-LS) L1 learners in letter knowledge and phonological processing tasks in Norwegian words. The same pattern was also found for Low-LS children where (Low-LS) L2 learners performed statistically at the same level of (Low-LS) L1 learners. These findings suggest that the same pattern as L1 learners can be observed for L2 learners of Norwegian when it comes to phonological processing skills and its relation to the level of oral language.

5.2.3 Summary

Previous research has reported contradictory results for the role of bilingualism in the development of phonological processing skills. As a sub-skill of metalinguistic ability, it is assumed that L2 learners can perform on phonological processing tasks, as well as or even

better than L1 learners due to the exposure of more than one language(s) which can increase the ability of metalinguistic (Vygotsky, 1962). Some research has supported this theory (Campbell & Sais, 1995; Rubin & Turner, 1989). However, the other studies indicate that bilingualism on its own shares a small direct role in influencing the development of phonological processing skills (Chiappe, et al., 2002b). The present study's results also supported those that have found neither privileged nor limited acquisition of phonological processing skills for L2 learners, pointing to the importance role of oral language skills in this development. As measure of TROG-2 is the oral language skill measure in the present study and this measure is built for reception of grammar assessment, it is recommended this will considered as limitation for the results.

In summary, results from the present study suggested that at the beginning of first grade: (a) L2 learners were more likely to be classified Low-LS than L1 children. (b) Children with high oral language skills outperformed children with low oral language skills on *letter knowledge and phonological processing tasks* in both groups of L1 and L2 learners. (c) By taking into account the level of oral language skill (High-LS vs. Low-LS), L1 learners did not perform significantly better or worse than L2 learners on *Letter Knowledge and Phonological Processing tasks*. These findings provide evidence to support the hypothesis of study:

''Children with high oral language skill (High-LS) would perform better than children with low oral language skill (Low-LS) in phonological processing tasks. Based on Cummins's (1979) Linguistic Interdependence Hypothesis, it is also hypothesized that there would be no statistically significant difference in performance on letter knowledge and phonological processing tasks between L1 and L2 learners by taking into account the level of oral language skill (High-LS vs. Low-LS).''.

5.3 Conclusion

5.3.1 Letter Knowledge and Phonological Processing Skills: High-LS children Versus Low-LS children

The present study revealed, in consistence with previous studies (Chiappe et al., 2002a; Puranik & Lonigan, 2012; Lonigan & et al., 1998), (High-LS) L1 learners outperformed (Low-LS) L1 learners in *letter knowledge and phonological processing tasks.* The same pattern was also observed for L2 learners where (High-LS) L2 learners outperformed (Low-LS) L2 learners in these tasks. In total, (High-LS) children (including L1 and L2 learners) outperformed (Low-LS) children (including L1 and L2 learners) in *letter knowledge and phonological processing tasks* in the present study. Thus, a similar pattern of relation between the level of oral language and *phonological processing skills*, was observed in L1 and L2 learners of a language, here Norwegian. These findings supported the Cummins's (1979) linguistic interdependence hypothesis. Cummins's (1979) linguistic interdependence hypotheses suggest that there is a significant relationship between L2 learners' skill in developing first and second languages (Chiappe, Siegel & Wade-Woolley, 2002b; Cummins, 1979). Accordingly, the present study hypothesized that due to the high relation between the oral language skill and *phonological processing skills* in children's first language (Chiappe, Siegel & Gottardo, 2002a; Puranik & Lonigan, 2012; Lonigan & et al., 1998), there would be similar relation in a second language as well. The findings of present study revealed that in the group of L2 learners of Norwegian, similar to the group of L1 learners, children with high language skill outperformed children with low language skill in *Letter Knowledge and Phonological Processing tasks*. In other words, similar to L1 learners, (High-LS) L2 learners outperformed (Low-LS) L2 learners in *phonological processing tasks*, and in total (High-LS) children (including L1 and L2 learners) outperformed (Low-LS) children (including L1 and L2 learners). As a result, these findings by suggesting similarity between the performances of L1 and L2 learners on phonological processing tasks and its relation with oral language, supported Cummins's (1979) linguistic interdependence hypothesis. There was a relation between L2 learners' skill in developing first and second languages as (High-LS) L2 learners performed as well as (High-LS) L1 learners, and outperformed Low-LS L2 learners. Similar patterns were also found for L1 learners. What we should consider is that in the present study

measure of *Language skill* was TROG-2 measure that is provided for assessing reception of grammar.

5.3.2 Letter Knowledge and Phonological Processing Skills: L1 Learner Versus L 2 Learners

As presented in chapter 4, L1 learners performed better than L2 learners on *letter knowledge and phonological processing tasks* where the level of language skills was not taken into account. Due to the high relationship between oral language skill and phonological processing skills (Puranik & Lonigan, 2012; Lonigan & et al., 1998), the present study hypothesized that by taking into account the oral language skill (High-LS vs. Low-LS), L1 learners would not perform significantly better or worse than L2 learners on *letter knowledge and phonological processing tasks*. The findings revealed that (High-LS) L1 learners did not perform significantly better or worse than (High-LS) L2 learners, or (Low-LS) L1 learners did not perform significantly better or worse than (Low-LS) L2 learners. These results suggest that by taking into account the oral language skill (High-LS vs. Low-LS), L1 learners did not perform significantly better or worse than L2 learners on *letter knowledge and phonological processing tasks*. The findings also revealed that similar to L1 learners, (High-LS) L2 learners outperformed (Low-LS) L2 learners.

In addition, in the present study L2 learners were more likely to be classified as Low-LS than L1 learners (see Table 4-1). This result suggests that some of these L2 learners could be identified as (Low-LS) children due to their limited exposure to Norwegian where the administrating measuring time was at the beginning of the school's first-grade. First language for both parents of L2 learners was a language other than Norwegian while for L1 learners, Norwegian was the first language for both parents.

In conclusion, these findings suggest that by taking into account the Norwegian level of oral language skill, *phonological processing skills* of L2 learners of Norwegian developed similar to their typically developing L1 learners. Moreover, similar to L1 learners, there was a relation between the performance of L2 learners of Norwegian on *phonological processing tasks* in Norwegian words and their level of Norwegian oral language. These findings, together with those of Chiappe et al. (2002a; 200b), suggest that L2 learners' limited exposure to Norwegian did not inhibit their acquisition of emergent literacy-related skills such as *letter*

knowledge and phonological processing skills. As no statistically differences were observed between the performance of (High-LS) L2 learners and those performance of (High-LS) L1 learners on *letter knowledge and phonological processing tasks*, it can also concluded that development of *letter knowledge and phonological processing skills* in Norwegian have a relation with Norwegian oral language skill in L2 learners of Norwegian as well as L1 learners. Thus, the same instructional methods as L1 learners can foster the development of literacy for the L2 learners (Chiappe et al., 2002a; 2002b) with more emphasis on oral language instruction. Moreover, the diverse language backgrounds of participants in the present study suggest that the findings are applicable to all L2 learners of Norwegian regardless of the first language background.

It should be mentioned that measure of *oral language skill* in the present study was measure of TROG-2. TROG-2 test is, in fact, a measure in which reception of grammar is assessed in the skill of oral language. Thus, this limitation of the present study should be considered when the results may be used for other measures of oral language skills. The limitations of the present study are discussed in the following:

5.4 Limitations and Future Research

Despite evidence for associations between emergent literacy skills and oral language in first language, there has been relatively few studies examining this relationship in second languages. This study provided evidence for a relationship between oral language and emergent literacy skills in L1 and L2 learners of Norwegian. However, like other studies, the present study was not without its imitations: Firstly, the results of this study should be considered preliminary in nature as it was a cross-sectional, comparative study in which drawing unambiguous causal inferences was not recommended. Future studies with larger sample sizes are needed to replicate these findings. Larger samples with more L2 learners is even more critical.

These results must also be used with caution, especially for children with low oral language skill as children's oral language performance has been shown to change over time while the gap between the performances of L1 and L2 learners appears to have remained the same, and sometimes even worse over time (August & Shanahan, 2008). Future research is required to examine the development of phonological processing and oral language of L1 and L2 learners over time.

Another limitation of the present study is that our phonological processing measure (IL-basis) was not a standardized test due to limited existence of standardized tests in the Norwegian language; even though the oral language was measured using the standard measure of TROG. TROG is also a measure for grammar that assesses only one aspect of language while it is required to consider all aspects of oral language to have a better picture of oral language skill. In addition, measures were administered in groups based and not individually, which has had some effect on the results. To moderate this effect we set the alpha level at 0.01 in the present study prior starting the analyzing data. Future research is required to use standardized tests and comprehensive test of oral language.

Finally, no information had been gathered about first-language skills of L2 learners as L2 learners participating in the present study were from a relatively wide range of language backgrounds (11 different languages). The present study benefited from this diversity as the obtained results were not related to a certain language, which made it applicable to L2

learners of Norwegian regardless of their first-language backgrounds (The present study had such an aim). However, language-specific studies are highly recommended in order to provide evidence for cross-language theory generating; it is, therefore, recommended that a replication of the present study will made to investigate L2 learners of Norwegian who speak one certain language. It would help to assess cross-language differences and similarity between that certain language and Norwegian.

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7 APPENDIXES

Appendix 1

Table 7-1- Tests of Normality for sub-measures of IL-basis: L1 and L2 learners, respectively in the group of High-LS and Low-LS.

Language Group		Language Skill	Kolmogorov-Smirnova		
			Statistic	df	Sig.
L1 Learners	Listening Comprehension Skill	High-LS	.220	58	.000
		Low-LS	.190	8	.200*
	Phonological Processing Skill	High-LS	.227	58	.000
		Low-LS	.237	8	.200*
	Simple Writing Skill/*Letter Knowledge*	High-LS	.196	58	.000
		Low-LS	.217	9	.200*
L2 Learners	Listening Comprehension Skill	High-LS	.174	8	.200*
		Low-LS	.196	9	.200*
	Phonological Processing Skill	High-LS	.194	8	.200*
		Low-LS	.149	9	.200*
	Simple Writing Skill/*Letter Knowledge*	High-LS	.199	8	.200*
		Low-LS	.217	9	.200*

Appendix 2

Table 7-2- Correlations among sub-scales of IL-basis, N=83

		Listening Comprehension	Phonological Skill	Simple Writing Skill
Listening Comprehension	**Pearson Correlation**	1	0.43	0.3
Phonological Skill	**Pearson Correlation**	0.43	1	0.77
Simple Writing Skill	**Pearson Correlation**	.304	0.77	1

Appendix 3

Table 7-3- Tests of Between-Subjects Effects. Dependent Variable: Listening Comprehension Skill

Language Skill	Source	Type II Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
High-LS	**Language Group**	10.54	1	10.54	3.12	.082	.046
Low-LS	**Language Group**	14.67	1	14.67	2.28	.152	.132

Table 7-4- Descriptive Statistics, Dependent Variable: Listening Comprehension Skill

Language Skill	Language Group	Mean	Std. Deviation	N
High-LS	**L1 Learner**	8.22	1.76	58
	L2 Learner	7.00	2.39	8
	Total	8.08	1.87	66
Low-LS	**L1 Learner**	6.75	1.67	8
	L2 Learner	4.89	3.1	9
	Total	5.76	2.64	17

Appendix 4

Table 7-5- Tests of Between-Subjects Effects, Dependent Variable: Phonological Processing Skill

Language Skill	Source	Type II Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
High-LS	**Language Group**	621.31	1	621.31	4.32	.042	.063
Low-LS	**Language Group**	1402	1	1402.04	6.86	.019	.314

Table 7-6- Descriptive Statistics, Dependent Variable: Phonological Processing Skill

Language Skill	Language Group	Mean	Std. Deviation	N
High-LS	**L1 Learner**	55.28	11.65	58
	L2 Learner	45.88	14.42	8
	Total	54.14	12.29	66
Low-LS	**L1 Learner**	46.75	13.44	8
	L2 Learner	28.56	15	9
	Total	37.12	16.71	17

Appendix 5

Table 7-7- Tests of Between-Subjects Effects, Dependent Variable:

Simple Writing Skill/Letter Knowledge

Language Skill	Source	Type II Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
High-LS	**Language Group**	639.68	1	639.68	2.81	.099	.042
Low-LS	**Language Group**	895.6	1	895.6	5.96	.027	.284

Table 7-8- Descriptive Statistics, Dependent Variable: Simple Writing Skill/Letter Knowledge

Language Skill	Language Group	Mean	Std. Deviation	N
High-LS	**L1 Learner**	28.41	15.04	58
	L2 Learner	18.88	15.45	8
	Total	27.26	15.3	66
Low-LS	**L1 Learner**	21.88	15.75	8
	L2 Learner	7.33	8.03	9
	Total	14.18	14.03	17

Appendix 6

Table 7-9- Correlations among 8 components of IL-basis

		Listening Comprehension	Rhyme	First Phoneme Identification	Phoneme Identification Counting 12	Compound Word Identification	First Letter Identification	First Letter Writing	Simple Word Writing 123
Listening Comprehension	***Pearson Correlation***	1	0.47	0.31	0.4	0.38	0.35	0.27	0.3
Rhyme	***Pearson Correlation***	0.47	1	0.52	0.56	0.62	0.67	0.43	0.43
First Phoneme Identification	***Pearson Correlation***	0.31	0.52	1	0.7	0.35	0.7	0.65	0.7
Phoneme Identification Counting12	***Pearson Correlation***	0.4	0.56	0.7	1	0.57	0.69	0.64	0.69
Compound Word Identification	***Pearson Correlation***	0.38	0.62	0.35	0.57	1	0.56	0.4	0.31
First Letter Identification	***Pearson Correlation***	0.35	0.67	0.7	0.69	0.56	1	0.66	0.62
First Letter Writing	***Pearson Correlation***	0.27	0.43	0.65	0.64	0.4	0.66	1	0.72
Simple Word Writing 123	***Pearson Correlation***	0.3	0	0.7	0.69	0.31	0.62	0.72	1

Appendix 7

Table 7-10- Tests of Between-Subjects Effects for all items regarding to the Measure of IL-basis

Source	Dependent Variable	Type II Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Language Skill	Listening Comprehension1&2	33.081	1	33.081	8.364	.005	.096
	Rhyme Detection	20.287	1	20.287	18.672	.000	.191
	First Phoneme Identification	34.339	1	34.339	4.734	.033	.057
	Phoneme Identification Counting1&2	242.663	1	242.663	9.709	.003	.109
	Compound Word Identification	15.303	1	15.303	9.051	.004	.103
	First Letter Identification	97.199	1	97.199	3.539	.064	.043
	First Letter Writing	235.144	1	235.144	3.262	.075	.040
	Simple Word Writing1,2&3	167.067	1	167.067	2.967	.089	.036
Language Group	Listening Comprehension1&2	24.133	1	24.133	6.101	.016	.072
	Rhyme Detection	5.790	1	5.790	5.329	.024	.063
	First Phoneme Identification	70.178	1	70.178	9.675	.003	.109
	Phoneme Identification Counting1&2	193.194	1	193.194	7.730	.007	.089
	Compound Word Identification	1.945	1	1.945	1.150	.287	.014
	First Letter Identification	274.625	1	274.625	9.998	.002	.112
	First Letter Writing	449.786	1	449.786	6.240	.015	.073
	Simple Word Writing1,2&3	293.127	1	293.127	5.206	.025	.062
Language Skill * Language Group	Listening Comprehension1&2	1.072	1	1.072	.271	.604	.003
	Rhyme Detection	7.439	1	7.439	6.847	.011	.080
	First Phoneme Identification	7.822	1	7.822	1.078	.302	.013
	Phoneme Identification Counting1&2	.328	1	.328	.013	.909	.000
	Compound Word Identification	1.185	1	1.185	.701	.405	.009
	First Letter Identification	50.556	1	50.556	1.841	.179	.023
	First Letter Writing	3.825	1	3.825	.053	.818	.001
	Simple Word Writing1,2&3	38.162	1	38.162	.678	.413	.009

Appendix 8

Table 7-11- Tests of Between-Subjects Effects. Dependent Variable: Listening Comprehension1&2

Language Skill	Source	Type II Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
High-LS	**Language Group**	10.54	1	10.54	3.12	.082	.046
Low-LS	**Language Group**	14.67	1	14.67	2.28	.152	.132

Table 7-12- Descriptive Statistics, Dependent Variable: Listening Comprehension1&2

Language Skill	Language Group	Mean	Std. Deviation	N
High-LS	**L1 Learner**	8.22	1.76	58
	L2 Learner	7.00	2.39	8
	Total	8.08	1.87	66
Low-LS	**L1 Learner**	6.75	1.67	8
	L2 Learner	4.89	3.1	9
	Total	5.76	2.64	17

Appendix 9

Table 7-13- Tests of Between-Subjects Effects. Dependent Variable: Rhyme Detection Skill

Language Skill	Source	Type II Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
High-LS	**Language Group**	0.05	1	.052	.076	.784	.001
Low-LS	**Language Group**	13.17	1	13.177	4.733	.046	.240

Table 7-14- Descriptive Statistics, Dependent Variable: Rhyme Detection Skill

Language Skill	Language Group	Mean	Std. Deviation	N
High-LS	**L1 Learner**	5.59	0.8	58
	L2 Learner	5.5	1.07	8
	Total	5.58	0.82	66
Low-LS	**L1 Learner**	4.88	1.64	8
	L2 Learner	3.11	1.69	9
	Total	3.94	1.85	17

Appendix 10

Table 7-15- Tests of Between-Subjects Effects, Dependent Variable: First Phoneme Identification

Language Skill	Source	Type II Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
High-LS	**Language Group**	24.04	1	24.04	3.45	.068	.051
Low-LS	**Language Group**	53.96	1	53.96	6.37	.023	.298

Table 7-16- Descriptive Statistics, Dependent Variable: First Phoneme Identification

Language Skill	Language Group	Mean	Std. Deviation	N
High-LS	**L1 Learner**	9.22	2.44	58
	L2 Learner	7.38	3.93	8
	Total	9	2.69	66
Low-LS	**L1 Learner**	8.13	2.95	8
	L2 Learner	4.56	2.88	9
	Total	6.24	3.36	17

Appendix 11

Table 7-17- Tests of Between-Subjects Effects, Dependent Variable: Phoneme Identification Counting1 &2

Language Skill	Source	Type II Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
High-LS	**Language Group**	112.97	1	112.97	4.62	.040	.067
Low-LS	**Language Group**	80.55	1	80.55	2.96	.110	.165

Table 7-18- Descriptive Statistics, Dependent Variable: Phoneme Identification Counting1 &2

Language Skill	Language Group	Mean	Std. Deviation	N
High-LS	**L1 Learner**	14.75	4.84	58
	L2 Learner	10.75	5.78	8
	Total	14.27	5.08	66
Low-LS	**L1 Learner**	10.25	5.68	8
	L2 Learner	5.89	4.78	9
	Total	7.94	5.53	17

Appendix 12

Table 7-19- Tests of Between-Subjects Effects Dependent Variable: Compound Word Identification

Language Skill	Source	Type II Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
High-LS	**Language Group**	.189	1	.189	.138	.712	.002
Low-LS	**Language Group**	2.941	1	2.941	.959	.343	.060

Table 7-20- Descriptive Statistics, Dependent Variable: Compound Word Identification

Language Skill	Language Group	Mean	Std. Deviation	N
High-LS	**L1 Learner**	4.41	1.14	58
	L2 Learner	4.25	1.39	8
	Total	4.39	1.16	66
Low-LS	**L1 Learner**	3.5	1.69	8
	L2 Learner	2.67	1.8	9
	Total	3.06	1.75	17

Appendix 13

Table 7-21- Tests of Between-Subjects Effects Dependent Variable: First Letter Identification

Language Skill	Source	Type II Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
High-LS	**Language Group**	76.24	1	76.24	2.97	.090	.044
Low-LS	**Language Group**	248.94	1	248.94	7.07	.018	.320

Table 7-22- Descriptive Statistics, Dependent Variable: First Letter Identification

Language Skill	Language Group	Mean	Std. Deviation	N
High-LS	**L1 Learner**	21.29	4.69	58
	L2 Learner	18	7.45	8
	Total	20.89	5.14	66
Low-LS	**L1 Learner**	20	4.5	8
	L2 Learner	12.33	6.95	9
	Total	15.94	6.97	17

Appendix 14

Table 7-23- Tests of Between-Subjects Effects. Dependent Variable: First Letter Writing

Language Skill	Source	Type II Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
High-LS	**Language Group**	241.94	1	241.94	3.33	.073	.050
Low-LS	**Language Group**	211.67	1	211.67	3.02	.103	.168

Table 7-24- Descriptive Statistics, Dependent Variable: First Letter Writing

Language Skill	Language Group	Mean	Std. Deviation	N
High-LS	**L1 Learner**	16.74	8.39	58
	L2 Learner	10.88	9.48	8
	Total	16.03	8.67	66
Low-LS	**L1 Learner**	12.63	9.96	8
	L2 Learner	5.56	6.67	9
	Total	8.88	8.88	17

Appendix 15

Table 7-25- Tests of Between-Subjects Effects. Dependent Variable: Simple Word Writing 1, 2 & 3

Language Skill	Source	Type II Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
High	**Language Group**	94.82	1	94.82	1.51	.223	.023
Low	**Language Group**	236.47	1	236.47	8.08	.012	.350

Table 7-26- Descriptive Statistics, Dependent Variable: Simple Word Writing 1, 2 & 3

Language Skill	Language Group	Mean	Std. Deviation	N
High	**L1 Learner**	11.67	8.03	58
	L2 Learner	8	6.91	8
	Total	11.23	7.95	66
Low	**L1 Learner**	9.25	7.36	8
	L2 Learner	1.78	2.73	9
	Total	5.29	6.5	17