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Abstract

This study focuses on dyslexic learners in the EFL classroom. The research will focus on if Lingdys software impacts 8th-grade dyslexic EFL learners' reading comprehension and spelling, and in what ways it impacts these skills. Lingdys Pluss is a dyslexia-friendly software, that supplies audio and writing support for dyslexics, in addition, it includes dictation and dictionary functions. In today's society reading and writing are basic skills that all humans are expected to master, where both skills are highly valued in the National curriculum. However, the participants of this study are a part of between five to ten percent of the population lacking reading and writing skills due to dyslexia. The participants in this study are eight 8th graders, divided into a research group and a control group, with four learners in each group. The study used a qualitative approach where the following data elicitation material was used: a reading comprehension task resulting in learner texts that were collected and analysed, and a questionnaire. The findings suggested that there were huge differences between the groups' reading comprehension and spelling, favouring the research group. Therefore, these results are promising when it comes to the application of Lingdys support in the EFL classroom.

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List of ABBREVIATIONS

EFL	ENGLISH AS FOREIGN LANGUAGE
IDA	INTERNATIONAL DYSLEXIA ASSOCIATION
BDA	BRITISH DYSLEXIA ASSOCIATION
FL	FOREIGN LANGUAGE
DFER	DYSLEXIA PREFERENCE FOR ENGLISH READING

1.0 Introduction

1.1 Research aim

In today's society, we are surrounded by multiple digital resources. However, in this digital world and society, there is also an assumption that everybody masters the skills of reading and writing. In school, for instance, almost all types of learning assume that the pupils know how to read and write (Høien & Lundberg, 2012). But what happens when the pupils lack the ability to read and/or write? Or what happens when pupils have difficulties mastering reading and/or writing?

It is a fact that some pupils have difficulties when it comes to reading and/or writing. To get one step closer to an integrated world suitable for everyone, we need to break the assumption that everybody masters the skills of reading and writing. Towards this, we need to start with the schools. According to statistics, approximately five to ten per cent of the Norwegian population have dyslexia (Dysleksi Norge, 2021; Solem, 2017). This equals approximately one to two pupils in each classroom. But do the teachers know how to facilitate the learning for these pupils in the best way possible? Based on my experience, my assumption is that several teachers in Norwegian schools do not know how to facilitate learning for this group of learners. As a result, if my assumption is correct, there could be an educational gap for pupils with dyslexia.

The Norwegian school system's inability to accommodate struggling readers has been a topic for a while, and can be highlighted through the obligatory, yearly, nationwide tests called *national tests*. Lie argues that the Norwegian national tests have not been adapted to struggling readers, including dyslexic pupils (Lie, 2018). *Norwegian Directorate for Education and Training* instructed the *Ministry of Education and Research* to adapt the tests to struggling readers (Utdanningsnytt, 2022), and for the first time in the history of national tests in Norway, the tests were adapted for struggling readers by providing them with audio support, in the autumn of 2022 (Svendsen, 2022). However, do we know anything about the effect audio support in EFL (English as a foreign language) has on the pupils' reading comprehension?

This research aims to develop my understanding of dyslexia and dyslexic pupils in the Norwegian EFL classroom. Furthermore, I aim to contribute to a field of research that needs more awareness among teachers, teacher-students, and others in the educational sector. I want to contribute to this research field, by investigating dyslexic pupils' reading comprehension and spelling skills in L2 (second language). Do pupils with dyslexia get the support they need through the audio support material, designed especially for them? Does Lingit's dyslexic-friendly software, Lingdys Pluss, neutralise the pupil's lack of decoding and spelling skills? The research applies qualitative instruments to collect data and address the research question, including a reading comprehension test and a short questionnaire reflecting on the process. The purpose of the research is to examine the reading comprehension of EFL 8th-grade pupils with dyslexia, with and without audio support, to examine if there are any differences, and in what ways these differences are expressed. In line with this purpose, the thesis will explore the following research question; ***Does the use of Lingdys support have an impact on 8th-grade dyslexic EFL learners' reading comprehension and spelling? If so, in what ways?***

1.2 Curriculum and educational legislations

The Knowledge Promotion Reform (LK20) emphasises the importance of the five basic skills: reading, writing, numeracy, oral skills, and digital skills. In the curriculum, it is stated that the basic skills are "important for developing the identity and social relations of each pupil and for the ability to participate in education, work and societal life" (Kunnskapsdepartementet, 2017, p. 13). The five basic skills are viewed as essential and should therefore be included in all sections of education, throughout the entire learning path. This is an important part of the process towards understanding their own learning processes (Kunnskapsdepartementet, 2017, p. 14). This is reflected in the subject curriculum in English where several aspects of reading and writing are included in the competence aims. These include reading a variety of texts, understanding, and interpreting different genres, and writing both formal and informal texts in English (Kunnskapsdepartementet, 2019). Furthermore, a curricular aim after *Year 10* is to "use different digital resources and other aids in language learning, text creation and interaction" (Kunnskapsdepartementet, 2019, p. 8). The specific curricular aims are relevant to this research since the processes of reading and writing are both connected to understanding and interpreting texts and writing formal and informal texts. Additionally,

Lingdys support serves as a digital resource, or aid, in language learning, text creation and interaction.

If pupils encounter problems learning how to read and write, teachers are obligated to act and take measures (Opplæringslova § 5-4). All schools are obligated to differentiate instructions and adapt teaching so that all pupils have the best possible learning outcome following ordinary education (Kunnskapsdepartementet, 2017), including struggling readers and writers. As mentioned earlier, the Norwegian school system assumes that all pupils master the ability of reading and writing (Høien & Lundberg, 2012). However, some pupils lack these abilities and may struggle to learn. In 2019, Andersen and Fagerås suggested that all Norwegian schools should be so-called dyslexia-friendly schools (Andersen & Fagerås, 2019), scaffolding struggling readers and writers to master school and the learning processes. In their proposal, they wanted the government to make a detailed plan, suggesting how all Norwegian schools could work towards reaching the dyslexia-friendly-mark, within a certain time limit. Their proposal was declined by Stortinget later that year. Although the proposal was declined, several schools in Norway have been marked as dyslexia-friendly over the past couple of years, showing an extra ability to adapt the school day to dyslexics. Additionally, the differentiating principles apply to all pupils and should preferably take place within the learning community, through variation and adaptation to the diversity within the class. Allowing pupils to spend more time examining various tasks and areas within a subject and taking into consideration that all pupils are different and learn at different speeds and within different progressions, would be considered differentiated instructions (Kunnskapsdepartementet, 2017). Yet, those who need differentiated instructions beyond the ordinary teaching program are entitled to special-needs education (Opplæringslova, §5-1; Kunnskapsdepartementet, 2017).

1.3 Lingdys Pluss

For this study, Lingdys software played an essential part. Lingdys has aided dyslexics for the past 20 years. However, the software has been upgraded over the last few years, and additional functions have been added, all specially developed for dyslexics. These functions, according to Lingit (2020), aim to help dyslexics reach their potential and provide them with tools that can make their reading and writing process independent. The software provides

audio and writing support, including a dictation mode. In order to use the audio support, the text is highlighted. After highlighting the text, you select the play button on the toolbar, and the audio support, in the form of a dyslexia-friendly voice, starts reading the highlighted text aloud. It is possible to pause and restart the reading. If preferred, it is also possible to highlight and listen to one paragraph, or a sentence at a time. Lingdys Pluss also offers writing support and a dictation function, as mentioned. The spelling support is shaped like a magnifying glass on the toolbar and can easily be switched on and off by pressing the symbol. When this tool is on, the user gets help spelling words correctly, and the function also contributes to predicting the next word while writing. Once one has started spelling a word, a list of up to nine words may help the writer spell the next word correctly. Furthermore, the dictation function makes it possible for the user to dictate what he or she wants to write, directly into a writing program. The symbol is shaped like a microphone, and the microphone is switched on by pressing the bottom. This function requires that the user speaks slowly enough so that the program has enough time to spell out what is being dictated. In addition, it requires that the user speaks clearly into the microphone. The function may benefit slow or struggling writers, as it allows the user to write a lot of information in a short time. Lastly, there are some additional functions that will not be presented for the participants in this study, however, they are worth mentioning. These include a dictionary and an ABC-function, checking sentences for spelling mistakes and grammar (Lingit, 2022).

1.4 Outline of the thesis

Regarding the structure of the thesis, Chapter 2 provides an overview of dyslexia, including its historical aspects, definitions, and distinctive features. Additionally, it includes a section on reading comprehension and spelling, followed by a review of previous research on dyslexia in the EFL classroom. Chapter 3 outlines the methodology of the study. First by examining qualitative research, followed by a description of the specific data collection methods employed in the study. Thirdly, it presents the procedures for data analysis and ethical considerations. Finally, Chapter 3 addresses the reliability and validity of the study. The data is presented in Chapter 4, where the results from the reading comprehension task are displayed first. This section includes both comprehension and spelling results, followed by the participant's responses to the questionnaire. Chapter 5 contains the discussion, where the research question forms the structure. First the topic of reading comprehension is addressed,

then spelling will be discussed. Additionally, the limitations of the study are discussed at the end of the chapter, in addition, suggestions for further research are made. Finally, Chapter 6 contains the conclusion, where the major findings are summarised and implications for teaching are presented.

2.0 Theory and literature review

The following chapter consists of 4 sections. The first section (2.1) deals with dyslexia in general. The historical perspective, definitions and distinctive features. Following is a section on reading comprehension (2.2) and different perspectives on reading connected to comprehension. Section 2.3 deals with spelling. Then, studies concerning dyslexia and studies on dyslexia in the EFL classroom follow in section 2.4, supplemented with other relevant research.

2.1 Dyslexia

2.1.1 Historical perspective

It has been known for nearly a century that some people struggle with decoding words and sentences. What we today know as dyslexia was once referred to as *congenital word blindness* and *strephosymbolia* (Hinshelwood, 1900; Morgan 1896; Orton, 1928, referred to in Gough & Tunmer, 1986). The word dyslexia is a combination of the words *dys* and *lexia*, respectively meaning *difficulties* and *words* (Høien & Lundberg, 2012), later presented as *difficulties with words* (Dysleksi Norge, 2021). However, dyslexia was first described and connected to children in 1896 by a British school doctor named Pringle Morgan. Morgan described a 14-year-old boy's reading disabilities as *wordblindness*; "He has always been a bright and intelligent boy, quick at games, and in no way inferior to others of his age. His great difficulties have been - and is now - his inability to read" (Shaywitz et al., 2008, p. 452). Yet, it was a German ophthalmologist who first used the terminology *dyslexia* in 1887, however, he used the term concerning adult patients with difficulties connected to printed words (Høien & Lundberg, 2012).

In the 1920s, the American researcher Samuel Orton presented a theory where he stated that the mental impression from writing was saved in both the dominant (most often the left hemisphere) and the non-dominant brain hemisphere (right half). The theory presented that writing was reversed in the non-dominant hemisphere and that the brain hemispheres operated equally. The fact that there was no dominant hemisphere could result in a collision, which Orton referred to as "reversed spelling" (Høien & Lundberg, 2012). Reversed spelling, or mirrored spelling, refers to words being read in the opposite direction, for instance, *was* could

be read as *saw*. Later research showed that this section of Orton's theory did not measure up; however, a lot of his observations on dyslexia have made an impact on more recent dyslexia research. Honouring his work, the *Orton Dyslexia Society* was established in 1949, however, the world-leading dyslexia research association is today known as the *International Dyslexia Association* (Høien & Lundberg, 2012).

2.1.2 Definitions

In later years, several definitions of dyslexia appeared due to a disagreement within the research of what dyslexia is and what the causes of dyslexia are. For instance, back in 1986, the World Federation of Neurology defined dyslexia as “[...] a disorder manifested by difficulties in learning to read despite conventional instruction, adequate intelligence, and sociocultural opportunities. It depends upon fundamental cognitive disabilities which are frequently of constitutional origin” (Høien & Lundberg, 2012, p. 18). The definition states aspects that do not explain dyslexia, such as capability, sociocultural aspects, and sensory disorders, rather, it explains the causes of dyslexia. Therefore, it has been criticised by several other researchers such as Aaron (1997), Fletcher et al, (2007), Lyon (1995) and Reid (1995), because it excludes people with different levels of intelligence who may have dyslexia (Høien & Lundberg, 2012). According to Shaywitz (2003), it is clear that “dyslexia represents a specific difficulty with reading, not with thinking skills” (Høien & Lundberg, 2012, p.20).

The Orton Dyslexia Society Research Committee's (1994) definition could be divided into two sections. The first part of the definition enlightens us that decoding is the most common struggle for a dyslexic person. The second part explains that the difficulties differ from child to child and from what is expected skills according to age. In addition, stating that dyslexia may be all reading, writing, and spelling difficulties.

These difficulties in single word decoding are often unexpected in relation to age and other cognitive and academic abilities; they are not the result of generalized developmental disability or sensory impairment. Dyslexia is manifested by a variable difficulty with different forms of language, often including, in addition to problems with reading, a conspicuous problem with acquiring proficiency in writing and spelling. (Høien & Lundberg, 2012, pp. 24 - 25)

Høien and Lundberg (1991, 2012) highlight that dyslexia is the “[...] disturbance in certain language functions which are important for using the alphabetic principle in the decoding of language” (Høien & Lundberg, 2012, p. 25). Furthermore, they state that the disturbance looks to be genetically connected, and therefore generally is passed on in families. Dyslexia is connected to the reading process, with a lack obtaining automatic word decoding, also including poor writing. “Another characteristic of dyslexia is that the disturbance is persistent. Even though reading abilities can eventually reach an acceptable performance level, poor writing skills most often remain” (Høien & Lundberg, 2012, p. 25). In other words, dyslexia is “a persisting disturbance in the coding of written language, which has its cause in a deficit in the phonological system” (Høien & Lundberg, 2012, p. 26). Also, Lyon et al. (2003) highlight the primary symptoms of dyslexia as decoding disabilities, phonological difficulties, and bad spelling in their definition.

Waalder and Waalder (2019) present the two most used dyslexia diagnosis assessments, which are the WHO’s International Classification of Diseases (ICD) and the Diagnostic and Statistical Manual of Mental Disorders (DSM) by the American Psychiatric Association. However, Solem (2017) states that Norwegian educationalists tend to lean towards more operational definitions like the one by International Dyslexia Association (IDA) or British Dyslexia Association (BDA):

Dyslexia is a specific learning disability 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 impede growth of vocabulary and background knowledge. (IDA, 2002)

Dyslexia is a learning difficulty that primarily affects the skills involved in accurate and fluent word reading and spelling. Characteristic features of dyslexia are difficulties in phonological awareness, verbal memory and verbal processing speed. Dyslexia occurs across a range of intellectual abilities. It is best thought of as a continuum, not a distinct category, and there are no clear cut-off points. Co-occurring

difficulties may be seen in aspects of language, motor coordination, mental calculation, concentration and personal organisation, but these are not, by themselves, markers of dyslexia. [...] The British Dyslexia Association (BDA) acknowledges the visual and auditory processing difficulties that some individuals with dyslexia can experience and points out that dyslexic readers can show a combination of abilities and difficulties that affect the learning process. Some also have strengths in other areas, such as design, problem solving, creative skills, interactive skills, and oral skills. (BDA, 2009)

In contrast to The World Federation of Neurology's definition presented earlier, IDA's and BDA's definitions present both inclusion and exclusion criteria. The range of these criteria varies from dyslexia being a neurological disorder, to dyslexia being separated from the sociocultural aspect. The definition also explains how dyslexia often can be noticed and that these difficulties are connected to the phonological aspect of the language.

Dysleksi Norge based their definition on both IDA's and BDA's, including the ROSE report from 2009, in which all three have a lot of similarities. Their definition states that dyslexia is a specific learning disorder which makes it harder to gain functional reading- and writing abilities. Difficulties in decoding and spelling words are distinctive features, furthermore, typically is a lack of phonological processing, rapid identification, and phonological short-term memory. In addition, they state that some also may struggle with slow processing speed and automation abilities. Lastly, the condition is a genetic, lifelong hereditary disability (Dysleksi Norge, 2012; Solem, 2017; Waaler & Waaler, 2019). Dysleksi Norge (2021) explains that the difficulties may be understood as a continuum. Furthermore, citing that an adaptation through for instance digital resources and supportive instructions tend to soften the consequences of the diagnosis. Yet, there are no clear lines between decoding disabilities and dyslexia (Solem, 2017).

2.1.3 Distinctive features of dyslexia

Among the different researchers and dyslexia associations there are several different indications and distinctive features of dyslexia presented. In Table 1 I have provided some lists and a self-assessment presenting some of the main indicators, strengths and weaknesses related to dyslexia. Shaywitz and Shaywitz's (2020) list presents common features dyslexics

find difficult in relation to reading, speaking and what they refer to as school and life, yet they also present common strengths of dyslexics. Since the study focuses on 8th graders, the focus will lay on the group referred to by Shaywitz and Shaywitz as *Second grade through High School*, also including some of the factors for *Young adults and Adults*. On the contrary, Solem (2017) states common difficulties which may indicate dyslexia. Furthermore, the IDA (2023) presents a 10-question-long self-assessment (targeting adults). If the respondent can tick off seven of the questions, it may indicate dyslexia and the respondent should contact a specialist for further testing. Several other sources support the elements presented in Table 1, such as Logometrica (2021). The support of the distinctive features is revealed in the several definitions, inclusion criteria and exclusion criteria. Yet, it is important to state that these distinctive features only serve as an indication, not a diagnosis criterion, and dyslexia differs from person to person (Solem, 2017; Waaler & Waaler, 2019; Høien & Lundberg, 2012).

Table 1: Distinctive features of dyslexia

<p>Solem (2017, p.14)</p>	<p>Difficulties:</p> <ul style="list-style-type: none"> • Related to phonetic awareness. • Weaker decoding abilities compared to learning abilities. • Difficulties related to phonological reading. • Difficulties related to rapid noticing of words (orthographic reading) • Lack of reading fluency. • Slow reading speed impacting reading comprehension. • Continuous difficulties related to spelling. • Simple language and little variation in language structures.
<p>Shaywitz & Shaywitz (2020, pp. 123 - 127)</p>	<p>Reading</p> <ul style="list-style-type: none"> • Very slow in acquiring reading skills. • Trouble reading unfamiliar words. • Avoids reading out loud and rarely reads for pleasure. • A history of reading and spelling difficulties. • Slow reading of most materials—books, manuals, subtitles in films. <p>Speaking</p>

- Spoken vocabulary is smaller than listening vocabulary, searches for a specific word and ends up using vague language, such as “stuff” or “thing,” without naming the object.
- Pauses, hesitates, and/or uses lots of “um’s” when speaking and seems to need extra time to respond to questions.
- Confuses words that sound alike, such as saying “tornado” for “volcano,” substituting “lotion” for “ocean”.
- Avoids saying words that might be mispronounced, and tend to mispronounce long, unfamiliar or complicated words.
- Often pronounces the names of people and places incorrectly (trips over parts of words) and have difficulties remembering names of people and places (confuses names that sound alike).
- Struggles to retrieve words; frequently has “It was on the tip of my tongue” moments.

School and Life

- Trouble remembering dates, names, telephone numbers, random lists.
- Struggles to finish tests on time and are often penalized by multiple-choice tests.
- Extreme difficulty learning a foreign language.
- Poor spelling.
- Messy handwriting.
- Low self-esteem that may not be immediately visible and despite good grades, often says he’s dumb or is concerned that peers think he’s dumb.
- Frequently sacrifices social life for studying.
- Suffers extreme fatigue when reading.

Strengths

- Excellent thinking skills: conceptualization, reasoning, imagination, abstraction
- Has a high capacity to learn and learning that is accomplished best through meaning rather than rote memorization.

	<ul style="list-style-type: none"> • Inclination to think outside of the box and a unique ability to get the “big picture”. • A high level of understanding of what is read to him. • Excellent writing skills if the focus is on content, not spelling. • Improvement as an area of interest becomes more specialised and focused—and a miniature vocabulary is developed that allows for reading in that subject area. • Excels in areas not dependent on reading, such as maths, computers and visual arts, or in more conceptual (versus fact-driven) subjects, including philosophy, biology, social studies, neuroscience and creative writing. • Shows noticeable improvement when given additional time on multiple-choice examinations. 																						
IDA (2023)	<p>Dyslexia Self-Assessment for Adults</p> <table border="1"> <thead> <tr> <th></th> <th>YES</th> </tr> </thead> <tbody> <tr> <td>1 Do you read slowly?</td> <td><input checked="" type="checkbox"/></td> </tr> <tr> <td>2 Did you have trouble learning how to read when you were in school?</td> <td><input type="checkbox"/></td> </tr> <tr> <td>3 Do you often have to read something two or three times before it makes sense?</td> <td><input type="checkbox"/></td> </tr> <tr> <td>4 Are you uncomfortable reading out loud?</td> <td><input type="checkbox"/></td> </tr> <tr> <td>5 Do you omit, transpose, or add letters when you are reading or writing?</td> <td><input type="checkbox"/></td> </tr> <tr> <td>6 Do you find you still have spelling mistakes in your writing even after <i>Spell Check</i>?</td> <td><input type="checkbox"/></td> </tr> <tr> <td>7 Do you find it difficult to pronounce uncommon multi-syllable words when you are reading?</td> <td><input type="checkbox"/></td> </tr> <tr> <td>8 Do you choose to read magazines or short articles rather than longer books and novels?</td> <td><input type="checkbox"/></td> </tr> <tr> <td>9 When you were in school, did you find it extremely difficult to learn a foreign language?</td> <td><input type="checkbox"/></td> </tr> <tr> <td>10 Do you avoid work projects or courses that require extensive reading?</td> <td><input type="checkbox"/></td> </tr> </tbody> </table> <p>If you checked seven or more of these questions, this may indicate dyslexia. Consider seeking consultation from a specialist or a formal diagnostic assessment from a qualified examiner.</p>		YES	1 Do you read slowly?	<input checked="" type="checkbox"/>	2 Did you have trouble learning how to read when you were in school?	<input type="checkbox"/>	3 Do you often have to read something two or three times before it makes sense?	<input type="checkbox"/>	4 Are you uncomfortable reading out loud?	<input type="checkbox"/>	5 Do you omit, transpose, or add letters when you are reading or writing?	<input type="checkbox"/>	6 Do you find you still have spelling mistakes in your writing even after <i>Spell Check</i> ?	<input type="checkbox"/>	7 Do you find it difficult to pronounce uncommon multi-syllable words when you are reading?	<input type="checkbox"/>	8 Do you choose to read magazines or short articles rather than longer books and novels?	<input type="checkbox"/>	9 When you were in school, did you find it extremely difficult to learn a foreign language?	<input type="checkbox"/>	10 Do you avoid work projects or courses that require extensive reading?	<input type="checkbox"/>
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10 Do you avoid work projects or courses that require extensive reading?	<input type="checkbox"/>																						

2.1.3.1 Reading disabilities

Dyslexia can be referred to as reading and writing disabilities. Some people may struggle to read and write, while others may find it easier to complete one element but struggle to do the other element. Looking at reading disabilities, one often determines a person’s reading abilities based on reading speed, which is counted based on words per minute. In connection

with speed, understanding is also an important component. However, dyslexics most often have a lack of autonomy in the decoding process of words, resulting in a slower reading speed, which may also affect their understanding. According to extensive research (see Fletcher et al. 2007; Pugh & McCardle 2009), the primary problem for dyslexic people in connection to reading, is shown to be a failure in the decoding process (Høien & Lundberg, 2012). Høien and Lundberg compare it with cycling in headwinds, which may enlighten how demanding and difficult it may be for dyslexic learners to read. As a result, they might just stop reading, also known as *the Matthew effect*. In contrast, what is proven to be the best way to help dyslexics is training and exposure. Dyslexics need to be exposed to the words they find hard, in order to automatize their decoding abilities (Høien & Lundberg, 2012). Complementing decoding disabilities, dyslexics often struggle decoding non-words. Non-words are words without meaning (Logometrica, 2021), and can give a clear indication of dyslexia since these words are not commonly used, and therefore not automated and learned. Furthermore, these words enlighten how a dyslexic may struggle in new meetings with unfamiliar words.

2.1.3.2 Writing disabilities

Dyslexia is a specific reading- and writing disorder, meaning that the disorder is specific without the area of reading and writing (Waalder & Waalder, 2019), where the two processes support each other (Logometrica, 2021). The main problem for dyslexics tends to be connected to the decoding referring to the reading aspect, resulting in a gap between reading comprehension and reading and spelling (Moats, 2005). Yet, it is likely that the writing and spelling are highly affected too. In most cases, the pupils' decoding abilities and disabilities reflect the pupils' spelling abilities (Høien & Lundberg, 2012). Assumably, “[...] learning about the meaningful relationships between words will contribute to vocabulary growth and reading comprehension” (Moats, 2005, p. 5). As presented, “dyslexia does not reflect an overall defect in language, but rather, a localised weakness within a special component of the language system: the phonological module” (Shaywitz, 2003, in Høien & Lundberg, 2012, p. 26). According to Shaywitz, these spelling disabilities are permanent and resistant which follows them as they grow old.

2.2 Reading comprehension

The ability to read and understand what is being read is decisive in today's society (Bråten, 2020). Reading comprehension implies that the reader extracts and makes sense of the written text, by exploring and interacting with the text (Bråten, 2020). Understanding concerns the question of how to connect previous knowledge and experiences, to what is being read in order to make connections and interpretations. These processes are basically the same as one uses when listening to a text being read by someone else (Høien & Lundberg, 2012). In the reading comprehension process, the ability to learn to learn will help the pupils by reflecting on learning and develop an awareness of their learning process (Kunnskapsdepartementet, 2017) and reading comprehension is an essential skill that is valuable throughout life (Bråten, 2020). Both the basic skills and the process of learning to learn can be connected to reading comprehension through the two aspects of reading comprehension presented by Bråten (2020). The first aspect is based on understanding in order to find the purpose of the text, what is the author's message? The second aspect deals with understanding the situations described in the text and being able to make meaning based on what the text presents. Basically, reading comprehension involves both understanding what the author has to say and how the reader actively makes sense of the text in his own head (Bråten, 2020).

Høien and Lundberg (2012) emphasise that it is crucial to divide the aspects of decoding and understanding. The distinction between decoding and understanding is made clear through for instance the following example: when you read a book aloud, your mind may not perceive what you have read. However, the child you might have been reading for has not complained, since you have decoded every word correctly. This illustrates that decoding and understanding does not have to influence each other. Additionally, to a lack of decoding skills, a gap between reading and listening comprehension may be an indicator of dyslexia (Høien & Lundberg, 2012). Looking at the example above, a child may be able to understand when an adult reads the text aloud but may struggle to understand the text while reading on its own, due to decoding difficulties, which may affect reading speed and reading comprehension negatively.

2.2.1 Variations in reading comprehension

Reading comprehension varies from text to text, genre to genre and person to person, based on instant language skills, previous knowledge of the theme or topic, the structure of the text,

motivation in the reading moment and cognitive abilities of the reader (Bråten, 2020). Each person interacts differently with a text, and the text and reading perspective changes from reader to reader and will affect reading comprehension. This is due to different sociocultural contexts. Everything from our family and culture to our social background and context influences the relationship between a text and the reader, further influencing reading comprehension in a positive or negative way (Bråten, 2020). “Even though the text may have certain frames, the individual reader’s comprehension of a text will always be unique to a certain extent (Bråten, 2020, p13)”. In other words, people understand and interpret the same text or situation differently, based on their views and understandings of the theme and topic, connected to their previous knowledge. As a result, two readers will never understand and interpret the same text in the exact same way. Furthermore, Bråten (2020) states that there is a gap between boys and girls, where girls show greater reading comprehension compared to boys. The result of his study revealed a lack in the use of reading comprehension strategies amongst boys. Additionally, Bråten (2020) emphasises that reading and comprehending a text is something that takes place in a certain context, affecting comprehension, it is not something that is being done in what he refers to as a separate vacuum.

2.2.2 Different views on reading comprehension

Bråten presents a perspective on reading comprehension where the idea is that decoding reflects comprehension. A good decoding normally results in good reading comprehension, whilst a bad decoding normally results in bad reading comprehension. Since the decoding of words has a bigger meaning for reading comprehension than any other components of the reading process, according to this perspective, it is called *Bottom-up*. Contrary, the *top-down* perspective states that reading comprehension is dependent on more than just decoding abilities, like the reader’s knowledge of the theme, content and structure of the text. This knowledge may help the reader to understand the main elements of the text and predict what kind of information the text will provide (Bråten, 2020). Additionally, a third view on reading comprehension is presented by Duke, Pressley and Hilden (2004, in Bråten 2020), who state that reading comprehension may be a combination of both the bottom-up and the top-down perspectives. “Since decoding is an important component, this perspective is important, however, the reader’s knowledge of the text prior to reading, seems to have an impact on the reading comprehension too” (Bråten 2020, p. 46). In other words, all aspects impact each other, however, they most likely impact each other in a complete manner.

2.2.3 The simple view of reading

Tønnessen, together with Uppstad criticised the common definition of dyslexia in the book: “Can we read letters? Reflections on Fundamental Issues in Reading and Dyslexia Research” (Tønnessen, 2015). Their criticism reflects that according to different common definitions of dyslexia, it assumes that reading is a product of decoding and comprehension, in the same way as presented by Gough and Tunmer’s (1986) theoretical perspective is named *The simple view of reading*. The theory presents that what is being decoded also must be understood, to call it reading. We can use German as an example; I can decode the letters of a word or a sentence, thus I do not understand what I have decoded. That is the reason why they present reading as a product of decoding and comprehension, “where each variable ranges from 0 (nullity) to 1 (perfection)” (Gough & Tunmer, 1986, p. 7). Furthermore, by referring to comprehension they mean linguistic comprehension, “the process by which, given lexical information, sentences and discourses are interpreted” (Gough & Tunmer, 1986, p. 7).

$$\text{Reading} = \text{decoding} \times \text{comprehension}$$

The model above shows that decoding skills and understanding are two key factors needed to be able to read. In other words, if decoding = 0, then reading = 0, vice versa with comprehension and reading too (Gough & Tunmer, 1986). Additionally, if any of the factors approach 0, then the reader struggles more compared to if the factors approach 1. Tønnessen presents that the researchers need to agree on what different criteria should be counted as dyslexia. Furthermore, he states that reading is looked on as a skill rather than a product of comprehension and decoding (Tønnessen, 2015).

Based on the common definitions of dyslexia (Dysleksi Norge, 2021; International Dyslexia Association, 2022; Solem, 2017), dyslexic people do most often not have any difficulties when it comes to understanding, compared to other pupils the same age. However, when reading a text dyslexic pupils struggle to understand what they have read, due to the difficulties connected to decoding words. Thus, the pupils will most likely be able to understand the content of an oral text much better than a written one. They use most of their energy trying to decode words correctly, which results in a lack of understanding (Statped, 2020). Supporting these ideas, Gough and Tunmer (1986) argue that according to *The simple view of reading*, reading disability can only occur in one way; from the combination of decoding and comprehension. However, a reading disability could be a result of the inability

to decode, the inability to comprehend, or a combination of both. As mentioned, the inability to decode is called *dyslexia*, whilst the following inability is respectively named *hyperlexia* and *garden variety* reading disability (Gough & Tunmer, 1986). As a result, we often allow pupils with dyslexia to use audio support while reading a text.

While looking at what reading is, reading comprehension is also important. Not only in terms of defining reading and dyslexia but also since the study will look at the dyslexic pupil's reading comprehension. According to Kunnskapsdepartementet (2019), one of the basic skills pupils need to develop is reading skills. It is assumed that most people's reading comprehension is well-developed in today's society, however, that is not necessarily the case. To understand what has been read, one needs to be able to reflect over and apply the content one just read. According to Bråten, "reading comprehension involves extracting and creating meaning by implementing and interacting with written text" (Bråten, 2007, p. 11). This definition highlights that reading comprehension involves the reader being able to determine and extract meaning in the text, and further make sense of it based on the text (Bråten, 2007). Several factors influence a person's reading comprehension, for instance, background knowledge, vocabulary, motivation, critical evaluation abilities and decoding and fluency skills. All factors are in some ways connected to each other (Ulland, Palm, & Andreassen, 2022). Also, Engen and Helgevold (2020) emphasise that the elements of decoding, vocabulary and motivation are essential to reading comprehension. Additionally, they state that the pupil's preparation before reading the text and their ability to process what they have read can help develop their reading comprehension.

2.3 Spelling

As mentioned, spelling is an essential part of human society, and one is expected to master the skill of writing. The two skills of reading and writing are highly connected, however, "[...] on average, the children tended to be much better at reading comprehension than at spelling" (Moats, 2005, p.5; Kunnskapsdepartementet, 2017). When referring to dyslexics and their spelling difficulties, Coltheart (2005, in Høien & Lundberg, 2012) presents three subgroups of dyslexia: 1) specific phonological disabilities (dysphonetic dyslexia), 2) specific orthographic disabilities (surface dyslexia) and 3) both phonological and orthographical disabilities (mixed dyslexia). Connected to reading, dyslexics typically tend to use a phonological strategy while

reading, focusing on the different sounds in the word. Later, the aim is for the dyslexic to master the orthographic strategy. Frequently, the same strategies are transferred into the process of writing (Dysleksi Norge, 2021). The phonological strategy concerns sound, syllables and diphthongs, meaning that pupils write the sound that they hear. Meanwhile, the orthographic strategy is connected to the picture of the whole word. Mastering this strategy, one is able to see a word and read it aloud or hear a word and know how to spell it correctly. This strategy needs practice, and pupils are often exposed to a word several times to know how the word is spelt correctly (Dysleksi Norge, 2021).

If a learner struggles decoding words, the learner most likely also struggles to spell words (Moats, 1995, in Høien & Lundberg, 2012). Some researchers claim that overcoming spelling disabilities is harder than improving decoding skills, yet, the difficulties descend from the same origin, a lack of phonological- and orthographic awareness. Lacking these abilities, one tends to use a phonological analysis when spelling an unknown word (Logometrica, 2021). Norwegian is a shallow language compared to English (Bråten, 2020). Spelling correctly using the phonological strategy is possible and perhaps easy in a shallow language. However, spelling irregular words by implementing phonological analysis is impossible, since the words are not orthographically transparent. Although dyslexics tend to use the method anyway, resulting in words being spelt the way we pronounce them (Logometric, 2021). Furthermore, their writing often contains other spelling and writing mistakes too, leading to dyslexics using simple sentences and neglecting to write long texts (Logometric, 2021).

2.3.1 Orthographic transparency

When someone says that a language “sounds right” in terms of phonemes and graphemes, they are typically referring to the way that the language’s sound units (phonemes) are represented by its written symbols (graphemes) (Aron, 2004). In other words, the degree of the regularity of the correspondences between letter units and sound units in a given language is named orthographic transparency (Waalder & Waalder, 2019). “A language with high orthographic transparency has a consistent and clear mapping between the sounds of the language and the symbols or letters used to represent them” (Aron, 2004, p. 10). In contrast, low orthographic transparent languages have more exceptions and irregularities in their writing system, which may result in difficulties for learners to understand and produce the correct sounds when reading or writing words, especially dyslexics (Aron, 2004; Waalder & Waalder, 2019).

“Norwegian and English both stem from Old Norse but have developed in different ways” (Helland & Kaasa, 2005, p. 42). Applying the International Phonetic Alphabet (IPA), English has 44 phonemes whilst Norwegian only has 40 phonemes. Phonemes that are not found in Norwegian are e.g. [w] and [ð]. In some languages, the writing system is well-matched to the sounds of the language, and the spelling of words will generally match their pronunciation, which can help them “sound right” to a native speaker. These languages are called shallow languages. Norwegian for instance, where the word “halter” is pronounced with a clear “h” sound at the beginning, and it is spelt with the letter “h”, is an example of a well-matched writing system. This match between sound and spelling may lead to a more natural and intuitive feeling of the word, to a native speaker. In contrast, a deeper language like English uses a more inconsistent spelling of words in connection to their pronunciation (Waalder & Waalder, 2019). For example, the word “tough” is pronounced with an “f” sound at the end, even though it is spelt with “gh”. This can make it harder for native English language learners and EFL learners to learn the correct pronunciation of words and may lead to words feeling “wrong” or unnatural even if they are technically correct. According to Helland and Kaasa (2005), Dewey (1971) ranked languages based on their orthography, Norwegian scored 3 and English scored 1, on a scale of 1 - 5. Finnish was ranked 5 and was categorised as highly regular, or a shallow language. In other words, Norwegian has a higher orthography compared to English, allowing the use of a phonemic approach in most cases, but with some important exceptions.

2.4 Previous research

2.4.1 Occurrence

Dyslexia may be caused by a number of factors operating independently or interacting with other factors to produce the outcome. Furthermore, different causes may be applicable to different children, and each child may have a dyslexia diagnosis that is caused by several different aspects (Nijakowska, 2010). There have been several studies looking at the cause of dyslexia, and most of them have come to an agreement that dyslexia may be caused by both a genetic link and abnormal cerebral anatomy (Smith, Kimberling, Pennington, & Lubs, 1983; Galaburda & Kemper, 1979, referred in Gough & Tunmer, 1986; Dysleksi Norge, 2021).

Sally and Shaywitz state that “family history is one of the most important risk factors” (Sally

& Shaywitz 1998, pp. 307 - 312), indicating that it is a genetic link with dyslexia. According to Nijakowska (2010), presenting one of the oldest theories of dyslexia origin, one first recognised a connection between familiar matters of dyslexia towards the end of the 1980s. “The theory portrays a connection between dyslexia and inherited anatomical and functional features of the central nervous system, determining whether a person is suffering from the disorder or not” (Nijakowska, 2010, p. 35). Newer research supports the theory, some claiming that between 20 - 30 % of the cases of dyslexia can be genetically connected, whilst others claim that it might be as high as 50 - 60 % (Nijakowska, 2010). The theory is supported by Snowling et al. (2007), who claim that dyslexic parents are at a higher risk of getting children with dyslexia. However, they highlight the correlation between genes and environment rather than looking at genetic risk as the main cause.

Sally and Shaywitz (1998) state that dyslexia is the most common and researched neurological disorder among children. Despite dyslexia being a common disorder, researchers disagree on the occurrence of the diagnosis. According to numbers from Statistisk sentralbyrå (SSB) one can assume that between five to ten per cent of the population between 15 and 66 years of age have dyslexia or dyscalculia (Statped, 2020; Dysleksi Norge, 2021; Waaler & Waaler, 2019). Snowling (2000, referred to in Nysether, 2014) operates with a percentage of the population between three to ten. Sallay and Shaywitz (1998) state that studies show that between five to ten percent and up to 17,5 percent of children are diagnosed with dyslexia. These variations may be caused by unclear definitions of dyslexia. Some of the definitions may include some people, and exclude others, whilst another definition might include the one that was excluded from the first definition. Vice versa. In addition, the occurrence may also vary from country to country and language to language, due to the orthographic transparency of the language (Aro, 2004).

Both boys and girls are diagnosed with dyslexia. However, boys are diagnosed four times more frequently than girls, according to Norsk Helseinformatikk (2022). Studies show that sex differences related to reading ability are valid, and it is “due to males’ lower mean and more variable performance relative to females” (Arnett et al., 2017, pp. 719 - 727).

Furthermore, there may be a link between the typical and common ways of behaving in the classroom. Traditionally boys tend to seek more attention and make more noise compared to girls, while girls that need help tend to hide and sit quietly and wait for help, resulting in an under-reporting of girls with dyslexia (Arnett et al., 2017).

2.4.2 Dyslexia and EFL learning in Norway

So far in the 21st century, dyslexia has gained increasing focus and several studies have been conducted within the field. However, there is still a lack of knowledge in the context of dyslexia in EFL learning (Helland & Kaasa, 2005; Juujärvi, 2009; Waaler & Waaler, 2019). The first study to focus on how Norwegian dyslexics learn English in school was conducted in 2005, by Helland and Kaasa. They studied dyslexic 12-year-olds in Norway and published a research article named *Dyslexia in English as a second language*. As the title suggests, the aim of the study was to look at dyslexic performance in English as a second language, or in other words EFL. The children were tested both orally and written, through a comprehension task, a model sentence task, pragmatic tasks and three literacy tasks. With 40 participants from six different schools in Norway, their research was extensive. Helland and Kaasa used a gender and aged-matched control group with non-dyslexic pupils. Furthermore, the study employed inclusion and exclusion criteria, such as ensuring that none of the participants received special education and that they were all within the normal range of IQ (Helland & Kaasa, 2005), and the participants were dyslexics who followed the ordinary education.

Prior to the study, Helland and Kaasa hypothesised that the results of the research would show that the dyslexia group and the control group's results differed on all tasks, furthermore, that subgrouping the dyslexia group based on comprehension would show heterogeneity within the groups. Their predictions were later shown to be correct (Helland & Kaasa, 2005). In order to gather data, they developed a set of tests, amongst others aiming to explore L1 and L2 differences in typology, phonology, morphology, syntax, semantics, pragmatics and orthography. Additionally, they determined a way of scoring the tasks. Verbal tasks were scored according to comprehension, morphology, syntax and semantics, and literacy tasks were scored according to spelling, translation and reading skills. Magnificent differences were seen between the control group and the dyslexia group, contrary, the subgrouping revealed minor differences between the control group and the subgroup with good comprehension skills. Yet, the differences between the control group and the subgroup with poor comprehension were bigger. The dyslexic pupils with good comprehension do not differ that much compared to the control group, except when looking at morphology, whilst the subgroup with poor comprehension scored lower than both groups on all aspects of the verbal tasks (Helland & Kaasa, 2005). Similar results were detected when looking at literacy tasks.

In contrast, spelling was shown to be especially difficult for the dyslexia group. Both subgroups scored equally low on spelling. Furthermore, they scored lower than the control group on the reading and translation tasks. However, the good comprehension group scored significantly higher than the poor comprehension group (Helland & Kaasa, 2005). Lastly, it is worth mentioning that Helland and Kaasa's study underline "[...] the importance of further research in L2 acquisition in dyslexia" in Norway (Helland & Kaasa, 2005, p. 56).

Nowadays, Norwegian children are exposed to English almost daily and from a young age, through TV computers, YouTube, etc. However, EFL is taught orally from first grade on, and by eighth grade, the pupils receive a combined grade in oral and written English (Kunnskapsdepartementet, 2019). "As for dyslexic children, this [L2 learning] often coincides with a peak experience of L1 failure" (Helland & Kaasa, 2005, p. 43). In L2 acquisition, the same distinctive features as in L1 must be accounted for as a result, a transition from L1 to L2 should be especially challenging for dyslexics, even though others do not find it hard to overcome. Research shows that "[...] dyslexic children in deep orthographies seem to fall behind at an alphabetic phase, while dyslexic children in more transparent orthographies fall behind at an orthographic phase when greater automation of reading is needed" (Hagtvet, Helland, & Lyster, in Helland & Kaasa, 2005, p. 43).

Cognitive factors also influence dyslexia, and Smythe and Evarett present a five-point model of influential factors (Helland & Kaasa, 2005). These factors are phonological processing, speed of processing, auditory system, visual system and semantic lexicon: "Whereas phonological processing is the dominant factor in English-speaking dyslexic subjects, phonological processing, auditory and visual systems form the main areas of deficits in this model" (Helland & Kaasa, 2005, p. 42). Furthermore, the model implies that each pupil may struggle in different areas, and one should be aware of the different aspects of where the dyslexic may show deficits, in order to see how these deficits, meet L2 typology. Dyslexia is normally diagnosed in L1, however, EFL learning tends to be especially difficult for dyslexics. Helland and Kaasa (2005) suggest that the reason why Norwegian children are not tested in L2 is that the tester often lack a formal competency in L2 teaching, that there are no formal tests for L2 assessment, and the main focus normally lays on the first language. However, they state that L2 testing could provide essential information, especially on dyslexic individuals with an extensively good L1 competence.

Other than Helland and Kaasa (2005), there have been few studies on Norwegian EFL learners, dealing with dyslexic kids and their learning outcomes. However, there have been some smaller Norwegian studies looking at dyslexics in the classroom. These studies tend to look at ways of adapting education for dyslexics or comparing Norwegian dyslexics to dyslexics in other languages. Combining these studies with international studies, one can get a greater picture of what could benefit the dyslexics in a classroom environment, and what tends to be strengths and weaknesses, yet little information about Norwegian EFL learners. For instance, Nysether (2014) studied ways special education teachers adapt and facilitate education for dyslexic children. Using a qualitative method, she found that the different teachers' knowledge of how to adapt and facilitate education for this group of pupils was essential in terms of what adaptations the pupils received in the classroom. In total 15 schools and 49 teachers and special education teachers participated in her research, where most of them highlighted that adapting and facilitating education to dyslexic learners within the frames of ordinary education is hard, due to a lack of resources. Furthermore, they state that this tends to result in a lack of adaptation (Nysether, 2014).

Furthermore, Juujärvi compared Norwegian dyslexic pupils and Hungarian dyslexic pupils' EFL skills in her master's thesis, back in 2009. Her focus was on the pupil's written skills, based on both dyslexic characteristic features and developmental features among children. However, her data is collected from previous research both in Hungary and Norway, making this a literature study. What is important to state, is that this research aims to compare and contrast two perspectives of EFL learning, where one of them focused on Norwegian pupils. Furthermore, Juujärvi referred to *bottom-up* and *top-down* perspectives. Her research shows an unexpected result, where Norwegian dyslexics have a lower score than all other groups, on all skills tests. The research group and the control group from Norway show a low score on spelling, whilst reading and translation were a bit better. According to Juujärvi, this indicates that Norwegian dyslexics have good comprehension, read well and have good pronunciation, compared to spelling more than they are able to spell correctly (Juujärvi, 2009). Connecting Juujärvi's study to Nysether's, they both found a lack of focus on spelling. Nysether states that a lot of her participants had a special focus on the pupils' lack of reading abilities, and therefore focused on different reading strategies to support the dyslexics who tend to struggle decoding words. Contrary, Nysether also suggests that spelling and writing should get more focus since spelling plays such a big part in today's society, and pupils with dyslexia who struggle with reading, tend to find spelling difficult later in life (Nysether, 2014).

According to Nysether, the use of computers and other digital tools to scaffold dyslexic pupils had a positive effect on the pupils (Nysether, 2014). Several software and interventions have been researched and proven to positively impact dyslexics. However, these are often time-consuming and tend to be excluded for dyslexics who don't qualify for special education due to limited time and resources (Hudson et al., 2007, in Nysether, 2014), which is unfortunate for the pupils. The software that Nysether suggests for dyslexics is Lingdys (Lingit), a linguistic-based pronunciation software. Corresponding with Nysether (2014), Hudson et. al. (2003), Schneider and Crombieand (2003), and Logometrica (2023) suggest a new way of adapting education for dyslexic pupils. They claim that using new technology such as artificial intelligence (AI) may help struggling readers and writers at school (Logometrica, 2023). Furthermore, AI may supply the pupils with reading strategies, in terms of suggesting different strategies. Other positive aspects of AI are that it can simplify and shorten explanations serve as a text-to-speech tool, and a speech-to-text tool, where the pupils easily can listen to and dictate their texts. According to Logometrica (2023), AI tools may lead to higher self-confidence among pupils. However, they also point out some negative sides of the tool. For instance, there is a risk of pupils becoming dependent upon the tool, thus failing to produce their own texts and ideas, and the use of different strategies in connection to reading and writing (Logometrics, 2023).

Scaffolding the learners with audio support has been researched, and according to Waaler and Waaler (2019), the use of information and communication technology (ICT) serves as scaffolding for dyslexic learners. Support such as dictation software enables the learner to orally say what the computer is supposed to write. In addition, Waaler and Waaler recommend what they refer to as *text to speech*, where the learner receives audio support on their own written texts to check spelling, grammar or pronunciation, in addition to access to audiobooks. Pupils may also use a scanner and have the text read aloud. In addition, they suggest using reading- and writing support, such as word prediction software and grammar programs (Waaler & Waaler, 2019).

2.4.3 International studies

Similar to the situation in Norway, there is a scarcity of international research on dyslexics. Some studies have focused on the influence of training programs in younger children at primary and secondary school, but less on older children (Sally & Shaywitz, 1998).

Furthermore, limited research exists on students at higher schools, colleges, and universities. Nonetheless, existing studies have found that it is crucial to provide dyslexics with additional time for decoding, recording books, access to laptops with spelling checkers, and other supportive tools (Sally & Shaywitz, 1998). Additionally, Gough and Tunmer (1986) present two studies from the 1970s, with dyslexic pupils and their reading skills. These studies mainly look at the pupil's pronunciation skills, and the ability to read correctly. Their research has no focus on scaffolding, like Sally and Shaywitz's study. However, Hogde (2000) highlights the use of reading aloud and audiobooks as good ways of scaffolding struggling readers and a method of working towards reaching reading for pleasure. Additionally, Hodge emphasised the benefit reading has of building a bigger vocabulary, which most likely will result in faster decoding skills and more correct decoding once one grows older (Sally & Shaywitz, 1998).

Stanovich et al. (1997) carried out a study on younger children, with third-grade dyslexic pupils and a reading skill-matched group of first and second graders. They did not only test the children's reading skills in terms of irregular words and non-words, additionally, they accomplished tests that could illustrate the children's phonological and orthographic skills. The tests revealed that a common factor among all dyslexic participants was a disability in their phonological skills. However, the level of disability varied throughout the group. Later, Stanovich et al. (1997a, 1997b, in Høien & Lundberg, 2012) state that orthographic dyslexia and phonological dyslexia can be explained through the relationship between the two factors: the degree of exposure to writing ("exposure to print") and the strength of the phonological failure. These findings resulted in orthographic dyslexia explained as minor phonological difficulties combined with inadequate reading experience. Meanwhile, phonological dyslexia is represented through more severe phonological disabilities, combined with high exposure to reading (also supported by Olson et al. (1997) (in Høien & Lundberg, 2012).

Several researchers have looked at the link between L1 and L2 learning. In the 1980s a link between difficulties and problems in L1 learning and FL learning was detected. "Apparently, foreign language learners with specific learning difficulties share various aspects of language functioning that might negatively influence their ability to learn a foreign language (Sparks et al., 1989)" (Nijakowska, 2010, p. 67). In his study, Dinklage researched a group of students at the University of Harvard in their FL classes and compared their achievements in other classes they attended. The outcome was clear, and the participants performed much lower in their EFL classes: "Again, the failure could not be traced back to lack of motivation or poor

attitude, as their attempts to perform well in foreign language courses and positive stance were evident” (Nijakowska, 2010, p. 66). Furthermore, L1 and EFL research indicate that children who develop faster in their mother tongue benefit and have an advantage in their foreign language and manifest a higher foreign language aptitude. Contrary, children who develop slower in their mother tongue tend to struggle in FL (Nijakowska, 2010). Van der Leij and Morfidi (2006) suggest that even though the universal phonological core deficit is responsible for transferring reading difficulties from L1 to L2, variable orthographic competence may possibly exist independently of phonological decoding and be capable of explaining differences between reading-disabled individuals in L2 with deep orthography and L1 with a shallow one (Nijakowska, 2010).

Research and hypotheses surrounding L1 and L2 links have occurred, however, some may be hard to prove. The LDCH hypothesis says that the FL skills are based on the first language skills when looking at phonological, orthographic, syntactic, and semantic components. Furthermore, in the early stages of learning a language, both phonological and syntactic tasks are crucial in language acquisition. In contrast, semantic understanding depends on the situation and the message conveyed through language units (Sparks et al, 1989, in Nijakowska, 2010). The results of numerous recent studies, with reference to various L1 languages, with English as a foreign language, seem to support the LCDH hypothesis. However, it is not positively verified in all studies (Nijakowska, 2010). One of the studies corresponding well to the hypothesis was Sparks et al. 1998s, who found that learners who scored higher at an oral and written FL proficiency test have stronger native skills in relation to phonological, orthographic, and semantic components, compared to those who scored lower (Nijakowska, 2010).

A study challenging the hypothesis that L1 dyslexic learners struggle in FL too, was conducted by Miller-Guron and Lundberg (2000), on Swedish dyslexic adults:

The relatively shallow Swedish orthography puts high demands on readers with regards to phoneme by phoneme decoding. That is why Swedish readers with dyslexia, who possess weak phonological skills at the level of phonemes, may paradoxically develop a preference for reading the deeper English orthographic, most probably because they are continuously inefficient in applying the grapheme-phoneme (small grain size phonological unit) strategy when approaching Swedish texts.

Reading English texts, on the other hand, requires word recognition strategies concerning larger orthographic segments such as rimes or whole words. (Nijakowska, 2010, p. 81)

The authors referred to the findings as “dyslexic preference for English reading (DFER)”, meaning that the participants preferred English rather than their L1. Other studies have supported these findings, showing that some dyslexic students did not experience problems with foreign language learning, supplying the researchers with no or little evidence of their hypothesis (Nijakowska, 2010). On the contrary, Nijakowska states that students that were not diagnosed with dyslexia sometimes experienced difficulties and failure in their foreign language classes. In addition, Sparks et al., (2002, 2003, 2006, in Nijakowska, 2010) found that dyslexic learners did not necessarily differ from low-level achievement non-dyslexic learners in the process of FL learning.

3.0 Methodology

This section is divided into five sections and describes the methods used in this study. In the first section of this chapter (3.1), the methodological approach is outlined. In Chapter 3.2 the data collection methods are presented and justified. Furthermore, section 3.3 describes how the data was organised and analysed. Section 3.4 explains the ethical considerations and the measures that were taken to protect the participants' rights. Finally, section 3.5 addresses issues of validity and reliability of the study.

3.1 Methodological approach

Qualitative research involves collecting and analysing non-numerical data that seeks to understand social phenomena, concepts, and opinions (Thagaard, 2021), that are not available elsewhere (Silverman, 2014). Typically used methods include interviews, observations, texts, and symbols (Høgheim, 2020). In contrast, a quantitative study focuses on numbers and is most often based on questionnaires and standardised tests (Høgheim, 2020). Furthermore, Høgheim states that qualitative methods are preferred to explore if a theoretical assumption could be true for a group of people or a certain place. In contrast, a quantitative study tells us something about the prevalence of phenomena and the connection between them (Johannessen, Christoffersen & Tufte, 2016; Tufte, 2011). This study uses a qualitative approach to investigate if Lingdys' support has an impact on dyslexic pupils' reading comprehension and/or spelling, and if so, in what ways it might impact.

3.2 Data collection

3.2.1 The sample

3.2.1.1 Inclusion and exclusion criteria

The participants of the study were all recruited by me, through my network. The principal of the research school granted permission to conduct the study and contact participants without any further notice. The inclusion strategy was based on convenience sampling, where participants are available and wish to participate in the research project (Thagaard, 2021). All the participants had a known dyslexia diagnosis, based on the results of a Logos test (Logometric, 2021), which was a crucial inclusion criterion. The participants all belong to one

secondary school in Rogaland, which is in western Norway. Since the aim of the study was to examine the impact of Lingdys support on 8th-grade dyslexic EFL learners, their grade and foreign language were essential. At this school, eighth grade consists of more than 110 pupils divided into four classes. Out of these, eleven pupils qualified for the study at the time of the recruiting process and eight pupils agreed to participate.

The exclusion criteria applied to this study was that participants could not qualify for special education, which none of them did. Special education aims to give adequate education to pupils that do not receive satisfactory education following the ordinary educational system (Kunnskapsdepartementet, 2019). All participants were therefore eligible to participate in the study. Based on these elements, the criteria that were set were the dyslexia diagnosis, that the participants needed to be EFL learners in an eighth-grade class, and the participants also had to follow the ordinary education system without receiving special education. These criteria also applied to the control group.

3.2.1.2 Learners level

The learners' level of English varies, although they have all been learning English in school since grade one. The majority were at the lower scale (A2-B1 level according to the Common European Framework of Reference for Languages (CEFR) guidelines) of the expected proficiency level for 8th graders. In addition, some of the participants managed to achieve some of the aims of a B1 learner. According to the CEFR scale learners at an A2 level can:

[...] understand sentences and frequently used expressions related to areas of most immediate relevance...Can communicate in simple and routine tasks requiring a simple and direct exchange of information on familiar and routine matters. Can describe in simple terms aspects of his/her background, immediate environment and matters in areas of immediate need. (Council of Europe, 2001, p. 24)

A more comprehensive learner (B1 speaker) manages to understand more of the main points of standard input on familiar matters encountered at school, work, etc. In contrast to an A2 level user, the B1 user manages to deal with:

[...] most situations likely to arise whilst travelling in an area where the language is spoken. Can produce simple connected text on topics which are familiar or of personal

interest. Can describe experiences and events, dreams, hopes and ambitions and briefly give reasons and explanations for opinions and plans. (Council of Europe, 2001, p. 24)

3.2.1.3 Consent form

The project was reported to the Norwegian Agency for Shared Services in Education and Research (SIKT) and was approved in January 2023 (see Appendix 1). A consent form (see Appendix 2) in Norwegian was created based on SIKT's guidelines and handed out to the participants and their guardians before the study. The consent form included information about the purpose and main aspects of the study. Since the participants were under the age of 16 when they took part in the study, their guardians had to consent to their child's participation. The consent forms were returned to the researcher and stored according to both SIKT and NESH's guidelines (SIKT, 2022; NESH, 2022).

3.2.2 Data collection method

This research is a small-scale study with a qualitative research design using an individual reading comprehension task and a questionnaire, as the data collection method. The participants were divided into two groups, a research group and a control group. At the beginning of the lesson, all participants were given the same instructions. Both groups were asked to read a text (see Appendix 3) and answer questions afterwards to check their reading comprehension and spelling (see Appendix 4). The research group were obligated to use the audio support from Lingit's software for dyslexic learners, named Lingdys Pluss. The learners were given headphones so that they could listen to the text. The control group were asked to read the same text as the research group, however, they were not allowed to use Lingdys support. They read the text on their own. Following the task, they were given a questionnaire where they had to reflect on the work method they used in the first task. Both groups consisted of dyslexic pupils only and were divided based on their biological gender and level of English, according to the researchers' knowledge. The aim was to make as similar groups as possible, based on the fact that one cannot compare individuals' abilities, motivation, relationships and performance levels since there are so many components impacting these elements from day to day (Skaalvik & Skaalvik, 2015; Buseth, Frostad & Mjaavatn, 2019). Furthermore, the aim was to make the two groups as homogeneous as possible compared to each other to make it possible to compare the results of the two groups.

3.2.2.1 *The text*

The text was retrieved from Cappelen Damm's digital platform named *Skolen*, in a section dedicated to eighth graders: *KON-TIKI: Thor Heyerdahls Amazing Raft Trip* by Bente Roestad (2020) (translated by Alison Sollie), a factual text for children. The original book consists of 70 pages, however, the participants only read an extract from pages 1- 18 (see Appendix 1). A factual text was chosen because it is easier to check reading comprehension based on written facts, compared to interpretations of a fictional text. The specific pages were selected since they are at the beginning of Roestad's text, allowing the participants to gain a greater understanding of the content and setting, when reading it from the start. Additionally, the excerpt was read through to ensure that the level suited the participants.

3.2.2.2 *Reading comprehension task*

Reading comprehension involves extracting and creating meaning based on written text (Bråten, 2007). In this study, the reading comprehension task aimed to get the participants to reflect upon the excerpt, to explore how much they understood and remembered from it. The task consists of 14 questions, some of which are "What happened?" questions, a question about the main idea and some more specific questions related to events from the text (see Appendix 4). The research group used Lingdys Pluss to compare comprehension and spelling to the control group who did not use Lingdys Pluss. The participants' answers to this task make up the *Learner text* results. When they finished this part, they were given the questionnaire.

3.2.2.3 *The questionnaire*

In planning this questionnaire, I used a mixed method where the purpose was to supply the written learner texts with more data (Cohen et al., 2007). Before the data collection lesson was conducted, a questionnaire guide was developed (see Appendix 5). "The questionnaire is a widely used and useful instrument for collecting survey information, providing structured [...] data" according to Cohen et al. (2007, p. 317). Responses retrieved from questionnaires can represent underlying social phenomena, such as the respondents' attitudes or values (Silverman, 2021; Cohen et al. 2007; Larsen, 2007), and they are often based on closed or open-ended questions or a combination of both (mixed questionnaires). Since the participants of this study were dyslexic children, open-ended questions may lead to little response or short

answers, being influenced by their reading and/or writing disabilities. As a way of combining closed and open-ended questions, Dörnyei and Taguchi (2009) suggest finishing the questionnaire with an open-ended question, which may serve as a “*bonus*” to the data set rather than an integral part of the expected results. As a result, the questionnaire of this study consisted of closed questions which are less time-consuming for the responders (Cohen et al., 2007), and one open-ended question at the very end, enabling the respondents to answer freely (Dörnyei & Taguchi, 2009).

The questionnaire was carried out through a Google Forms questionnaire, accessed through a URL, ensuring the anonymity of the participants. The participants answered questions based on their experience with the reading comprehension task. The research group received 14 questions dealing with how they felt about using Lingdys Pluss, whilst the control group were asked nine questions about how it was to read without support. Answering the closed questions, a scale was set. To leave out the opportunity of being neutral to all questions, the scale was divided into four since choosing an even number of scales potentially requires a decision on the rating to be indicated (Cohen et al., 2007; Dörnyei & Taguchi, 2009). Furthermore, regarding the language there are both positive and negative elements of translating and conducting questionnaires in L1 and L2. Considering the aim of the questionnaire was to explore the dyslexic participants’ experience of using Lingdys software, the questionnaire was written in Norwegian to ensure understanding (Dörnyei & Taguchi, 2009). Lastly, the questionnaire was piloted on my fellow master students to ensure that the questions were written in an understandable way (Thagaard, 2021; Dalen, 2011).

3.3 Data analysis method

In research, data analysis involves processing and analysing the data, and there are many approaches to analysing qualitative data. As this qualitative study aims to explore phenomena, the analysis consisted of searching for patterns in the pupils’ responses, related to the phenomena. Thus, the learner texts were a part of the data, document analysis was considered the most appropriate approach. In combination, a thematic approach was used to identify patterns to investigate how the participants answered the questions based on their understanding of the text. Thematic analysis is a commonly used analytic method in qualitative research (Hsieh & Shannon, 2005 in Høgheim, 2020). Braun and Clarke define

thematic analysis as “a method for identifying, analysing and reporting patterns (themes) within data. It minimally organizes and describes your data set in (rich) detail” (Braun & Clarke, 2006, p. 79). In other words, a thematic analysis involves searching across the entire data set to find meaning.

3.3.1 Learner text

The learner texts served as data material and were later analysed as a part of the data collection material. The texts were the learners’ responses to the reading comprehension task questions, and eighth texts were collected. The data analysis in this research was inspired by Høgheim’s five-step cycle; 1) read, get to know and summarise the data, 2) make codes, 3) make categories, 4) analyse, lastly 5) make conclusions. Reading through and getting to know the data was the first step of the analysis (Høgheim, 2020). After each learner’s text was read through, the four analysis themes were determined and put into a table: right answer, partly right, wrong answer and did not reply. Then, the data was analysed manually based on these themes. When I went through the learner texts, I made sure to double-check the answers to the extract, to ensure that the answers were not partly right. The analysis process was hard due to all the different ways one can interpret each learner’s text (Høgheim, 2020), based on their understanding of the Kon-Tiki extract. In this process, the analysis aimed to check the participants’ answers, are they right or wrong, and do each participant understand the text, yes or no. In other words, do their responses reflect what is conveyed in the text? To keep the data as authentic as possible, only the research groups’ responses to question 14 and the control groups’ responses to question 9, in the questionnaires, were translated from Norwegian to English in the result section (see Tables 4.1 and 4.2 for authentic answers in Norwegian). For the learner texts, all participants responded in English (see Chapter 4.0 for participants responses).

The second part of the analysis was to compress the data and make it more manageable through coding, to identify patterns and trends in the data set. According to Dörnyei, coding in research means “highlighting extracts of the transcribed data and labelling these in a way that they can be easily identified, retrieved, or grouped” (Dörnyei, 2007, p. 250). Not only does this apply to transcribed data, but it is also a huge part of my thematic analysis of the learner texts. The researcher used the reading comprehension task as a template when structuring the responses in the learner texts into the four categories of responses. Later, the responses were put into a table to check the number of answers suiting each category of

response. All responses were put into the same table, where the research group participants are represented through numbers and the participants of the control group are represented through letters (see Table 2). This section of the analysis is significant because the identified themes shed light on the level of understanding and are therefore relevant to the research aim (Thagaard, 2021). Furthermore, Høgheim's fifth step of analysing data involved making meaning of the data which will be presented in the results (Høgheim, 2020).

Table 2: Overview of learners' responses and categories

Question	Right answer	Partly right	Wrong answer	Did not reply
1	34	12AC	D	B
2	134AC	2B		D
3	34		CD	12AB
4	4A	123C		BD
5	34A		C	12BD
6	134AC	B		2D
7	134AC		2	BD
8	34	1AC		2BD
9	134AC		D	2B
10	14		C	23ABD
11	4	3A	C	12BD
12	4	13A	C	2BD
13	34	12AC		BD
14	134	AC		2BD
Totally	[1-4] = 30 [A-D] = 10	[1-4] = 12 [A-D] = 13	[1-4] = 1 [A-D] = 8	[1-4] = 13 [A-D] = 25

Thirdly, the learner texts were analysed once more in connection with spelling, rather than reading comprehension. Each learner's text was read through and the words that the learners misspelt according to orthographic transparency. Misspelt high-frequency words like *that* and *they*, and other misspelt words that the participants used several were highlighted and later organised into a table to check their spelling (see Table 3). Later, the misspelt words were connected to a participant from the research group or the control group. For this analysis section, it is important to state that the researcher only focused on words misspelt according to what seemed to be the phonological strategy, and not typing errors. The aim was to highlight the relevance of the data set to the research aim (Thagaard, 2021). To ensure that the themes and the misspelt words identified in the learner texts were a full representation of the data set, all the data were continuously reviewed in light of the research questions.

Table 3: Overview of learners' spelling mistakes. (Note: the learners without spelling mistakes do not appear in the table).

Learner	1	3
Learner's spelling (correct spelling): Frequency	Somthing (Something): 1 time Shindt (Shined): 1 time	Tor (Thor): 15 times Ailand (Island): 2 times Ailend (Island): 1 time Fin (Find): 1 time Is (Ice): 1 time Falt (Fell): 1 time Fault (Fell): 1 time Liket (Liked): 1 time
Learner	A	C
Learner's spelling (correct spelling): Frequency	Becaus (Because): 2 time Som (Some): 1 time No (Know): 1 time Now (Know): 1 time Follo (Follow): 1 time	Tro (Through): 4 times Dey (They): 4 times Dat (That): 3 times Iland (Island): 2 times Live (Liv): 2 times Fich (Fish): 2 times Kan (Can): 1 time

	Farytail (Fairy-tale): 1 time	Som (Some): 1 time Vent (Went): 1 time Fruth (Fruit): 1 time Wen (When): 1 time Hwo (Who): 1 time Dere (There): 1 time Der (There): 1 time Plac (Place): 1 time Wid (With): 1 time Meth (Met): 1 time Pesfully (Peacefully): 1 time Tink (Think): 1 time Carful (Careful): 1 time Beacus (Beacuse): 1 time Jumt (Jumped): 1 time Marid (Married): 1 time Crismas ev (Christmas Eve): 1 time Abaut (About): 1 time Eayt (ate): 1 time
Learner	D	
Learner's spelling (correct spelling): Frequency	Bilt (Built): 1 time	

3.3.2 Questionnaire

The questionnaire responses were analysed based on Dörnyei and Taguchi's (2009) three aspects of response patterns. In addition to the learner texts, the questionnaire responses were organised into tables, based on the range of responses, and categorised into a research group (Table 4.1) and a control group (Table 4.2). The tables reveal the participants' feelings, understanding and/or opinions of the reading comprehension task resulting in the learner

texts, and supply the learner texts data. The data is authentic, and the responses to the final question are presented in an original way and have not been translated (Dörnyei & Taguchi, 2009) (see Tables 4.1 and 4.2). The findings of the data analysis, of both the learner texts and the questionnaire will be further explained in the results chapter (4.0).

3.4 Ethical considerations

All research aims to collect and systematically search for new knowledge, using different scientific methods, according to The National Committee for Research Ethics in the Social Sciences and the Humanities (NESH) (NESH, 2022). Høgheim (2020) states that the universities are responsible to ensure that research and development work follows the guidelines and established ethical principles. Simultaneously there is a separate legislation stating that all research should follow ethical principles (Forskningsetikkloven, 2017). Teachers are committed to follow the ethical guidelines presented by NESH, stating that research ethics consists of a core set of scientific norms, developed over time, and institutionalised in the international research community (NESH, 2021). These norms can be summed up through Pimple's (2002) view on ethics in research. He divided it into three categories: "(A) Is it true? (B) Is it fair? (C) Is it wise?". The first question concerns the research in connection to the physical world. Is the data fabricated or falsified? In this study, the data presented has not been contaminated and is therefore presented as true data.

The second question, "Is it fair?", "concerns social relationships within the world of research" (Pimple, 2002, p. 192). The social relationship refers to all aspects of fellow researchers, the participants, and the institutions, among others. Ensuring that the study is truthful to research standards and that it is my work and not plagiarism, was an important part of the ethical considerations (Check, 2012). A researcher has obligations like dissemination and responsibility to the research community and the collaboration institute. Additionally, obligations linked to working methods and attitudes from one's own and others' research apply (NESH, 2021; Pimple, 2002). Providing a detailed and open method section, and thorough transparency when presenting the research findings, enabled openness and honesty in the study. Ethical clearance is mandatory before a project start-up (Silverman, 2021) and since my research project deals with personal data and is conducted in Norway, I was obligated to apply to Kunnskapssektorens tjenesteleverandør (SIKT) before the project start-

up (Thagaard, 2021). During the study, I took all the measurements and followed all the procedures given by SIKT (2022) and NESH (2021), which applied to the study.

According to Check, protecting the participants “[...]is the primary focus of research ethics” (Check, 2012, p. 55), especially applying to this study as a consequence of the participant’s young age and diagnosis. To ensure anonymity, participants’ responses were referred to by pseudonyms like *Learner A*, *Learner B*, *Learner C* etc., after the data collection was carried out (Thagaard, 2021). However, Thagaard (2021) states that it is hard to anonymise an individual’s response so that the individual itself does not recognise his or her data in the published text. Despite this, the participants must stay as anonymous as possible to take care of their integrity and private life (Thagaars, 2021). A step that was taken to protect the participant’s identity post-study, was deleting all personal data such as the consent forms when the study was done (SIKT, 2022; NESH, 2022). Since the research group and the control group only consisted of a total of eight participants, I was considering anonymising their gender ensuring that participating in the study would not harm or hurt the participant (Thagaard, 2021). Yet, including gender enabled me to compare each participant, and the two groups to each other, and further make as homogeneous groups as possible based on level and gender.

Pimple’s (2002) third question addresses if the study is wise. In other words, this refers to the relationship between the research agenda and the broader social and physical world, both now and in the future. If a study is wise, it may impact the world in a better way, and improve a specific area. For this study, the aim was to see if *Lingdys support had an impact on 8th-grade dyslexic EFL learners’ reading comprehension and spelling. If so, in what ways?* In other words, the aim was to contribute to improving EFL dyslexic learners’ classroom experience, by examining if audio and writing support would aid their reading comprehension and spelling, or not. However, concerning the sanity of the study, the importance of truth and fairness is also important to remember.

3.5 Validity and reliability

3.5.1 Validity

Validity is an evaluation on a scale of truth, of the research that has been conducted. Johnson and Christensen (2017,) state that the validity of qualitative research concerns the term *trustworthiness*. If the research is valid, the conclusion of the research is trustworthy (Høgheim, 2020). In other words, validity refers to the validity of the results that the study presents, and how we interpret these (Thagaard, 2021). According to Silverman, validity refers to the interpretation of the data from research “whether or not the inferences that the researcher makes are supported by the data, and sensible in relation to earlier research” (Silverman, 2021, p. 447). Furthermore, validity is often divided into two segments: internal validity and external validity.

Internal validity refers to the conclusion of the researcher and how the researcher interprets the results, does it make sense according to the findings of the study? (Postholm & Jacobsen, 2011; Høgheim, 2020). Validity also considers the relationships between the theoretical aspects and the observations that are alleged to represent those aspects (Silverman, 2021). In this study, validity is addressed through transparency on the research design, how it is constructed to fit with the research questions, how the analysis is carried out and finally to what degree the results and conclusions are coherent with the theories and empirical data (Cohen et al. 2007; Thagaard, 2021). Another measure to ensure validity was considering the relationship between the participants and the researcher. Analysing the actual findings and results, and not making biased assumptions based on my prior knowledge about the participants was one thing that I was cautious about (Cohen et al. 2007). Thus, I will strengthen the validity of the research by being critical of my interpretation and analysis of the results (Thagaard, 2021).

Considering bias and motivation in the study, it was crucial to acknowledge my personal connection to the topic of dyslexia. Thagaard (2021) asserts that researchers often hold preconceptions related to the subject of their study. Therefore, prior to and throughout the study, I took precautions to distance myself from personal opinions, beliefs, and predictions, particularly regarding my preconception of the positive impact of Lingdys software in supporting dyslexics. Additionally, I had to detach my own feelings regarding the challenges I faced in regarding and writing compared to my preference for audiobooks, movies, and oral

presentations in school. If the researcher is unaware of their own beliefs and preconceptions, they may affect the analysis and the interpretation of the results (Thagaard, 2021). According to Kvale and Brinkmann (2015), humans understand the world based on our understandings and values, and therefore it can be hard not to be biased. Through clarification, documentation, and presentation of my findings, I have provided information on how this study was conducted, what data was collected and analysed and what my findings were, allowing others to reproduce my study (Thagaard, 2021), aiming to ensure dependability, credibility and validity (Tracy, 2010).

External validity explains to what degree we can assume that these findings can be generalised and applied to a wider population, group, case, area, or situation (Postholm & Jacobsen, 2011; Cohen et al., 2007; Høgheim, 2020; Thagaard, 2021). The generalisability of the results from this study is limited to year eight dyslexic pupils in Norwegian schools, with and without access to Lingdys Pluss. However, it might also be further limited to only reflecting dyslexic learners at the school involved in this study. The extent of this generalisability is limited because of the size and type of sample used for this study. To expand the external validity, further research could be carried out using a random sample with greater numbers of participants from other schools and areas in Norway or even in other countries. Additionally, expanding the age or grade of the participants could also benefit to add external validity.

3.5.2 Reliability

The reliability in qualitative research addresses the consistency of the study, in addition to the extent to which other researchers would obtain the same results by applying the same methods (Thagaard, 2021; Dörnyei, 2007; Postholm & Jacobsen, 2011). In this study, the relationship between the participants and me as a researcher was established before the study since they were recruited through my network. Hopefully, this relationship enabled the participants to answer honestly in their responses, yet it may also limit the study slightly in the way that both parties could act biased and/or contaminate the responses in any way before the study. Postholm and Jacobsen (2011), highlight the challenge of replicating studies due to the constant changes in people and contexts. In the context of this study, considering the variations in participants and the research-participant relationship, achieving identical results in a similar study would be extremely difficult. Additionally, Dörnyei (2007) states that the presence of a researcher may affect and bias the participants' behaviour. A result may be a

slightly weakened study because the participants knew that their results and their answers were part of a study.

Cohen et al. describe reliability in the qualitative study as “a fit between what researchers record as data and what actually occurs in the natural setting that is being researched” (Cohen et al., 2007, p. 149). In this study, I tried to improve reliability by applying a control group. The control group was given the same tasks as the research group, however, they were not allowed to use audio support. This measure was taken to be able to compare their results and to see if there were any misunderstandings surrounding the tasks. I also discussed the questionnaire and the reading comprehension task with fellow master students and my supervisor to make sure that the questions were understood similarly by everyone. To improve the reliability of my data even further, I made the decision to conduct the questionnaire in the participants’ preferred language, Norwegian. Again, the purpose was to ensure that the participants understood the questions, thus minimising the chances of errors in understanding due to language issues. Additionally, this would also allow them to enrich their answers to the open questions. However, a limitation of this study is that the participants’ dyslexia diagnosis influenced them to a certain extent, so their open responses to questions may lack enrichment. This could have been avoided using interviews.

4.0 Results

The following chapter presents the results of the collected research data. The findings are presented systematically based on the dataset. The chapter is divided into two main sections: learner text and questionnaire. Section 4.1 is divided into two sections; The research group and the control group, both consisting of two subsections. Sub-sections 1) comprehension 2) spelling. Section 4.2 is also divided into two sections, the research group and the control group. The participants are referred to as Learner 1 - 4 and Learner A – D, also referred to as L1, L2, etc., based on participation in the research group or the control group.

4.1 Learner text

This section deals with the participants' perceptions and responses to the reading comprehension task. Perceptions in this context are based on the participants' understanding of the Kon-Tiki extract, as well as their opinions on how Lingit's dyslexia-friendly software worked for those in the research group. The participants' open-ended responses are also presented, demonstrating their reflections on the software and the setting. These responses were written in Norwegian and have in this chapter been translated into English (see Tables 4.1 and 4.2 for authentic responses). Lastly, spelling mistakes will be presented in section 4.1.1.2 and 4.1.2.2, however, the mistakes are written using an italic font throughout the following chapter.

4.1.1. Research group results

4.1.1.1 Comprehension

All of the participants in the research group answered the first two questions correctly, or partly right (see Table 2). For the first question: "What is the main idea of the text?", two of the learners, both boys, answered that "the main idea is to take a raft to a faraway island" (L1) and that "Kon tiki is a raft that someone sailed over the pacific ocean" (L2). Whilst a more correct answer was added by L4, saying that the text's main idea was "To tell about Kontiki and Thor and the trip and his life". Additionally, L3 said that; "To know about *Tor* and his life" was the main idea. However, to the questions asking "What happened in the book? Can you tell me what happened in order?", the length of the responses varied from learner to learner. L3 and L4 answered in greater detail compared to the rest of the research group:

Tor is a man who likes to study nature, he loves animals. When he was a little boy he liked to go and visit a museum in Oslo, with his mother. When *Tor* was a little boy he *falt* into the *is* two times. One when he was five years old and one when he was ten years old. He was afraid of the weather and did not learn to swim before he was 30 years old. When *Tor* was 19 years old, he wanted to get a girlfriend who liked nature. He met Liv at a party and they got married. *Tor* and Liv lived in their own *ailand*, there they have to *fin* the food self. They found mango, coconut and orange. (Learner 3)

First Thor was a child. He almost drowned. He loved animals and wanted to work with animals when he grew older. The book tells about his dreams. Thor was afraid of water since he almost drowned when he was five years old. But he later in life rafted on Kontiki. When he was 19 he met Liv. Thor and Liv married and lived on an island. (Learner 4)

Additionally, L1 managed to get the content of the story in the right order and referred to Thor's childhood and his interest in animals and museums. In addition, L1 comprehended that Thor married the day before, what is being referred to as "a big adventure". L2's answer was much shorter and less detailed, and only partly right due to a lack of content, stating that "He [Thor] learned how to live in the forest and in nature. And then he wanted to build kontiki and sail over the pacific ocean" (L2). As stated, all participants in the research group answered the first two questions correctly, or partly right.

In question three, "According to the text, what happened 65 years ago?", L1 and L2 did not provide an answer, thus showing little understanding of this particular content of the extract. However, L4 showed comprehension and wrote that "Kontiki and the crew sailed over the Pacific Ocean and showed that it was possible to cross the ocean on a small raft". L3 also answered this question correctly, and stated that "65 years ago, *Tor* and some friends traveled in their own boat over the sea". Contrastingly, all four participants in the research group managed to answer correctly or partly correctly to the question; "Why does the author of the text think there still is so much interest in the Kon-Tiki journey?". All four wrote that it was because they made a movie about Kon-Tiki, which was partly right as the author states that in

the beginning of the extract. Additionally, L4 added “Because it is a real life fairytale [...]”, reflecting upon the author’s statements in the extract.

The question with the least amount of response from the research group was question number five: “According to the text, can this story inspire us to do something?”. The two boys (L1 and L2) did not answer at all, while L4 stated correctly: “Follow the dreams we have and work hard”. Furthermore, L3 wrote “I think this story can inspire us to think that you can do so much more than you think”, which was categorised as right answer since the author wrote: “These stories inspire us to go beyond our own boundaries, follow our dreams, dare to take chances and act based on our own convictions.” L2 did not answer question 6: “What do you know about Thor Heyerdal’s childhood” either. However, the other learners answered correctly. L1 wrote “that he loved animals and adventures” and L3 wrote: “*Tor liket* to visiting the museum in Oslo. He lived in a place called Larvik. He *fault* in the weather to *tims* and are scared of the weather.” In this question, L4 wrote in a detailed manner about Thor’s life:

He [Thor] lived in Larvik. He collected animals in the basement and started a small zoo. Thor wanted to work with animals. When he was five he almost drowned in a small pond with ice when he went through the ice. Thor liked to go to Tøyen to the museum with his mother. He was curious and liked the nature. Thor was afraid of the water. (Learner 4)

For the second half of the comprehension task, the research group’s learner texts show that between 50 to 100 percent of the participants answered correctly or partly correct on the last eighth questions (see Table 2). In their learner texts, learners 1, 3 and 4 wrote what Thor dreamt of becoming as he grew older. They wrote the following responses: “something with animales” (L4), “*Tor* dreams to study nature and animals” (L3) and that “he dreamt about being a zoologist” (L1). These answers were correct answers as can be seen in Table 2, indicating that the participants understood this part of the text. Contrastingly, L2 wrote that Thor wanted to become “Kontiki”, which means that the learner did not understand much from the second half of the extract. Another important finding was that L2 did not reply to questions eight to 12, nor to question 14, thus are L2’s responses lacking in the following sections (except in question 13).

Three participants mentioned that Thor liked to find animals and insects in his spare time, which was partly correct. Two of them also wrote that “*Tor* like to visit the museum and study nature” (L3) and “He liked best to go to zoo museum in Tøyen in Oslo” (L4). Both are correct answers to the following question: “What did Thor like to do in his spare time, and what was it that he liked to do best out of these things?”. All three participants also answered correctly when asked: “What happened to Thor when he was five years old, please explain.” One explained that:

Thor fell into a pond with ice. He saw up and the hole was black and the rest of the ice was white. He wondered why. He hit his head in the ice but was able to get out. He was saved by some boys that saw his shoes (Learner 4)

Learner 3 and 1 explained that “*Tor* *fault* in the water when he was five years old. He said that it was black under the water. *Tor* hits his head in the is” (L3) and “he almost drowned because he went under the ice” (L1). In question 10, the participants were asked what happened to the live adder that Thor caught. L3 did not answer the question, whilst L1 and L4’s responses were categorised as correct, and their answers also complement each other’s according to the extract. One wrote that the live adder was “Put it in a jam jar” (L4) and the other replied that “a museum in oslo got it” (L1).

The participants were asked “After Thor started to study zoology, which is the scientific study of animals, what did he dream of for the future?” to which L4 replied correctly “To live somewhere without cars, fabrics and buildings. He wanted to find a place without people” (L4). Like L2, L1 did not answer this question. However, L3 answered “To live in nature and study more”, which was categorised as a partly right answer since the response lacked further details from the extract. For questions, 12 to 14, Learners L1, 3 and 4 answered correctly six times in total, and three answers were partly right, two belonged to L1 and one to L3. In question 12, participants were asked: “According to the text, why was the ice black when Thor looked up at it?” The first response revealed that it was “*something* about the light an how much it *shindt* through the ice” (L1) that affected the colour of the ice when Thor looked up at it. Or as stated by L3: “Because of the light”, both. Answers categories as partly right. According to L4, the ice was dark “Because the sun goes through the water easier than through ice,” which was a right answer according to the extract. In response to question 13, asking “How did Thor meet Liv for the first time, and what was their conversation about?”,

L1 responded “at a club and they went for a walk”, which did not answer the second part of the question. As mentioned, L2 did not answer questions 8 to 12 but got the question above partly right stating that Thor and Liv met each other “at a party” (L2). Furthermore, L4 wrote that they met “At a party” and that “They talked about the nature”, which was correct according to the extract. Additionally, L3 responded correctly writing “*Tor* meet Liv on a party, the go for a walk then *Tor* ask Liv something about the nature. Liv answer something that *Tor* liked”.

To the last question: “Please explain, how did Thor and Liv live “the rest of their life” according to the extract? What did they eat, where did they live, how was it there, etc. (write as much as you remember)”, L4 showed comprehension in her 50-word long written answer stating that:

They ate fish that they hunted with a spear, baked fish and had fires that they used sticskes to start. The both studied animales, lived in the nature and used their resources, the fruits such as bananas and mangos. They fished and used coconuts as cups and shell as plate. (Learner 4)

L1 used 14 words in his response, stating that “they eat fruits and fish and they lived on an island i the pacific” (L1), a response without any misconceptions of the extracts ending. Additionally, in L3’s 30-word response, she managed to write that “*Tor* and Liv live the rest of their life in a *ailend*, they found food in the nature like, mango, papaya, orange and coconut. They found fishes in the sea”, a response that was categorised as correct. As mentioned earlier, L2 did not reply to this question.

In summary, the research group results displayed that L4 comprehended all parts of the extract and was able to show this comprehension through the learner texts. Secondly, L3 answered correctly to 10 out of 14 questions, and partly correct to three questions. Additionally, L3 only left one question unanswered. Furthermore, the results indicated that the second part of the extract was not comprehended and/or remembered by L2, who left nine of the 14 questions unanswered. Furthermore, L2 answered partly right to four questions and had one question with a wrong answer. L1 did not answer three questions, and got five answers partly correct, while six of the responses were categorised as correct (see Table 2).

4.1.1.2 Spelling

Within the research group, some misspellings could be detected. These were detected based on their spelling, and what could be detected by the use of a phonological strategy, either in Norwegian or in English. Therefore, the focus was on orthographic transparent spelling. In total, the research group revealed little evidence of the use of the strategy, and only 10 words have been detected (see Table 3). In reply to question 12, “According to the text, why was the ice black when Thor looked up at it?” L1 replied “*something* about the light an how much it *shindt* through the ice.” The word something was written as *something* by L1. Another word that L1 wrote that may indicate the use of an phonological strategy was *shindt*, in this context meaning shined. L3 wrote the name Thor without an “h” 15 times throughout her learner text. Furthermore, the following learner response shows other misspellings L3 made:

Tor is a man who likes to study nature, he loves animals. When he was a little boy he liked to go and visit a museum in Oslo, with his mother. When *Tor* was a little boy he *falt* into the *is* two times. One when he was five years old and one when he was ten years old. He was afraid of the weather and did not learn to swim before he was 30 years old. When *Tor* was 19 years old, he wanted to get a girlfriend who liked nature. He met Liv at a party and they got married. *Tor* and Liv lived in their own *ailand*, there they have to *fin* the food self. They found mango, coconut and orange. (L3)

In the answer stated above, L3 spelt *Tor*, *falt*, *is*, *fin* and *ailand* wrong, according to how these words are spelt in the provided extract. Additionally, L3 once wrote a response: “*Tor liket* to visiting the museum in Oslo. He lived in a place called Larvik. He *fault* in the weather to *tims* and are scared of the weather”, showing misspellings of the words: *liked*, *time* and *Thor*. Furthermore, L3 spelt *ailand* once more later in the learner text. In total, the research group misspelt 10 words, and some of the words were misspelt several times (see Table 3), and most of the misspellings were produced by learner 3. The misspellings presented, are based on the orthography of the word and will be further discussed in Chapter 4.

4.1.2 Control group

4.1.2.1 Comprehension

To the question “What is the main idea of the text?”, one participant in the control group did not answer (LB). Another replied “He made a text 10 years ago. He was afraid of water”

(LD), which was categorised as the wrong answer when analysed. Further, LA and LC showed partly comprehension of the main idea of the text (question 2), answering “The idea of the text is to learn about the kontiki trip” (LA) and “Go to a *iland* and live pecefuley” (LC). In replies to the understanding of the elements and the order of events in the extract, LC and LA managed to understand and reply with some of the main elements in the correct order: “He [Thor] fell *tro* the ice and he *meth* a girl and her name was *live* thor an *live vent* to a beautiful island *dat* had much fodd and water” (LC).

In the book the storry starts when Thor was littel and his dreams, and that he loved animals. They talkt about that Thor was afraid of the weather *becaus* he had fell under the ice when he was five. When Thor was 19 he met a girl at a party, and they married *som* years later. (LA)

In addition, one participant did not answer the question (LD), while another replied “He [Thor] fell into ice water and he learned to swim when he turned 30” (LB). In total, the control group had two correct answers, three partly right answers, one wrong and three missing responses on the first two questions of the reading comprehension task.

None of the participants in the control group answered correctly to question three: “According to the text, what happened 65 years ago?”, seeing that they responded incorrectly or failed to respond. LB did not reply to any of the questions three to five. LA did not respond either, whilst LD wrote “he wa bourn i think” and LC replied “i *tink* he went to the *iland* and live *pesfully*”. Furthermore, LD left questions four to eight unanswered. Therefore, only two responses to the following question were collected: “Why does the author of the text think there still is so much interest in the Kon-Tiki journey?” The following response represent LA and LC, respectively: “*becaus* its a real life *farytail*” and “because its a exciting book”. LA responded correctly, whilst LC answered partly right. These findings indicate that only two of the participants in the control group managed to comprehend and remember the first part of the extract.

To the question “According to the text, can this story inspire us to do something?” LC responded: “yes we *kan* be more *carful*”, indicating that the learner did not understand the extract to a full extent. On the other hand, LA responded “yes you can be inspired to *follo* your dreams”, showing comprehension. The following question: “What do you know about

Thor Heyerdahl's childhood?" generated three responses, "He liked to exspolre" (LB), "he fel *tro* the ice 2 times and he had maney animals at home" (LC), and "He loved animals, sand he felld under the ice when he was five years old. (LA). All responses were categorised as correct (La and LC) or partly correct answers (LB).

From question seven and onwards, the replies indicate a lack of comprehension within this group. Table 2 reveals that the participants managed to get zero to two correct, or partly correct answers in total, in each of the remaining questions. LB did not answer any of the final eight questions (seven to 14), whilst LA stated that according to the text Thor wanted to become "some thing whit animals," whereas LC wrote he wanted to "find a beautiful *plac wid* no peoples an no cars or schools and no work". Both answers were categorised as correct. In question eight, "What did Thor like to do in his spare time, and what was it that he liked to do best out of these things?", the two answers were partly correct. One said that "He liked to studie animals" (LA) and another said that he liked to "study animals and nature" (LC).

To the question "What happened to Thor when he was five years old, please explain", LC responded: "he fel *tro* the ice *becaus* det was *som* older kids *hwo jumt* on the ice and *wen* he was trying to do it he fel *tro* the ice." Additionally, in her written response LA correctly claimed "he felld under the ice", whilst LD incorrectly wrote, "he bilt kontiki". Question 10 only generated one response, which was categorised as incorrect: "What happened to the live adder that Thor had caught, please explain", LC answered "*Dat* she was uteful and he *marid* her om *crismas ev*". Furthermore, LD did not respond to any of the remaining questions. To question 11: "After Thor started to study zoology, which is the scientific study of animals, what did he dream of for the future?", LC responded incorrectly "yes", whilst LA responded partly correct, stating "he dreams of explore."

To the question regarding why the ice was black when Thor looked up at it, LA was the only one who, to some extent, knew: "it was some thing whit the light" (LA). LC replied, "because he was skard and *dere* was pepole over it", however, this response was categorised as incorrect. In question 13, two participants managed to respond partly correct by stating that Thor and Liv met for the first time "at a paty when he was 19" (LA) and LC said, "*dey meth* at a party and *dey caked abaut* the future". They also responded partly correct to question 14: "Please explain, how did Thor and Liv live "the rest of their life" according to the extract? What did they eat, where did they live, how was it there, etc. (write as much as you

remember)”. LC claimed that “*dey laivd at a island dat was named kon-tiki and dey eayt fruth an fich and water it was beautiful der*”, a response in 21 words, whilst LA had a shorter response only using nine words: “the eat *fich* and coconuts it was fine there.” Both participants exhibited a certain level of comprehension regarding the conclusion of the extract.

Summing up, LD answered three questions incorrectly and left 11 questions unanswered. We also saw that LB failed to respond to 12 out of 14 questions, whilst the 2 other answers were partly correct. In total, LC had nine correct or partly correct answers, whereas five were correct and the remaining four were partly right. Additionally, LC responded incorrectly to five questions. With 12 correct or partly correct answers, LA was the learner with the highest score within the control group. Half of her answers were categorised as correct and the remaining half as partly correct, meaning six were right and six were partly right since LA additionally left two questions unanswered.

4.1.2.2 Spelling

Within the control group, there were detected a total of 33 different spelling mistakes (see Table 3). LD provided one of these mistakes when answering “he *bilt* kontiki”, however, LB did not have any spelling mistakes connected to a phonological strategy. LA had six spelling mistakes, however, some misspellings occurred twice. Furthermore, some of the words spelt wrong are high-frequency words in the English language, such as the word *some*.

Furthermore, LA spelt the word *know* wrongly in two different ways: *no* and *now*, in sentences where the meaning was that: *I don't know*. Another participant, LC, had a lot of misspelt words in his learner text. Words that were written based on the phonological strategy. For example, an answer written by LC went like this: “*dey laivd at a island dat was named kon-tiki and dey eayt fruth an fich and water it was beautiful der*”. The words *they*, *that*, *ate*, and *there* are spelt incorrectly, and the word *dey* appears twice. The same misspelling appear four times throughout his learner text. In response to the question asking: “According to the text, what happened 65 years ago?”, LC responded “i *tink* he went to the *iland* and live *pesfully*”, thus misspelling several words in the same sentence. Furthermore, LC wrote: “he fel *tro* the ice *becaus* det was *som* older kids *hwo jumt* on the ice and *wen* he was trying to do it he fel *tro* the ice.” The sentence consists of seven words that have been identified as misspelt, and frequently used words such as *some* and *when* are among the misspelt words. Finally, the control group revealed several spelling mistakes in their learner

texts, and all of them that are connected to the phonological strategy can be seen in Table 3, together with the meaning of the word based on its context.

4.2 Questionnaire

4.2.1 Research group

The control group consisted of two boys and two girls, and according to Table 4.1, L1 and L3 achieved a grade of 4 in the first semester in grade eight, whilst L2 and L4 received a grade of 3. L3 and L4 read the text twice, in contrast to L1 and L2 who read the text one time. Answers to question five reveal that none of the participants used Lingdys' dictation function, even though they were allowed to, however, all of them used the audio support. Furthermore, all participants, except L2, used the software's writing support. For a full view of the participants' individual answers, see Table 4.1 and Table 4.2.

All four learners found the software easy to use. However, an interesting finding was that L3 and L4 claimed that they found the program useful to a "Very large extent", L1 to "Some extent" and L2 only to a "Somewhat little extent". Furthermore, L1 and L3 claimed it was useful to a "Very large extent" to get the text read aloud. L4 responded that it was useful to "Some extent", and L2 to "Somewhat little extent". Additionally, L2 used the same scale responding to "To what extent do you mean that you managed to understand more of the content in the text, using the audio support, compared to if you were to read the text on your own?". In contrast, the other participants were positive and felt that they comprehended more. Furthermore, all participants in the research group claim that they to a "Very large extent" (L3 and L4) or to "Some extent" (L1 and L2) will use Lingdys Pluss audio support in the English lessons in the future. Additionally, even though they did not use the dictation function, L1, L3 and L4 state that they to a "Somewhat little extent" will use the dictation in English in the future, at the same time L2 claimed he will use it to a "Very little extent". In terms of focus the responses differ, L1, L3 and L4 claimed to stay focused to a some or very large extent, whilst L2 claimed the focus to be at a "Somewhat little extent". Shockingly, all participants added a comment to the open-ended question. L1 stated "Technical issues". L2 responded that "It did not work. I spent a lot of time waiting for it to work properly". L3 said "I liked Lingdys Pluss a lot :)", lastly:

It was hard to concentrate when the program did not work. The fact that the program did not work probably resulted in me using more time and that it was stressful to use the software since I like using Lingdys Pluss. It helps me to understand and remember more of the text. (L4)

Table 4.1: Overview of learners' opinions based on the questionnaire. Learners who used Lingdys Pluss.

Questions	Answers			
1. Hva er ditt biologiske kjønn	Gutt: 1, 2		Jente: 3, 4	
2. Hvilken karakter fikk du i engelsk til jul i 8. klasse?	Karakter 4: 1, 3	Karakter 3: 2, 4		Ønsker ikke å svare: 0
3. Hvor mange ganger leste du teksten	Leste 1 gang: 1, 2		Leste 2 ganger: 3, 4	
4. Brukte du Lingdys Pluss til å lese teksten?	Ja: 1, 2, 3, 4		Nei: 0	
5. Dersom ja på forrige spørsmål, huk av for de som er sanne	Jeg brukte diktering:	Jeg brukte opplesningsfunksjonen for å lytte til teksten: 1, 2, 3, 4		Jeg brukte skrivehjelpen: 1, 3, 4
	Veldig stor grad	Litt stor grad	Litt liten grad	Veldig liten grad
6. I hvilken grad var programmet lett å bruke?		3, 4	1, 2	

7. I hvilken grad var programmet nyttig?	3, 4	1	2	
8. I hvilken grad var det nyttig at du fikk oppleit teksten?	1, 3	4	2	
9. I hvilken grad mener du at du fikk med deg mer av tekstens innhold ved å bruke opplesningsfunksjonen, i forhold til om du skulle lest selv?	4	1, 3	2	
10. I hvilken grad vil du bruke Lingdys Pluss (opplesningsfunksjon) i engelsktimene fremover?	3, 4	1, 2		
11. I hvilken grad hjalp det at du kunne snakke inn svarene på spørsmålene fremfor å skrive?			3	1, 2, 4
12. I hvilken grad vil du bruke Lingdys Pluss (dikteringsfunksjon) i engelsktimene fremover?			1, 3, 4	2

13. I hvilken grad klarte du å holde fokus?	4	1, 3	2	
14. Annet du vil legge til?	Learner 1: “Tekniske problemer.”	Learner 2: “Det funka ikke. Brukte mye tid på å venta på at det skolle fungera.”	Learner 3: “Jeg likte lingdys pluss godt:)”	Learner 4: “Vanskelig å konsentrere seg de gangene programmet klikket. Det at programmet ikke virket skikkelig gjorde at det tok tid og at det ble litt stress å bruke det fordi jeg liker å bruke programmet. Det hjelper at jeg får meg mer og at jeg kan huske bedre teksten.”

4.2.2 Control group

Answering the questionnaire, three girls and one boy were a part of the control group (see Table 4.2). Two of the learners did not want to share their semester grade, contrary, LA stated she received a grade of 4 and LB received a grade of 3. Interestingly, of the participants in the control group, only LB read the extract twice. Question 5 for the control group asked, “To what extent did you miss receiving help reading and understanding the text?”. All participants answered to a “Very large extent” (LB & LD) or to “Some extent” (LA & LC). When the participants were asked “To what extent did you miss reading support?”, LA, LB and LD missed a lot of to some extent, however, LC stated that he missed reading support to a “Very little extent”. LC also claimed to miss writing support to a “Somewhat little extent”, whilst all the other participants missed it to a “Very large extent”. An interesting finding was when LC stated he managed to concentrate to a “Very large extent”, and LA to a “Somewhat little extent”, whilst LB and LD claimed they found it hard to concentrate. Lastly, to the open-

ended question participant B added that she found it “hard to concentrate” and LD said, “Did not manage to concentrate”.

Tabell 4.2: Overview of learners’ opinions based on the questionnaire. Learners who did not use Lingdys Pluss

1. Hva er ditt biologiske kjønn	Gutt: C		Jente: A, B, D	
2. Hvilken karakter fikk du i engelsk til jul i 8. klasse?	Karakter 4: A	Karakter 3: B		Ønsker ikke å svare: C, D
3. Hvor mange ganger leste du teksten	Leste 1 gang: A, C, D		Leste 2 ganger: B	
4. Brukte du Lingdys Pluss til å lese teksten?	Ja:		Nei: A, B, C, D	
	Veldig stor grad	Litt stor grad	Litt liten grad	Veldig liten grad
5. I hvilken grad savnet du å få hjelp til å lese og forstå teksten?	B, D	A C		
6. I hvilken grad savnet du lesehjelp?	B, D	A		C

7. I hvilken grad savnet du skrivehjelp?	A, B, D		C	
8. I hvilken grad klarte du å holde fokus?	C		A	B, D
9. Annet du vil legge til?		Learner B: “Vanskelig å konsentrere seg”		Learner D: “Klarte isje og konsentrere meg.”

5.0 Discussion

In this chapter, the findings from the analysis are discussed in relation to the research questions of the thesis and in light of the theory and previous research presented in Chapter 2. Firstly, the participants' reading comprehension will be shaded light over in section 5.1, then their spelling will be discussed in section 5.2. Finally, in section 5.3, the implications and limitations of the current study are outlined, followed by avenues for future research.

5.1 Reading comprehension

The use of Lingdys support has an impact on 8th-grade dyslexic EFL learners' reading comprehension. As stated in the methodology section, the research group used Lingdys audio support in the reading process, in contrast to the control group (see Tables 4.1 and 4.2). The use of audio support in written text can be compared to listening to an oral text, which through previous research has been shown to be in favour of dyslexics' comprehension, in comparison to reading and decoding a written text on their own (Statped, 2020). In Table 2, the participants' total numbers of correct, partly correct, incorrect and unanswered responses in the learner texts are presented. Stating the findings, learners 1 - 4 answered 30 questions correctly, whilst learners A - D only got 10 correct answers. Furthermore, the research group answered one question incorrectly, whilst the control group had eight incorrect answers. Since the subgrouping of the participants was based on making as homogeneous groups as possible, both based on gender and performance in the EFL subject so far in the 8th grade, these findings were relatively noticeable, favouring the research group. Furthermore, if the idea of reading comprehension is that decoding reflects comprehension (Braaten, 2020), the research groups decoding skills could be described as way better than the control groups skills', based on their comprehension results. However, a common agreement still supports the idea that dyslexics lack the ability to decode (Høien & Lundberg, 2012), meaning some factors had to affect their decoding skills. Findings indicate that Lingdys audio support worked as a replacement for the pupils' lack of decoding skills, enabling them to comprehend more of the oral text than the written one. Furthermore, impacting their understanding in a positive manner.

The individual decoding process may impact the pupils' comprehension, especially towards the end of longer texts. In the analysis of the learner texts (see Table 2) it was revealed that the research group answered correctly or partly correctly 22 times in total, from question one to seven, whilst the control had 13 answers within the two categories. However, the differences are greater towards the end of the extract, where responses from the research group were categorised within the two correct answer categories 20 times, contrary, the control group had 10. This finding may support Shaywitz & Shaywitz's (2020) claim that decoding is a demanding process for dyslexics. Yet, it is important to state that the numbers of correct or partly correct answers were reduced by two or three for both groups showing that both groups comprehended less at the end of the extract. However, these findings also reveal a huge contrast between the research group using Lingdys Pluss, and those who did not use the software, in favour of the research group. Previous research has found that audio support allows dyslexics to depend on their oral comprehension skills, rather than their reading comprehension which tends to lack (Statped, 2020). Similar findings are indicated in this study. Decoding is demanding for dyslexics, leading to a lack of reading speed and effort, resulting in bad comprehension for the control group in general. Contrary, as one might be tired of listening to the audio support, listening tend to be less demanding for dyslexics, compared to reading and decoding, resulting in greater comprehension, especially at the beginning of the text. As a consequence, scaffolding the learners towards the end of longer texts could possibly be a good way of adapting for dyslexics and at the same time challenge their reading ability at the start of the text.

Dyslexics tend to lack the ability to read quickly, especially unknown texts, which further may impact understanding negatively (Høien & Lundberg, 2012). Learners 3 and 4 were the only participants who, according to Table 4.1, read the extract twice before writing the learner text. In addition, LB from the control group stated to have read the text twice. As Table 2 suggests, L3 and L4's comprehension of the text was to a greater extent compared to the rest of the participants in the study. In response to the questionnaire, both stated that they comprehended more using audio support and that they found the audio support useful. In contrast, LB together with the rest of the control group stated that they missed reading support (see Table 4.2). Perhaps, some of the participants in the control group were not able to read the whole extract one time, due to their reading speed, or LB might have read the text twice due to a lack of focus and comprehension resulting in her reading the start of the extract once more. However, these findings indicate that the audio support supplied the two specific

participants with extra time enabling them to re-read the extract once more. Yet, only half of the research group listened to the extract twice. L1 and L2 both read the text using audio support one time. Interestingly, the results show that L3 and L4 who read the text twice were able to comprehend and remember more of the text, compared to L1 and L2 reading the text once, which supports Braaten's (2020) statement that knowledge of the text impacts reading comprehension positively. On the contrary, other factors than reading the text twice may have affected the results, such as motivation, concentration, previous knowledge, fear of failure, etc. and some will be discussed at a later stage. Furthermore, these findings indicate that the reading speed of dyslexics decoding on their own is slower compared to decoding using Lingdys. Nysether (2014) presented that computers and other digital tools to scaffold dyslexic pupils had a positive effect on the learners (Hodge, 2000; Waaler & Waaler, 2019). Looking at the results presented above, this study indicates that Lingdys audio support supplies learners with additional time for re-reading (or listening) to the text, impacting their knowledge of the text, which further impacts comprehension positively, findings that are in line with Sally & Shaywitz's findings back in 1998.

Compared to the rest of the research group, L2 scored lower on reading comprehension, although he used the same scaffolding tool as the other learners, this may be caused by different reasons. One cause may be the way his dyslexia diagnosis affects him differently from others (Solem, 2017; Waaler & Waaler, 2019; Høien & Lundberg, 2012). Firstly, addressing the learner's response to the open-ended question reveals what could be a frustration that the program did not work properly and that he spent much time waiting for it to work (see Table 4.1). Supporting this view, his responses earlier in the questionnaire also suggest that even though he felt that he did not find it easy to use, he did not comprehend more, or find it useful, he contrary states that he will use Lingdys audio support in upcoming EFL classes. This finding can be seen in relation to Hudson et al. (2007, in Nysether, 2014), who stated that using digital scaffolding tools is time-consuming, resulting in a lack of adaptation due to a lack of resources and time. However, an interesting finding was that L2 stated that he found it to a somewhat little extent easy to stay focused, however, his partly correct answers were to questions 1, 2, 4 and 13, indicating that he must have been able to comprehend and stay more focused at the start, compared to at the end. It is important to state that comparing the participant's responses is to some extent hard and unethical since one cannot infer that the intensity of feeling in the Likert scale between "Strongly agree" and "disagree" somehow matches the intensity of feeling between "strongly disagree" and "agree"

(Cohen et al., 2007). Furthermore, interpreting his responses, they may show that L2 normally finds decoding like “cycling in headwinds” (Høien & Lundberg, 2012), and that he perhaps gave up due to a lack of mastery. Lastly, there might be a chance of L2 finding EFL learning extremely difficult (Shaywitz & Shaywitz, 2020): “As for dyslexic children, this [L2 learning] often coincides with a peak experience of L1 failure” (Helland & Kaasa, 2005, p. 43). If this was the case, which the results may indicate, comprehension was influenced by more than L2 having the inability to decode or comprehend (Gough & Tunmer, 1986), elements such as motivation, previous knowledge of the format or the text, and a lack of preparation before reading, combined with EFL difficulties (Duke, Pressley & Hulden, 2004, in Bråten 2020), all may have influenced his reading comprehension negatively. This show that the participant must be both motivated and receptive for learning.

Dyslexics might find reading over time demanding (Høien & Lundberg, 2012), and in some cases suffer extreme fatigue (Shaywitz & Shaywitz, 2020). In response to the questionnaire, LD stated that staying focused was hard, even emphasising it in the open-ended question by writing in Norwegian that she did not manage to concentrate (see Table 4.2). This could be connected to the diagnosis of dyslexia (BDA, 2009). Throughout the learner text, none of learner D’s responses were categorised within the two aspects of right answers, three responses were wrong, and 11 questions were unanswered. We can interpret the lack of responses, and failure in responses to LD finding it hard to master EFL learning (Shaywitz & Shaywitz, 2020), or as evidence of LD struggling to decode words, resulting in a lack of comprehension. However, not only does slow reading speed impact reading comprehension (Solem, 2017; Høien & Lundberg, 2012) but based on Gough and Tunmer (1986), if decoding skills approach 0, then comprehension will be affected. The fact that LD gave a response to three questions indicates that the learner thought she comprehended parts of the extract, meanwhile, the results analysis revealed that she did not. Thoughts about her lack of response may be linked to her lack of decoding skills. Likewise, previous research has concluded that giving dyslexics additional time for decoding may be enough scaffolding (Sally & Shaywitz, 1998) and help in the comprehension process. This could perhaps have improved L’s comprehension. However, for this study, the aim was to look if Lingdys software impacted comprehension, and in what ways. Therefore, the control group was not given additional time or scaffolding, clearly highlighting LD’s difficulties and underlining that Lingdys support may have been effective for some of the other learners at LD’s level.

Like learners 2 and D, LB's learner text showed little comprehension, however, her pattern of response may indicate other causes of lack of comprehension than those discussed for the two previous learners. LB answered two questions, whereas both were categorised as partly correct. One stated that in his childhood, Thor "[...] liked to exspolre" and the other stated that "He [Thor] fell into ice water and he learned to swim when he turned 30". The lack of responses, except from these two responses may indicate that not only did LB struggle to decode words and comprehend the extract, but she might also be afraid of failure. Could LB find that the fear of failure is bigger than leaving a question unanswered? If so, LB only answered the two questions she knew she remembered and had understood to some extent and left the rest unanswered. Connected to her questionnaire responses, LB stated that she missed reading and comprehension support, yet she managed to comprehend two elements of the extracts. In addition, LB also wrote twice that she did not manage to stay focused (see Table 4.2), however, this could be partly true, and perhaps partly an excuse for hiding her insecurity and fear of giving an incorrect answer.

Supporting the claim that Lingdys software increases reading comprehension, is L4's results. L4 stated that she received a grade of 3 last semester and that she found the software relatively easy to use, and at the same time helpful since she managed to comprehend more of the extract's content, which seems to be a fact. What stood out in her learner text, compared to other participants, was not only that she comprehended all questions, however, L4 tended to have long answers to many of the questions, including the open-ended question in the questionnaire. This competence reveals that she mastered the skill of reading comprehension for this specific extract and situation (Braaten, 2020), being able to interact with the text. However, it also reflects great EFL skills in general, connected to a wish of succeeding. A response showing a great comprehension was given to question six:

He [Thor] lived in Larvik. He collected animals in the basement and started a small zoo. Thor wanted to work with animals. When he was five he almost drowned in a small pond with ice when he went through the ice. Thor liked to go to Tøyen to the museum with his mother. He was curious and liked the nature. Thor was afraid of the water. (Learner 4)

In the response, L4 does not only show comprehension, but she also reveals skills connected to memory and remembering what is being read or listened to, that can be connected to

comprehending more of an oral text than a written text (Shaywitz & Shaywitz, 2020). Her great results may reflect good previous knowledge of the theme (Høien & Lundberg, 2012), however, this study lacks a mapping of previous knowledge connected to Kon-Tiki and Thor Heyerdahl. Furthermore, Braaten (2020) stated that in terms of reading comprehension “The first aspect is based on understanding in order to find the purpose of the text, what is the author’s message?”, an aspect L4 mastered well using Lingdys support, reflecting that Lingdys may scaffold this process. However, what should be considered as another limitation of the study is that comprehension is measured in EFL, and not in the first language, making it hard to say if L4 lean towards DFER (Nijakowska, 2010), or if the learner also comprehends well using audio support in Norwegian.

A lack of EFL comprehension can be connected to an inadequate vocabulary, leading to a first language-based strategy when comprehending parts of the extract. As presented in the analysis, LC showed comprehension to most of the extract. However, he gave five incorrect answers throughout the learner text, some showing a lack of understanding in connection to vocabulary. In response to question 10 (see Appendix 4) he responded: “*Dat* she was uteful and he *marid* her om *crismas ev*”, a response indicating that LC misinterpreted the word *live*, in English meaning being alive, with the Norwegian name Live, since Thor's wife was named Liv (close to Live). Furthermore, this could look like a misinterpretation of words that sound alike (Shaywitz & Shaywitz, 2020), like *to live* and the name *Liv*, both pronounced similarly. The same mistake connected to the names Liv and Live was made by LA: “He [Thor] fell *tro* the ice and he *meth* a girl and her name was *live* thor an *live vent* to a beautiful island *dat* had much fodd and water”. However, building on the participants’ difficulties with decoding and foreign language learning, the lack of comprehension could also be a sign of a lack in vocabulary understanding in EFL. LC has shown that he masters decoding words and is able to understand what is being decoded (see Table 2), however, he does not reflect these skills throughout the entire learner text. The simple view of reading (Gough and Tunmer, 1986) explains that one has to understand the words one reads, in order to comprehend a text. In response to question 11: “After Thor started to study zoology, which is the scientific study of animals, what did he dream of for the future?”, LC responded incorrectly “yes”, showing a lack of understanding the vocabulary to the question being asked. Therefore, emphasising that vocabulary is essential in a comprehension process (Engen & Helgevold, 2020), is crucial, and as a tool in expanding vocabulary to secure reading comprehension (Sally & Shaywitz, 1998), Lingdys software should be considered, as it may scaffold the comprehension of single

words through a dictionary function (Lingit, 2022). Lastly, it is remarkable that this learner did not miss reading support at all, however, he missed reading and comprehension support to a somewhat extent. This could mean that the learner feels that decoding is fairly easy, however, he sees that he lacks the ability to comprehend in EFL due to for instance vocabulary issues.

According to Braaten (2020), girls tend to score better than boys on comprehension skills. Comparing two learners who achieved the same grade in the first semester of 8th grade, one boy and one girl, both wanting to achieve good results, one can shed light on this statement. Firstly, LA and L1 attended different groups during the study. LA attended the control group and L1 the research group using Lingdys software. In total, L1 had six correct answers, five partly right answers and three unanswered questions, while LA answered correctly six times, partly correct six times, and left two questions unanswered. In other words, their level was quite even. An interesting aspect of their results is that L1, the boy, had one less partly correct answer compared to LA and one more unanswered response. The participant that attended the research group comprehended less than the ones attending the control group, based on the results in Table 2. These results show that that specific boy comprehended less than that specific girl, however, looking at the other boys (L1, L2, LC) who attended the study, the tendency is that they achieved a lower comprehension score than girls (L3, L4, LA, LB, LD) receiving the same grade last semester. Nevertheless, it is important to state that LC and LD did not state their grades (see Table 4.2). Another aspect of this comparison worth mentioning is that the grades reflect the pupils' oral and written skills (Kunnskapsdepartementet, 2019), which does not correspond to the aim of this study. However, based on Braaten's (2020) statement, where LA should have an advantage over L1, L1 scored relatively well using Lingdys software, indicating a positive effect. Furthermore, noticing the study's limitation, especially when comparing results, brought by an odd number of boys and girls, is worth mentioning as it is hard not to pick the "better girl" in comparison to the "struggling boy", and vice versa.

Furthermore, the learners' use of reading and learning strategies should be discussed in light of the analysis. The analysis reveals that some learners are way better than others concerning reading comprehension (see Table 2). Are these differences connected to other aspects than dyslexia impacting individuals differently, or that one group used Lingdys software and the other did not? L2, LB and LD were the participants with the least correct answers, and with

the most unanswered questions in their learner texts. As discussed earlier, the fear of failure could be greater than leaving an unanswered question, yet participants from both the control group and the research group showed lower comprehension skills compared to the other participants, indicating that Lingdys software was not the only aspect impacting their comprehension in this study. A possibility is that some pupils lack the ability to use reading and learning strategies independently, furthermore, not being aware of in what ways they master learning, understanding and remembering. Kunnskapsdepartementet (2017) emphasised that the five basic skills are essential in this process, however, the L2, LB and LD may lack one or some of these skills, and the awareness of their own learning strategy, which may have resulted in a lack of comprehension in this study. The support of Lingdys software does not work as a learning strategy by itself, however, providing learners with efficient learning strategies in combination with Lingdys software, seems to have an impact looking at L1, L3 and L4, who tend to master a learning strategy well, based on their comprehension results.

Lastly, like Helland and Kaasa's study (2005), this study has proven that dyslexics struggle in terms of reading comprehension. However, the project clearly indicates that learners who master using a learning strategy in EFL also benefit from using Lingdys software when working on reading comprehension. In dividing the participants into a control group and a research group, the aim was to have as homogeneous groups as possible. Since two participants from the control group and one from the research group might lack the ability to use learning strategies in EFL learning, the remaining participants represent the positive effect of Lingdys support. In total, L1, L3 and L4 comprehended 12 to 14 of the questions each, based on the two different categories of correct answers. From the control group, LA was at the same level with 12 to 14 correct answers, whilst LC comprehended 9 questions, all indicating that Lingdys strengthened research group participants' comprehension.

5.2 Spelling

A common feature of dyslexia is a lack of spelling abilities (Moats, 2005 in Høien & Lundberg, 2012; Helland & Kaasa, 2005; Solem, 2017). A text, or given words or vocabulary may serve as scaffolding, likewise with Lingdys Pluss writing support which supports the user with a word prediction box based on the last written word and the letters that one types.

However, some words, like names, can be written in different ways, still being almost similar, and therefore not be marked as incorrect spelling. Learner 3 for instance, spelt the name Thor without an “h” 15 times throughout her learner text, even though the questions in the reading comprehension task wrote Thor with an h, the learner constantly wrote Tor, representing a gap between reading comprehension and spelling mistakes (Moats, 2005). As mentioned earlier, LA made a similar spelling mistake with the name Liv, which was written as Live. These mistakes may also be connected to the Norwegian way of spelling these names. Tor and Live are two quite common names in Norway, and based on the orthographic transparency in Norwegian, these names are shallow. Contrary, in English, Thor I spelt with an h and the word is deeper in terms of orthographic transparency, whilst Liv is a shallower name like Live in Norwegian. Furthermore, we identified the same results when L3 wrote *is* instead of *ice*, where the Norwegian spelling of ice is *is*, however, the English word *is* having a meaning on its own. These learners’ spelling mistakes show that the use of Lingdys software does not remove all spelling mistakes based on phonological strategies, however, scaffolding with vocabulary and questions might not help either, as shown L3 and LA spelling the names wrong.

The spelling of names according to Norwegian spelling, also reflects other spelling mistakes made by the participants. Yet, these mistakes also reflect the use of a phonological strategy and were made by participants from the research group. These mistakes show a lack of vocabulary rather than a lack within the software, due to the participants using Norwegian words and translating them into a word that sounds like English, called Norwenglish. Since the orthographic transparency of Norwegian is shallower than English, there is a clearer mapping between the sounds of the language and the symbols or letters used to represent them (Aron, 2014). When the participants used a phonological strategy writing unknown English words, the spelling reflected a phonological spelling, however, based on Norwenglish. L3 wrote: “When *Tor* was a little boy he *falt* into the *is* two times.” In this sentence, L3 translated the Norwegian words “å falle”, or spelt as “han falt” (he fell) in the past tense, into English cause that sounded correct. Furthermore, the same word, to fall, was translated to *fault*, when she wrote: “He *fault* in the weather to *tims* and are scared of the weather,” making even more Norwenglish than before. As suggested, these spelling mistakes are hard to detect using the spelling support by Lingdys, because the prediction shows words that you most likely would like to use, or as you start spelling and keep on pressing buttons, the words that are predicted

are English words. Only the word *fault* has a meaning in English, connected to being guilty or making a mistake, not falling into the water.

Even though Lingdys support does not notice all phonological-related misspellings, or all Norwegian words translated directly into English, the results indicate that Lingdys software impacted the participants positively. When analysing the misspellings (see Table 3), it was clear that the majority of the misspelt words (based on a phonological strategy) were written by participants within the control group. The spelling aspect was perhaps the most revealing area of difference within this study, matching Helland & Kaasa's (2005) findings of dyslexics and non-dyslexics. For this study, LA to LD had 45 misspellings in their learner texts, whilst L1 to L4 had 25, whereas the misspelling of Thor's name counted 15 of them. An interesting discovery was that LC was responsible for 37 of the misspellings, where high-frequency words like *that*, *they*, *some* and *can* were misspelt as shown in Table 3. Comparing these misspellings to the misspellings of the research group, none of the research group participants misspelt these commonly used words. This could suggest the effect Lingdys software has on spelling, especially on highly frequently used words. Furthermore, in connection to Lingdys impacting pupils' spelling positively, a remarkable statement from LC needs to be shed light on. The learner missed writing support to a "somewhat little extent". This was remarkable due to all the misspellings made by the learner, implying that LC has no idea that these words are spelt incorrectly. Therefore, based on the results, using Lingdys as a writing tool scaffolds the learners and prevents them from making unnecessary spelling mistakes.

Throughout the responses, phonological spelling strategies were used. This can be detected in several of the learners' texts, however, one L4 did not present any misspelt words that clearly were spelt using the phonological strategy, which could be connected to her use of writing support. Yet, Smyrge and Evarett (in Helland & Kaasa, 2005) implied that dyslexia affects differently, and that first language disabilities often can impact FL learning. For instance, LC may struggle more than L4 with first-language misspellings, impacting EFL spelling too. Furthermore, one has to highlight the differences in misspellings between the research group and the control group. Yet, some words tend to be misspelt by participants within both groups. The perhaps not so often used word island was spelt in the following ways: ailand (L3), ailend (L3) and iland (LC). These misspellings indicate that the participants have spelt the word using a phonological strategy which can be seen in L3 basing her response on the diphthong "ai", since the phonological strategy concerns sound, syllables and diphthongs,

meaning pupils write what they hear (Dysleksi Norge, 2021). Typically, Lingdys software should be able to detect these spelling mistakes, however, that would be using another function than the word prediction the pupils in this study used. Yet, participants from both groups revealed misspellings in connection to this not-so-frequently used, and deep orthographic word, but the research group participants revealed fewer misspellings of this type.

We know that pupils' reading and writing skills may vary due to the degree of exposure to written language (Stanovich et al. 1997a, 1997b), and that a "characteristic of dyslexia is that the disturbance is persistent. Even though reading abilities can eventually reach an acceptable performance level, poor writing skills most often remain" (Høien & Lundberg, 2012, p. 25). However, for this study, some pupils did not show any spelling mistakes or difficulties connected to spelling although their learners' texts revealed a lack of comprehension. Firstly, it is important to state that this study examined their spelling mistakes at a specific date, not over time. Furthermore, the aim was to look at the effect of Lingdys software. For instance, L2 did not reveal any misspellings in his learner text which could indicate that the software impacted in a positive way, yet, LB and LD also had a limited number of misspellings, only one in total. Therefore, the use of Lingdys has to be seen in connection to the amount of text each participant presented, the number of answered and unanswered questions and also the comprehension they showed. L3 and L4 for instance, had extensive answers to several questions in addition to answering almost all of them. However, if learners struggle decoding words, they most likely struggle to spell words (Moats, 2005 in Høien & Lundberg, 2012), meaning that L2, LB and LD's lack in decoding and comprehension skills also reflects their spelling. However, using L2, LB and LD's spelling results as an argument in the theses will weaken the reliability of the theses, due to no or little room for misspelling in their response patterns.

To compare and contrast boys' and girls' spelling results is hard, due to a lack of responses by L2, LB and LD, an uneven number of the genders within the different groups. However, it is important to underline that both LB and LD missed scaffolding in the writing process (see Table 4.2) and that their way of "missing writing support" may be understood as Lingdys writing support or support from a teacher or a co-learner. Therefore, it is likely that these pupils might have replied in greater detail or to other questions if some support had been offered. Yet, it is hard to compare and contrast the individual learners' spelling mistakes due

to individual differences related to the diagnosis. However, L4 can represent that Lingdys software might help dyslexics write a text presenting mainly spellings based on the orthographic spelling strategy, rather than the phonological. Furthermore, Hellans and Kaasa (2005) found that dyslexics tend to lack spelling competence compared to non-dyslexics. Since their study identified such a magnificent difference between the two groups, future research could examine the differences between non-dyslexics EFL spelling and dyslexics EFL spelling using Lingdys writing support. Nevertheless, it is worth mentioning that a limitation of this study lies in the examination of other spelling mistakes for instance grammar.

Lastly, what is clear through this research, is that dyslexic learners struggle spelling words correctly both with and without spelling support. As mentioned earlier, the control group tends to spell frequently used words wrong more often than participants from the research group. Yet, L1 in his spelling of the word *something*, spelt *somthing*, a combined word with a deeper orthography than many Norwegian words. The word is a combination of two words, *some* and *thing*, both deeper words with respectively an *e* and an *h* that is not pronounced when talking. An interesting finding was that L1 spelt the second half of the word correctly, whilst the first half was spelt incorrectly. Even through Lingdys support, this mistake was written, implying that L1 used the phonological strategy at the beginning of the word, however, the learner knew the orthography of the second word and therefore he managed to spell it correctly. Resulting in a word written partly using the phonological strategy and partly using the orthographical strategy. In other words, the learner texts written by the research group were not perfect in terms of spelling, yet the results reflect that the software might help reach a more correct spelling of single words, at least, the software does not influence the users in a negative way. Lastly, the support might even be helpful in terms of exposure to language, resulting in better vocabulary knowledge and a better written EFL language.

5.3 Limitations and further research

When evaluating my own research, there are several components I would have changed in order to improve the research and the result. As presented throughout the discussion, there are several limitations that need to be addressed. Firstly, the focus of the study changed after the data collection lesson was conducted, from studying Lingdys audio support to aiming at

Lingdys as a software impacting both comprehension and spelling. This change was made due to several findings of phonological-related spelling mistakes in the analysis, which had to be discussed and highlighted. Furthermore, the change of focus impacted the participant's reflection on the software, by lacking focus on writing and spelling support. In connection to Lingdys software as a supportive tool, the dictation function, which was not used by any of the participants, needs to be shed focus on. Further research should look at ways Lingdys dictation function could scaffold dyslexics in an EFL classroom, and how the tool could beneficially and effectively serve as a replacement for lack of writing and spelling abilities, for dyslexics following the standardised educational system. Additionally, since Logometrica (2022) claims AI technology could serve as a great tool for dyslexics both in terms of reading and writing, research aiming at AI technology in comparison to dyslexia-friendly software such as Lingdys, needs to be conducted in the nearest future. Nevertheless, the benefits and challenges of AI technology as scaffolding for dyslexics need attention, both inside and outside of the classroom.

Secondly, the reading comprehension task was shown to include questions that could be misinterpreted by both the researcher and the participants. For instance, question five: "According to the text, can this story inspire us to do something?". As a researcher, my interpretation of the question was quite literal, meaning that the text provided some literal things that could inspire us. Yet, reviewing the question in connection to the learner's responses, a limitation was discovered in terms of the question being hard to analyse. In other words, my second thought was: "How can there be a correct and a wrong answer to the question?". Likewise, asking what they knew about Thor's childhood and when being asked what the main idea of the extract was, reflect the same issue as stated above. Furthermore, Braaten (2020) states that comprehending a text is an individual process and each text is interpreted differently from person to person, meaning that my interpretation of the main idea might not be the same as other people's perception. Furthermore, as mentioned earlier this study lacks a mapping of the participants' previous knowledge about Thor Heyerdahl and Kon-Tiki. By adding a mapping of previous knowledge, the comprehension results would have been clearer, since the researcher could compare, and contrast comprehension results based on previous knowledge.

In terms of Lingdys as a software, a limitation implied by the participants was that they were influenced by technical issues. During the data elicitation lesson, all research group

participants suffered from Lingdys Pluss lack the willingness to work properly. These technical issues were time-consuming, however, they reflect issues that users of the software experience in the classroom. Considering that the issue has been addressed and the research has been conducted in accordance with the processes outlined earlier in this thesis, I would like to make a recommendation to Lingit. It would be beneficial for users of the software to have a guide on your website specifying the recommended computers, tablets or Chromebooks that are most compatible with Lingdys software. Lastly, in terms of spelling, a limitation was that the study only aimed at misspellings according to the phonological strategy. Dyslexics tend to lack both writing and spelling skills, in combination with a lack of decoding skills, which reflects their overall spelling (Solem, 2017; Shaywitz & Shaywitz, 2020). Expanding the research, researching how Lingdys software impacts dyslexics' EFL writing in general, in terms of for instance vocabulary, grammar and sentence structure would benefit in terms of knowledge. Furthermore, looking at dyslexics using the software compared to a non-dyslexic control group could complement Helland and Kaasa's study, and the findings from this study, by providing information on how dyslexics score compared to non-dyslexics. However, huge gaps in the knowledge of dyslexics and their disabilities connected to writing and spelling suggest that it is time for further research within this area.

6.0 Conclusion

As presented in the introduction chapter, this thesis aims at investigating if Lingdys support has an impact on 8th-grade dyslexic EFL learners' reading comprehension and spelling, and if so, in what ways. The study has attempted to gain insight into pupils' attitudes in terms of the value Lingdys support offers connected to reading comprehension and spelling. Further, research is crucial within the field, due to the overall basic skills in the new English curriculum. As far as the researcher is aware, there have been limited studies carried out on software support for dyslexics in the Norwegian EFL classroom, and the current study aims to contribute to this.

A qualitative method was used in the study, including a reading comprehension task and a questionnaire, both conducted with eight 8th-grade dyslexic EFL learners to gain insight into the research topic. Firstly, participants read an extract of a text about Kon-Tiki and Thor Heyerdahl, before writing learner texts that were analysed to examine comprehension and spelling. Lastly, the participants answered the questionnaire. The findings from the questionnaire data showed that the pupil's perceptions of the use of Lingdys software were generally highly wished for and appreciated. Further, the research group was split, where three of the participants found the software useful, and one participant did not feel that the software benefited his reading comprehension and spelling. In addition, the control group generally missed the support in both the reading and writing processes.

Based on the learner's text, comprehension was measured. Lingdys Pluss audio support supplied the learners with additional time to re-read the text one more time, which resulted in better results compared to other participants, in connection to reading comprehension. Furthermore, the results indicate that learners who did not use the software suffered faster from fatigue, compared to participants who used the software. Another finding was that pupils who lack the ability to use reading and learning strategies efficiently, also struggle using the software. However, opposite to the control group, the participant in the research group lacking the ability to use learning strategies, comprehended some elements throughout the extract. Lastly, the analysis revealed that participants from the control group lacked comprehension due to inadequate vocabulary. In contrast, these findings were not detected among participants of the research group, indicating that Lingdys software serves as a tool for understanding vocabulary, which also has a positive impact on reading comprehension. In conclusion,

Lingdys software serves learners with additional time enabling them to read the text several times, and no areas of disadvantages of using the software were discovered in terms of reading comprehension.

The most significant findings were connected to the participants' lack of spelling skills. When pupils lacked orthographic writing skills, the study revealed that they tend to use the phonological strategy in the spelling of the words. The finding clearly shows that Lingdys support does not remove all spelling mistakes made by dyslexics, however, they indicate that the number of misspelt words is reduced when using Lingdys software, especially high-frequency used words. Furthermore, results also imply that a negative aspect of Lingdys was that the software struggled to identify words spelt in Norwenglish, names and words with other meanings than what the pupils aimed to use. Another significant finding revealed that the control group reported that they missed scaffolding and help in the writing process. In addition, results indicate that using Lingdys software scaffolds the learners in the writing process, enabling them to write words according to the orthographic strategy, even when not know the orthography of the word.

The current study has attempted to show the strong relevance of using Lingdys software in EFL learning. The control group participants' misspellings, lack of answers and comprehension reveal that dyslexia in the EFL classroom is a fairly common issue. However, the thesis has argued that dyslexics struggle with decoding and spelling in EFL classes and that Lingdys software may serve as a tool towards dyslexic pupils to be more independent in their reading and writing process while being able to comprehend and spell correctly. Even though Lingdys support does not remove all spelling mistakes, or make sure that learners comprehend all aspects of a text, the software has not been proven to have a negative effect on dyslexics. On the contrary, results highlight that Lingdys support not only supply learners with additional time, but also reduces fatigue and misspellings.

Finally, findings from this study highlight the positive effect Lingdys software has on 8th-grade dyslexic EFL learners' reading comprehension and spelling. Hopefully, this research has brought awareness of this and will contribute to an increase in the use of the dyslexia-friendly software being used by all dyslexics in the EFL classroom.

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Appendices

Appendix 1 - SIKT approval



[Meldeskjema](#) / [Dyslexia in the EFL classroom](#) / Vurdering

Vurdering av behandling av personopplysninger

Referansenummer 102516	Vurderingstype Standard	Dato 17.01.2023
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Prosjekttittel
Dyslexia in the EFL classroom

Behandlingsansvarlig institusjon
Universitetet i Stavanger / Fakultet for utdanningsvitenskap og humaniora / Institutt for grunnskolelærerutdanning, idrett og spesialpedagogikk

Prosjektansvarlig
Marte Handal

Student
Charlotte Olsen

Prosjektperiode
05.11.2022 - 30.11.2023

Kategorier personopplysninger
Alminnelige
Særlige

Lovlig grunnlag
Samtykke (Personvernforordningen art. 6 nr. 1 bokstav a)
Uttrykkelig samtykke (Personvernforordningen art. 9 nr. 2 bokstav a)

Behandlingen av personopplysningene er lovlig så fremt den gjennomføres som oppgitt i meldeskjemaet. Det lovlige grunnlaget gjelder til 30.11.2023.

[Meldeskjema](#)

Kommentar
OM VURDERINGEN
SIKT har en avtale med institusjonen du studerer ved. Denne avtalen innebærer at vi skal gi deg råd slik at behandlingen av personopplysninger i prosjektet ditt er lovlig etter personvernregelverket.

TYPE OPPLYSNINGER
Prosjektet vil behandle alminnelige personopplysninger og særlige kategorier av personopplysninger (helseopplysninger).

FORELDRE SAMTYKKER FOR BARN under 16 ÅR
Prosjektet vil innhente samtykke fra foresatte til behandlingen av personopplysninger om barna (under 16 år).

Lovlig grunnlag for behandlingen vil dermed være foresattes samtykke, jf. personvernforordningen art. 6 nr. 1 bokstav a.

Behandlingen av særlige kategorier av personopplysninger er basert på uttrykkelig samtykke fra foresatte, jf. personvernforordningen art. 6 nr. 1 a og art. 9 nr. 2 a.

BARN SAMTYKKER SELV - ALMINNELIGE PERSONOPPLYSNINGER
Prosjektet vil innhente samtykke fra mindreårige (16-17 år) til behandling av personopplysninger. Vår vurdering er at barn over 15 år kan samtykke selv til behandling av alminnelige personopplysninger, og at prosjektet legger opp til et samtykke i samsvar med kravene i art. 4 og 7, ved at det er en frivillig, spesifikk, informert og utvetydig bekreftelse som kan dokumenteres, og som den registrerte kan trekke tilbake.

BARN SAMTYKKER SELV - SÆRLIGE KATEGORIER PERSONOPPLYSNINGER
Prosjektet vil innhente samtykke fra mindreårige (16-17 år) til behandling av personopplysninger. Vår vurdering er at barn over 16 år kan samtykke selv til behandling av særlige kategorier personopplysninger, og at prosjektet legger opp til et samtykke i samsvar med kravene i art. 4 og 7, ved at det er en frivillig, spesifikk, informert og utvetydig bekreftelse som kan dokumenteres, og som den

registrerte kan trekke tilbake.

FØLG DIN INSTITUSJONS RETNINGSLINJER

Vi har vurdert at du har lovlig grunnlag til å behandle personopplysningene, men husk at det er institusjonen du er ansatt/student ved som avgjør hvilke databehandlere du kan bruke og hvordan du må lagre og sikre data i ditt prosjekt. Husk å bruke leverandører som din institusjon har avtale med (f.eks. ved skylagring, nettspørreskjema, videosamtale el.).

Personverntjenester legger til grunn at behandlingen oppfyller kravene i personvernforordningen om riktighet (art. 5.1 d), integritet og konfidensialitet (art. 5.1. f) og sikkerhet (art. 32).

MELD VESENTLIGE ENDRINGER

Dersom det skjer vesentlige endringer i behandlingen av personopplysninger, kan det være nødvendig å melde dette til oss ved å oppdatere meldeskjemaet. Se våre nettsider om hvilke endringer du må melde: <https://sikt.no/melde-endringer-i-meldeskjema>

OPPFØLGING AV PROSJEKTET

Vi vil følge opp ved planlagt avslutning for å avklare om behandlingen av personopplysningene er avsluttet.

Lykke til med prosjektet!

Appendix 2 - Consent form

Vil du delta i forskningsprosjektet "Dyslexia in the EFL classroom"?

Dette er et spørsmål til deg om å delta i et forskningsprosjekt hvor formålet er å finne ut hvordan bruken av opplesingsfunksjon kan fremme/påvirke elever med dysleksis leseforståelse i engelsk som andrespråk. I dette skrivet gir vi deg informasjon om målene for prosjektet og hva deltakelse vil innebære for deg.

Formål

Formålet med denne oppgaven er å få innsikt i hvordan man gjennom opplesingsfunksjon kan ivareta og tilrettelegge undervisningen i engelsk som andrespråk, for elever med dysleksi. Videre ønsker jeg å bidra med innsikt i hvilke opplevelser og erfaringer elever med dysleksi har med tanke på tilpasning og tilrettelegging i engelsk, i håp om å bevisstgjøre nåværende og fremtidige lærere på hvordan å best tilrettelegge for dyslektikere i engelsk som andrespråk. Derfor ble problemstillingen min: ***In what ways does the use of audio support have an impact on 8th-grade dyslectic English Foreign Language (EFL) learners' reading comprehension?*** Dette forskningsprosjektet er en masteroppgave. I prosjektet ønsker jeg å studere elevenes svar på oppgaver. Deltakerne skal også reflekterer rundt bruken av opplesingsfunksjon. Dette skjer på et spørreskjema. Fokuset for refleksjonen vil være på elevenes opplevelse av bruken av programvaren.

Hvem er ansvarlig for forskningsprosjektet?

Institutt for grunnskolelærerutdanning, idrett og spesialpedagogikk (IGIS) er ansvarlig for prosjektet. IGIS er en del av fakultet for utdanningsvitenskap og humaniora ved Universitetet i Stavanger.

Hvorfor får du spørsmål om å delta?

Du får spørsmål om å delta fordi jeg ønsker å komme i kontakt med flere elever på ungdomstrinnet med dysleksi. Rektor ved din skole har godkjent at jeg kontakter deg, med en påvist dysleksi diagnose. På grunn av alderen din, vil dine foresatte måtte godkjenne din deltakelse.

Hva innebærer det for deg å delta?

Dersom du velger å delta i prosjektet innebærer det at du skal gjennomføre en oppgave i løpet av en skoletime. En gruppe elever skal lese og skrive uten hjelp fra lærer eller digitalt verktøy for dyslektikere, mens en annen gruppe elever skal gjøre de samme oppgavene ved hjelp av digitale

verktøy. Dine svar på spørsmålene blir registrert digitalt og lagret kryptert for analyse. Videre vil det på slutten av økten bli lagt opp til at du som elev får et spørreskjema om hvordan du opplevde din arbeidsmetode. Dette vil du svare på skriftlig/via å lese inn dine svar til et transkriberingsprogram (tilpasset dyslektikere, slik at skriving ikke er nødvendig). Spørreskjemaet vil innebære noen spørsmål rundt temaene: fikk du lest hele teksten, hadde du god nok tid, fikk du med deg det du leste, hvordan likte du arbeidsmetoden, foretrekker du denne arbeidsmetoden fremfor motsatt metode – hvorfor? Dersom foresatte ønsker, er det mulig å se dette spørreskjemaet på forhånd. Ønsker du det, er det bare å ta kontakt (se kontaktinformasjon under).

Det er frivillig å delta

Det er frivillig å delta i prosjektet. Hvis du velger å delta, kan du når som helst trekke samtykket tilbake uten å oppgi noen grunn. Alle dine personopplysninger vil da bli slettet. Det vil ikke ha noen negative konsekvenser for deg hvis du ikke vil delta eller senere velger å trekke deg. Jeg ser viktigheten av å presisere at det kun vil være denne ene time som inngår i dette forskningsprosjektet, ikke annen undervisning på skolen.

Ditt personvern – hvordan vi oppbevarer og bruker dine opplysninger

Vi vil bare bruke opplysningene om deg til formålene vi har fortalt om i dette skrevet. Vi behandler opplysningene konfidensielt og i samsvar med personvernregelverket. Det vil kun være jeg og prosjektansvarlig som har tilgang til opplysningene dine og svarende dine. Navnet ditt og kontaktopplysninger vil holdes adskilt fra resten av dataen og lagres på et eget dokument med en **krypteringskode**. Du vil ikke kunne gjenkjennes ved publisering av masteroppgaven, og navnet ditt vil ikke bli brukt i oppgaven min, da det vil bli erstattet med **tall eller fiktive navn**. Jeg vil også lagre besvarelsen din på et eget dokument med en **krypteringsnøkkel** som kun jeg har tilgang til.

Hva skjer med personopplysningene dine når forskningsprosjektet avsluttes?

Opplysningene anonymiseres når prosjektet avsluttet, noe som etter planen er 30.11.2023. Når oppgaven godkjennes, vil alle opplysninger om deg og datamateriale produsert av deg bli slettet, og vil ikke lenger være tilgjengelig for student eller prosjektleder.

Hva gir oss rett til å behandle personopplysninger om deg?

Vi behandler opplysninger om deg basert på ditt samtykke. På oppdrag fra Universitetet i Stavanger har Personverntjenester vurdert at behandlingen av personopplysninger i dette prosjektet er i samsvar med personvernregelverket.

Dine rettigheter

Så lenge du kan identifiseres i datamaterialet, har du rett til:

- innsyn i hvilke opplysninger vi behandler om deg, og å få utlevert en kopi av opplysningene
- å få rettet opplysninger om deg som er feil eller misvisende
- å få slettet personopplysninger om deg
- å sende klage til Datatilsynet om behandlingen av dine personopplysninger

Hvis du har spørsmål til studien, eller ønsker å vite mer om eller benytte deg av dine rettigheter, ta kontakt med Universitetet i Stavanger ved:

- Student: Charlotte Olsen, mobil: [REDACTED], epost: char.olsen@stud.uis.no
- Prosjektansvarlig: Marte Handal, epost: marte.handal@uis.no
- Personvernombud ved Universitetet i Stavanger: epost: personvernombud@uis.no

Hvis du har spørsmål knyttet til Personverntjenester sin vurdering av prosjektet, kan du ta kontakt med:

- Personverntjenester ved SIKT på epost (personverntjenester@sikt.no) eller på telefon: 55 58 21 17.

Med vennlig hilsen

Charlotte Olsen
(Student veileder)

Marte Handal
(Prosjektansvarlig)

Samtykkeerklæring

Jeg har mottatt og forstått informasjon om prosjektet «*Dyslexia in the EFL classroom*» og har fått anledning til å stille spørsmål. Jeg samtykker til:

- å delta i undervisningstimen hvor det jeg produserer kan brukes til forskningen
- å delta ved å svare på et spørreskjema etter undervisningstimen

Jeg samtykker til at opplysninger om _____, mitt barn, behandles frem til prosjektet er avsluttet

(Signert av prosjektdeltakers foresatte, dato)

Appendix 3 - Kon-Tiki (extract)

Kon-Tiki

Thor Heyerdahls amazing raft trip

By Bente Roestad, translated by Alison Sollie.

Kon-Tiki - an amazing journey

It is now 65 years since Thor Heyerdahl and his crew set out on their journey over the Pacific Ocean on a raft made of balsa wood. Unlike what the experts had claimed, they proved that it was not only possible but also probable that people could have crossed the sea in simple vessels and settled on faraway islands.

I wrote about their strenuous experiences 10 years ago, with a lot of help from Thor Heyerdahl and Knut Haugland. Since then, I have been invited to visit libraries, schools and cultural arenas throughout Norway to tell people about this amazing raft journey. The Kon-Tiki Museum in Oslo is constantly being visited by people from around the world, books on the journey have been published in many languages, and in 2012 a new Norwegian feature film was released that made this story of interest once again. So why is there still so much interest in the Kon-Tiki journey? I think it is because the story of Kon-Tiki is a real-life fairytale. It has the magical ingredients of the Jack and the Beanstalk and David and Goliath stories: the inventive little person who wins against a much stronger opponent. If you have faith, conviction and perseverance, you can win even if you are facing a lot of opposition. These stories inspire us to go beyond our own boundaries, follow our dreams, dare to take chances and act based on our own convictions.

"I've crossed the world's biggest oceans but I've never seen any boundaries. I think boundaries are something that are inside people's heads," said Thor Heyerdahl.

Thor the explorer

Thor Heyerdahl decided when he was just a little boy that he wanted to be an explorer when he grew up. He was born on 6 October 1914 and grew up in a town called Larvik.

He started to go on expeditions at an early age. In the ponds behind the house where he and his family lived there were frogs, tadpoles and salamanders. Thor collected insects and all kinds of small animals that lived on land and in the water. Down by the beach, he gathered starfish, sea urchins and all the shells and snail-shells that he could find. When the other boys dreamed of becoming policemen or pilots, Thor was determined to be "someone who studies animals".

One of the things he liked best was to go with his mother to the Zoological Museum at Tøyen in Oslo. He never grew tired of studying all the animals they had exhibited there. "Imagine if there had been a museum like that in Larvik. I really wish there was", thought Thor. When the fishing boats came into the harbour, Thor was given octopuses and other sea animals which he put in sealed glass jars.

Thor was given a large room in an old stables which he made into a little museum. He spread sand on the floor and laid shells and dried starfish over it so that it would look like the beach. On the shelves, he put everything from conch shells to butterflies and centipedes. He called the museum "The Animals' House". His friends in the neighborhood thought it was fun to help him and everyone who wanted to could come in and take a look.

Fear of water

When Thor was five years old, he fell through the ice covering a pond. He had seen some big boys hop from one patch of ice to another and decided to try to do the same. He stepped onto one piece of ice but flipped over and he disappeared under the ice. He fell down into a black hole surrounded by white ice but, when he was under water and looked up, the hole was white and the ice was black. This is because light passes through water more easily than through ice. That confused him. He struggled to get to the black bits because he had fallen down through the black hole, but he just hit his head on the ice. He was fighting for his life until some of the big boys saw his boots and managed to pull him out of the water. Five years later, when Thor was 10 years old, he almost drowned again. He went under the water three times before someone managed to save him. Thor developed a fear of water and this lasted until he was over 30 years old and learned to swim.

Thor and Liv took three months to get to Fatu-Hiva. This beautiful south sea island was far away from the routes normally travelled by ships, so they had to travel to Tahiti first. There, they were allowed to live with Teriieroo, the local chieftain. He adopted them, as was the custom in Tahiti, and gave them the name "Mr and Mrs Blue Sky". In Tahiti, they were taught how the natives lived. They learned to catch crawfish using a spear, to light a fire using sticks and bake fish in an earth oven.

Finally, Thor and Liv arrived at Fatu-Hiva. This was a really beautiful island. Here, they could live close to nature, study the animal life and find all the food they needed in the forest and water around them. They found bananas, papayas, mangos and oranges in the trees and fish in the water. Coconuts were used as cups and huge mother-of-pearl shells acted as plates.

Appendix 4 - Reading comprehension questions

Reading comprehension task

- 1) What is the main idea of the text?
- 2) What happened in the book? Can you tell me what happened in order?
- 3) According to the text, what happened 65 years ago?
- 4) Why does the author of the text think there still is so much interest in the Kon-Tiki journey?
- 5) According to the text, can this story inspire us to do something?
- 6) What do you know about Thor Heyerdals childhood?
- 7) What did Thor dream of becoming as a grown up, according to the text?
- 8) What did Thor like to do in his spare time, and what was it that he liked to do best out of these things?
- 9) What happened to Thor when he was five years old, please explain.
- 10) What happened to the live adder that Thor had caught, please explain.
- 11) After Thor started to study zoology, which is the scientific study of animals, what did he dream of for the future?
- 12) According to the text, why was the ice black when Thor looked up at it?
- 13) How did Thor meet Liv for the first time, and what was their conversation about?
- 14) Please explain, how did Thor and Liv live "the rest of their life" according to the extract? What did they eat, where did they live, how was it there, etc. (write as much as you remember).

Appendix 5 - Questionnaire

Spørreskjema

- Hva er ditt biologiske kjønn?
 - Jente
 - Gutt
- Karakter i engelsk til jul i 8. klasse
 - 1
 - 2
 - 3
 - 4
 - 5
 - 6
 - Ønsker ikke å svare
- Hvor mange ganger leste du teksten?
 - 1
 - 2
 - 3
 - 4
 - 5 eller flere
- Jeg brukte Lingdys Pluss?
 - Ja
 - Nei
 - Dersom ja;
 - Jeg brukte diktering (snakke inn mine egne setninger for å skrive svar).
 - Jeg brukte opplesningsfunksjonen for å lytte til teksten.
- I hvilken grad var programmet lett å bruke?
 - Veldig stor grad
 - Litt stor grad
 - Litt liten grad
 - Veldig liten grad
- I hvilken grad var programmet nyttig?
 - Veldig stor grad
 - Litt stor grad
 - Litt liten grad
 - Veldig liten grad
- I hvilken grad var det nyttig at du fikk teksten opplest?
 - Veldig stor grad
 - Litt stor grad
 - Litt liten grad
 - Veldig liten grad
- I hvilken grad mener du at du fikk med deg mer av tekstens innhold ved å bruke opplesningsfunksjonen, i forhold til om du skulle lest det selv?
 - Veldig stor grad
 - Litt stor grad
 - Litt liten grad
 - Veldig liten grad

- I hvilken grad vil du bruke Lingdys Pluss (opplesningsfunksjon) i engelsktimer fremover?
 - Veldig stor grad
 - Litt stor grad
 - Litt liten grad
 - Veldig liten grad
- I hvor stor grad hjalp det at du kunne snakke inn svarene på spørsmålene fremfor å skrive?
 - Veldig stor grad
 - Litt stor grad
 - Litt liten grad
 - Veldig liten grad
- I hvilken grad vil du bruke Lingdys Pluss (dikteringsfunksjon) i engelsktimer fremover?
 - Veldig stor grad
 - Litt stor grad
 - Litt liten grad
 - Veldig liten grad

- I hvilken grad savnet du lesehjelp?
 - Veldig stor grad
 - Litt stor grad
 - Litt liten grad
 - Veldig liten grad
- I hvilken grad savnet du skrivehjelp?
 - Veldig stor grad
 - Litt stor grad
 - Litt liten grad
 - Veldig liten grad

- I hvilken grad var det vanskelig å holde fokus?
 - Veldig stor grad
 - Litt stor grad
 - Litt liten grad
 - Veldig liten grad

- Annet du vil legge til? (Bruk gjerne "Lingdys Pluss diktering" for å svare her):