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# Physically active children in the English classroom

A mixed-method study on 4<sup>th</sup> graders ability to remember English vocabulary

Master's thesis in Fagdidaktikk – studieretning engelsk og fremmedspråkdidaktikk

Supervisor: Karen Bauer

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Faculty of Social and Educational Sciences  
Department of Teacher Education



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# Abstract

This study investigates how physically active lessons can improve Norwegian 4<sup>th</sup> graders ability to remember English vocabulary. Word-learning is an important part of English education and it is therefore interesting to investigate if physical activity could be a beneficial method when teaching vocabulary. It is desired that students remember the English vocabulary they learn at school, and therefore this study focuses on physical activity and the long-term memory of English vocabulary. This study aims to provide additional research on physically active lessons in Norway and suggests a physically active way of approaching vocabulary learning.

The main aim was to study how physically active lessons can improve the participants ability to remember English Vocabulary. Consequently, I conducted this project in a group of thirty-six fourth graders in a Norwegian primary school. An intervention lesson consisted of a relay method and a classroom method, conducted by their teacher and myself. This is a mixed-method study, where the data collection consists of a short-term test, three intervention lessons, questionnaire and long-term tests.

The results indicated that students like relay the most. 60% of the girls and 80% of the boys preferred relay compared to writing the words in the classroom. The participants also remembered the most words from the relay method. The short-term score was used to determine their vocabulary proficiency and by comparing the results from the short-term test and long-term test, links could be made. Sixteen out of thirty-six participants were available for a frequency analysis including the results from the short-term test and the long-term tests. This analysis resulted in findings showing that the ones who scored the best on the short-term test were also the ones who had the highest response on preferring the classroom method. In addition, there was five students who remembered most from the classroom method, four of these, scored above 30 points (out of 38points) on the short-term test. Conversely, the most interesting finding was that the students who scored below the 29points on the short-term test, seemed to have benefited the most from the relay method.

This study confirms that students seem to remember more words when they are active during the learning of new words, although, this study includes a small selection and the findings needs to be reviewed in the light of the limited sample. Students seem to prefer the relay method, they learn the most from the relay method. Additionally, it seems like the students with a lower proficiency could in particular benefit from the relay method. These indications can contribute to the further research in the area of physically active lessons and English education.

# Sammendrag

Denne studien undersøker hvordan fysisk aktive timer kan forbedre norske 4. klassinger sin evne til å huske engelsk vokabular. Ordlæring er en viktig del av engelskundervisning, og det er derfor interessant å undersøke om fysisk aktivitet kan være en fordelaktig metode for ordlæring i undervisningen. Det er ønskelig at elevene husker de engelske ordene de lærer i undervisningen, og dette skaper grunnlaget for å forske på fysisk aktivitet og langtidsminne av engelsk vokabular. Denne studien har som mål å tilføye forskning på emnet fysisk aktive timer i Norge, og foreslår en aktiv måte å undervise i engelsk vokabular.

For å undersøke hvordan fysisk aktiv undervisning kan forbedre deltakernes evne til å huske engelsk vokabular, benyttet jeg meg av en prosjektmetode med en gruppe av 36 4.klassinger på en norsk barneskole. Intervensjonstimerne bestod av en stafett metode og en klasseroms metode, gjennomført av elevenes lærer og meg. I denne studien benyttes en metodetriangulering, hvor data innsamlingen besto av en korttidsminne test, tre intervensjons timer, spørreundersøkelse og langtidsminne tester.

Funnene i denne studien tydet på at elevene likte stafett metoden best. 60% av jentene og 80% av guttene foretrakk stafett fremfor å skrive ordene i klasserommet. Deltakerne husket også flest engelske ord fra stafett metoden. Korttidsminne testen ble brukt for å gi indikasjoner på deres vokabular kompetansenivå. Når man sammenligner resultatene på korttidsminne testen og langtidsminne testen, er det mulig å se en sammenheng. Seksten deltakere var aktuelle for en frekvens analyse som inneholdt resultatene fra korttidsminne testen og langtidsminne testene. Et av funnene var at elevene som hadde best resultat på korttidsminne testen var også de som hadde høyest andel svar på at de likte klasseroms metoden best. Fire av fem elever som husket mest fra klasseroms metoden, hadde over 30 poeng på korttidsminne testen. Det mest interessante funnet var at elevene som hadde under 29 poeng på korttidsminne testen, så ut til å ha mest fordel av stafett metoden.

Denne studien bekrefter at elever synes å huske flere engelske ord under en fysisk aktiv undervisningsøkt. Samtidig er utvalget i denne studien lite, og funnene må ses i lys av dette. Funnene tyder på at elevene verdsatte å lære engelske ord gjennom stafett. Elevene lærte mest av denne metoden og elever med lavere kompetanse i engelsk vokabular så ut til å dra størst nytte av stafetten. Disse funnene kan være et bidrag for videre forskning på fysisk aktive timer innenfor undervisning i engelsk.

# Acknowledgements

As a teacher I have been fortunate enough to spend time with students at all ages when working at primary schools. During my time in the classroom, I have experienced that some of the teaching methods used could be renewed, and I find especially glossary tests as a procedure that could be improved. In addition, students spend most of the time during the school day sitting at their desk, and I believe that physical activity could have a positive impact on their learning. The social aspect of physical activity is also present, which can be a foundation for a successful learning environment.

I started my master degree in order to research the outcome of physically active lessons and I wanted to look into this method related to English education. With this specific interest, I was delighted when realising that NTNU had a master degree that suited my interests. I would like to thank Anita Norman who was the first person I came in touch with at NTNU and who reassured me that I could write the master thesis I have planned at NTNU. I would also like to give a sincere thank you to my perfect supervisor Karen Bauer, who has inspired me by her own research as well as she has provided her great support during this period of time.

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# 1 Introduction

When looking into a 4<sup>th</sup> grade classroom, you might want to see 24 students sitting still with expectation and motivation in their eyes. You want them to want to learn and to have an inner motivation for learning English, although this could be difficult to achieve. Motivated students might want to increase their English vocabulary whenever they can, but what about students who lack this motivation? These students could affect the other students in the class negatively, which make teachers think of ways to motivate the whole class as a group. However, there seem to be a routine in many English classrooms of having vocabulary of the week, with a glossary test in the end of the week. Do vocabulary tests increase their learning? I believe that glossary tests might have a negative impact on their motivation for learning English and learning in general. The method of learning something only for a test, should be decreased to a minimum. When teaching to a test and learning for the benefit of a test, the students might not see the long-term purpose for learning the words. There might not be a correct way to teach vocabulary, but most teachers agree that it is important to vary the teaching methods. With this paper I want to give an example of how physical activity could be implemented in the English classroom. Furthermore, I want to demonstrate that there are other ways of teaching vocabulary, and that physical activity could be one of the ways of teaching vocabulary that might also have positive effects on the memorisation on vocabulary.

A school class consists of individuals with different prerequisites which need to be taken in consideration when teaching. My experience from being a teacher indicates that at least one of these individuals will struggle with their concentration and sitting still at their desks for various reasons. These students are the ones one should keep an extra eye on, and it is of particular importance to find methods that include students actively in the class and gives them positive experiences with learning. Some students who struggle with the classroom situation are active students who are eager to use their energy. No matter if students like to sit still or not, I will argue that students move their bodies only occasionally during the school day. They sit still most of the day, and if there is a chance of moving instead of sitting still, the opportunity should be used. The classrooms might not always be as harmonic as desired, and the students often feel restless, and a restless child might not learn as much as intended. What if physical activity could actually increase their vocabulary acquisition?

## 1.1 The context of this study

The Norwegian department of education and training (2017) includes the aspect of inclusive learning in their core curriculum - values and principles for primary and secondary education. They mention that the school should develop an inclusive environment that promotes health, well-being and learning for all. In 2009 (Opplæringsloven, 2009, § 1-1a) they added 76 extra hours in total for year 5 to year 7, designed to increase the amount of physical activity. The 76 hours should be spread over the course of 570 school days. They explain that the hours should not be divided into only a few minutes per day, and they state that it will for instance be inexpedient to include only 10 minutes physical activity per day (The Norwegian department of education and training, 2009, p. 3). Therefore, it seems like they would prefer for half an

hour of physical activity two times a week to be added. In addition, they mention that there are no requirements regarding using staff that are qualified to teach, but the school owner can decide what is expedient (The Norwegian department of education and training, 2009, p. 4). This rather vague guideline seems to be practiced differently at each school. I have experienced both 20 minutes of physical activity twice a week as a part of their normal break, as well as 30 minutes at the end of the school day, where they could also play cards or boardgames. Both schools had one or two teaching assistants to implement the physical activity for 70 students at once. There is a huge potential in physical activity during the school day, and even though The Norwegian department of education and training (2009, p. 3) warn about only having 10 minutes of physical activity, Bartholomew et al. (2018) suggest otherwise. They found a significant increase on *time on task* in 4<sup>th</sup> graders after only 5-15 minutes active learning. *Time on task* was measure by observing the student ´s attention to their task, hence, they became more concentrated on their task after active learning (Bartholomew et al., 2018)

The 76 hours extra is a start in creating a more dynamic, creative and active school day for our students, and in 2017 the Norwegian parliament set a suggestion for one-hour physical activity each day for students at year 1 to year 10. Even though the government did not act on the suggestion, there seem to be some positive thoughts regarding more physical activity during the school day. This context will also urge English teachers to look for active learning in their English lessons, and therefore it is interesting to look at the effects it has on vocabulary learning. There have been several studies on physical activity and the effect on academic performance, however some of them struggle to find significant effects. One of the studies that inspired me to investigate the aspect of active learning closer was the Active Smarter Kids intervention study, conducted by Resaland and his colleagues (2016) in Sogn og Fjordane, since they also stated that there was still inadequate evidence to conclude that physical in school activity increased academic achievement in children. Resaland and his colleagues (2016) used the standardized national test and control schools to investigate if the children in the intervention study increased their academic performance. To add to this research, I wanted to study a specific aspect in English education instead of a general approach as Resaland (2016). This study includes a specific research area which is active learning as a method for remembering English vocabulary. This area of research has to my knowledge not been researched in a Norwegian context before and will therefore add a new aspect of research in the area of physically active lessons and active learning.

## 1.2 Social constructivism

Before starting this project, it was important to look into the different epistemologies to place my research in a field of different theories. Epistemology could be explained as the principle of knowledge, and the question we should ask us is how do we know that we have acquired accurate knowledge (Postholm & Jacobsen, 2018). In social constructivism, one would state that knowledge is something that occurs through speech in a social society (Postholm & Jacobsen, 2018). This way of reviewing knowledge, could be adapted to my research regarding the teaching method used in the intervention. The students are part of a classroom environment that they are socially engaged in, and when they are interacting with each other or the teacher, knowledge is created. Social reality will differ from the natural one and will not be constant over time and therefore be in constant change (Postholm & Jacobsen, 2018). Therefore, it could be difficult to generalise the results, and researcher ´s knowledge and interpretation could also differ during the project without even noticing. Moreover, it is stated by Postholm & Jacobsen

(2018) that as humans we will act and interact, which establishes a reality who will be in constant change. Postholm & Jacobsen (2018) argue that in social-constructivism one believes that it will be impossible to differentiate between the object studied and the one who studies it. This could be especially difficult in action research when the one who studies takes part in the interaction. Furthermore, they mention that we do not necessarily perceive objects as it is presented, but we construct an interpretation of the object. In other words, our understanding of reality is not the reality but our understanding of reality (Postholm & Jacobsen, 2018). The aspect of social constructivism is important to keep in mind, because it can explain some of the challenges one meets when doing research. My observation is a created reality and one cannot exclude that others could have experienced the lessons differently.

### 1.3 The research question

The purpose of this action research study was to learn how active lessons could improve student's ability to remember English vocabulary. Which lead me to this research question:

*How can physically active lessons improve Norwegian 4<sup>th</sup> graders ability to remember English vocabulary?*

In order to answer the question, I conducted a mixed-method study, that included an intervention for seventy fourth graders in a period of four weeks plus the three long-term tests conducted during three weeks. The consent form was distributed, and the sample ended up consisting of thirty-six students. The students had three lessons that included a classroom situation where they learned five words, and thereafter a relay on the stairs where they learned five new words. A short-term test, questionnaire and long-term tests were conducted to investigate the students short- and long-term memory as well as their experience with the methods.

### 1.4 Structure of the text

In this text, both physically active lessons and active learning will be used to describe an interpretation of physical activity in the classroom. This means both physical activity with academic content and physical activity as in active breaks. The text is structured in seven chapters, starting with the introduction where the reason for choosing to conduct this study and background information was outlined. Chapter 2 includes the theoretical background, where the first section is for establishing the view of learning for this study as well as a general theory and research on the area of vocabulary acquisition and word-learning. As the main purpose is to investigate how physically active lessons could improve the students ability to remember English vocabulary, it is desirable to review the research on how physical activity could facility for long-term memory of English vocabulary. The last section in chapter 2 is about the previous research on physically active lessons and the positive effects on interpreting physically active lessons. Chapter 4 included the conduction of the analysis and chapter 5 displays the results from the analysis. In chapter 5 the results from the questionnaire, short-term test and long-term tests will be displayed as well as comparison between the results made. In Chapter 6 the results will be discussed in the light of the theoretical background. Finally, the conclusion constitutes chapter 7.

## 2 Theoretical framework

The purpose of this chapter is to more closely consider the aspect of physical activity and recall of English vocabulary. There are different theories that are interesting to study, but especially previous research is granted a large focus in this chapter. Social cultural theory is the first aspect that will be outlined, to base this paper in a social cultural view of learning. The next section is about Vocabulary acquisition, and hereafter it is necessary to look into brain science and memory. Both brain science and the theories and research of memory are important when considering how physical activity can increase memory and the brain activation. Secondly, the core of the paper is physical activity and vocabulary learning, and these sections encompass previous research on the area. Finally, the studies physically active lessons will be revised.

### 2.1 Social cultural theory

The main perspective in this thesis is the recall of word and physical activity. In addition there is an overall focus on social interaction. The social interaction which the students are constantly a part of, needs to be addressed as a constant aspect in my research. The social interaction and cooperation could be beneficial in their social development, as well as enjoying their time together as a results of the physical activity could give the students positive experiences with their peers (Vingdal, 2014). Physical activity could be a part of the acquisition of social competence, as when solving conflicts and working together in teams. Moreover, some physical activity as relays and team activities force them to cooperate. The social aspect of physical activity could be just as important as the physical effect.

Lantolf and Thorne (2007) state that the most important forms of human cognitive activity develop through interaction when participating in cultural, linguistic and historically forms settings, such as family life and in institutional contexts like schooling and organized sports activities. Moreover, they mention that language is the most pervasive and powerful cultural product that humans possess to negotiate their connection to the world, to each other and to themselves. This statement also explains why learning a second language can expand the horizon for the students. The social interaction in the classroom will also facilitate the students to work in their zone of proximal development. *The zone of proximal development defines those functions that have not yet matured but are in the process of maturation, functions that will mature tomorrow but are currently in an embryonic state* (Vygotsky, 1978, p.86). It could therefore be anticipated that students work in their zone of proximal development to reach their potential, and one way of accomplishing this is to let the students interact with each other whenever possible. Active learning could be an opportunity to let students talk to their peers and help each other when needed.

To further address the aspect of social interaction and experience, it is interesting to look into Masuhara's (2016) chapter in *SLA Research and Materials Development for Language Learning* called *Brain studies and materials for language learning*. In this chapter she focuses on affect, as she explains that teachers face the challenge every day of having to persuade unmotivated students to engage with second language learning.

She also states that brain studies demonstrate how important it is that learners are given an engaging experience. Moreover, she finds it important that teachers supplement their coursebook materials with activities that learners really want to participate in, and which motivates them through enjoyment, fun, laughter and achievable challenge. *The brain is designed to enhance life by learning* (Masuhara, 2016, p. 29), and therefore it is desired that students experience that the learning opportunities that teachers provide them, actually make them feel that learning is enhancing their life. Immordino-Yang and Damasio (2007) point out the clear link between emotion and learning. When outlining that reasons for solving a math problem will range from the intrinsic reward to helping a friend or to avoid punishment. And as they state: all of these aspects have powerful emotional components. Conversely, emotion and learning are strongly attached and should be acknowledged.

The book: *Fysisk aktiv læring, et helhetlig læringssyn*, written by Vingdal (2014) reviews physically active learning in a learning perspective. Children learn with or from each other most of the time and therefore the learning environment is vital for creating space for these learning situations to take place (Vingdal, 2014). Through physical activity one could as Vingdal (2014) states, create a safe and enhanced environment. Moreover, she argues that the learner's motivation for learning has great importance for their development. Vingdal (2014) states that socio-cultural theory is all about learning in social settings and an active learner. She also holds that learners have to reach after what they do not know, but have the possibility to learn, and therefore it will be important to keep the proximal development zone in mind. Moreover, she argues that learning and context have a strong relation, hence where the learning occurs and who you learn it with matters.

## 2.2 Vocabulary acquisition

The students' vocabulary is important for their English language development. They need to acquire a certain amount of words before they will be proficient users of the English language. I will first present some fundamental aspects of word learning and thereafter include some examples on other aspects in word learning.

Learners of English will need to acquire an amount of new words, and Nation (2006), who is one of the specialists within word learning, states that an 8000-9000 word family vocabulary is needed to comprehend a written text, and 6000-7000 word families are required to understand a spoken text. Therefore, it could be claimed that a large vocabulary is crucial in second language learning. In addition to Nation, it is important to mention Norbert Schmitt who is also known for his work in second language vocabulary acquisition. Schmitt (2008) claims that learning vocabulary is a fundamental part of mastering a second language, and he argues that the quality of vocabulary knowledge is as important as vocabulary size. In addition, he argues that an explicit approach with a focus on establishing the form-meaning link could be beneficial, while one later could focus on exposure for increasing contextual knowledge.

This part of learning English is also described in *The Young Language Learner* (Hasselgren, Drew & Sørheim, 2012), in the chapter to Hestetræet (2012) where she mentions that Norwegian learners are highly exposed to English, which is increasingly important to develop their vocabulary size. The background for this statement could be caused by the interpretation of Norwegian learners watching English tv-series and movies, and playing videogames in English, as well as talking English to each other when

playing. An increased vocabulary will, according to Hestetræet (2012), help learners guess meaning when reading as well as reduce the gap between their first language (L1) and second language (L2).

### 2.2.1 Word-learning strategies

In vocabulary acquisition it is important to distinguish between the different types of knowing a word. According to Nation (2001) a word could be remembered only by memorizing the form of the word. One could also recognise the form of the word and apply some of the spelling rules, as stated by Nation (2001). Moreover, he mentions that the relation between item knowledge and system knowledge is complex. Nation (2001) explains that each word has a learning burden, where he adds that learning burden is the amount of effort it takes to learn the word. He also add that the more familiar the pattern and knowledge about similar word is, the lighter the burden will be. Regarding Norwegian learners, some words written similarly to Norwegian and therefore experience a lighter burden because the word is familiar.

Dual coding theory (DCT), is a theory that could be directly related to vocabulary learning. Clark & Paivio (1991) explain that DCT relies on a nonverbal and a verbal mental system, where the nonverbal system process imagery and the verbal mental system processes linguistic information. They also explain that the DCT is about the activation and development of the networks of verbal and imaginal representations. Further, the link between verbal and non-verbal representation join corresponding verbal and imaginal codes, which creates operations as imaging to words and naming to pictures (Clark & Paivio, 1991). They also state that within the nonverbal system there could also be connections between one image to another image. Moreover, they argue that when presenting pictures or telling students to generate images for pair of words, will increase the likelihood that words will activate mental images. These kinds of instructions are incorporated into various memory techniques that facilitate vocabulary and other school learning (Clark & Paivio, 1991).

Clark & Paivio (1991) mention that concrete words are more likely to have corresponding images than abstract words. According to DCT, Clark & Paivio (1991) argue that words derive meaning from their semantic relations with other words as well as from images and this is also the main source of meaning for abstract words that lack object referents. In an educational perspective, it is interesting that they mention that lessons containing concrete information and evoking vivid images will be easier to comprehend and remember.

Sadoski (2005) performed a dual coding view of vocabulary learning and argues that DCT can be helpful in understanding the acquisition and teaching of meaningful vocabulary. Hereafter, he mentions two main sources of meaningful vocabulary learning; Incidental learning from context and direct vocabulary instruction. According to DCT, encountering and using words in various contexts establishes a rich set of verbal and nonverbal connections, such as listening, speaking, reading and writing (Sadoski, 2005). It is also interesting that Sadoski (2005) criticizes the DCT when arguing that the aspect of pictures can distract the learner from remembering the written word form. Therefore, he also suggests that using both verbal context and imagery in the direct learning of definitions may be a highly effective combination.

When teaching vocabulary, one could use word-picture repetition and Barcroft (2007) studied how writing (copying) target words and word fragments affected intentional second language (L2) vocabulary learning. The participants tried to learn 25 Spanish



nouns by using word-picture repetition, and the ones who did not write at all scored higher, while word-writing scored higher than fragment-writing. However, he states that especially word-picture based learning is beneficial when learners have time to attempt to regain target words on their own. Barcroft (2007) argues that copying words can decrease vocabulary learning, as it uses resources that should be focused on forms and meaning. However, the sample in the study of Barcroft (2007) was small which can decrease the reliability. Thus, it seems that teachers have to remember that learners need to have time to retain the words on their own, and not only ask them to copy words. There could also be some difference between learning concrete and abstract words, and Begg (1973) discovered that a list of concrete words required less processing capacity than abstract words. Moreover, he argues that the reason for this aspect is that concrete words have both an imaginal and verbal code available in memory, while abstract words have only a verbal code. It is stated that a functional unit is a set whose elements tend to be forgotten or remembered together (Begg, 1973).

Folse (2006) examined the effect of written exercise on L2 Vocabulary retention. The participants practiced vocabulary using three different types of written exercises; one fill-in-the-blank, three fill-in-the-blank and one original-sentence-writing exercise. In other words, they used three methods where the first method consisted of writing the word one time, while the other method consisted of writing the word three times. The last method consisted of them writing a sentence including the word. The results were that the words practiced under the three fill-in-the-blank exercise, were retained much better than those under either of the two exercises. The suggestion made is that the important feature of a given L2 exercise is number of word retrievals required. In other words, the number of times that the learner meets the word plays a part in learning. However, to remember a word is complex and there will be different factors that play a part, such as how responsive they are in the learning moment (Jensen, 2005).

### 2.2.2 Gender and word-learning

In this study, the participants have been split by gender to consider if there were any gender differences in the results from the short-term test, long-term test and questionnaire. Therefore, it is desirable to explore previous research on gender and word-learning. Kaushanskaya, Gross & Buac (2013) studied whether gender difference in word learning would be observed in children. The participants were sixty-nine children in the age between 5 and 7, who learned phonologically-familiar or phonologically unfamiliar novel words in association with pictures. Kaushanskaya, Gross & Buac (2013) tested the children's retention immediately after the learning phase by using a forced-choice recognition. Their analysis uncovered a stronger phonological and referent familiarity effect in girls than in boys. The main finding was that girls outperformed boys and they are more likely to employ native-language phonological and semantic knowledge during novel word learning. In addition, they discovered that girls have an advantage in word-learning tasks only when these involved learning of familiar information, hence in a situation where their long-term knowledge of the language can support learning. On the other hand, Herlitz, Nilsson and Bäckman (1997) found a gender difference in episodic memory. Moreover, they found no difference in semantic knowledge but this study included only adults. Langeland (2012) found no gender difference in vocabulary development among Norwegian pupils in year 5 to 7. Although, she did find some results indicating that girls write longer texts which some claim could facilitate higher written proficiency in general.

### 2.3 Physical activity and vocabulary learning

Students will need to acquire many new words during their English education, and it could be considered a fundamental part of mastering a language (Schmitt, 2008). There are also different aspects of knowing a word (Nation, 2001), which make teachers think of different ways of teaching vocabulary, so that they can cover these different aspects. According to Barcroft (2007), the use of pictures could be beneficial, while Folse (2006) mentions that the number of word retrievals required by the learner seems to be the important feature in a given vocabulary exercise. The methods needed in vocabulary learning could also rely on the gender differences. Girls may seem to outperform the boys (Kaushanskaya, Gross & Buac, 2013; Langleand, 2012), but could this be caused by the way we teach? Either or, it is interesting to look at different ways of teaching vocabulary. One of the other ways of teaching could include physical activity, where students get an opportunity to move instead of sitting still. Using physical activity could be a whole different angle to teaching in general and in this case teaching vocabulary. Findings indicate that physical activity at all intensities could have a positive effect on vocabulary acquisition (Schmidt-Kassow et al., 2013; Salis, 2013; Winter et al., 2006; Liu, Kornpetpanee & Job, 2014)

The first interesting study regarding physical activity and vocabulary learning was conducted by Schmidt-Kassow et al. (2013). They studied how physical exercise could improve vocabulary learning in young female adults. The participants cycled with a light to moderate intensity while learning. They discovered that light to moderate simultaneous physical activity during encoding is beneficial for a recall of new items. Schmidt-Kassow et al. (2014) also studied how walking on a treadmill during encoding could affect the acquisition. Their study indicated that physical activity during encoding is indeed beneficial for vocabulary learning, even low to medium intensity had an effect. Salis (2013) conducted a study to investigate if cardiovascular exercise could increase cognitive recall and comprehension. The study was done on 69 adults with an average age of 21- 26 years and she discovered that high intensity exercise before or after rehearsing for a vocabulary comprehension test improved the test results. Hence, exercise could both have a reactive effect to prepare the mind for learning as well as a reactive effect on retrieving information. Said differently; the participants results could reason in a placebo effect.

Winter et al. (2006) discovered the same aspect in their study, where the participants learned words after 15 minutes relaxation, two sprints of three minutes or low impacts running for 40 minutes. Although, the moderate group stayed active for a longer period of time, the participants who sprinted performed best. The sprinting group learned vocabulary 20 percent faster than the two other groups (Winter et al., 2007). Liu, Kornpetpanee & Job (2014) had a similar study and studied Chinese L2 learners of English. They wanted to test if the learners learned most from cycling or sitting on a chair, while hearing a word and looking at a picture of the word. Furthermore, they concluded that learning foreign vocabulary while performing a simultaneous physical activity results in better performance than learning the same vocabulary while being in a static situation. This study needs to be reviewed in the light of the fact that it includes adults participants. Although, they suggest that schools should consider introducing learning supportive environments relying on physical activity. This implies that they believe that students at younger age also can benefit from a physically active way of learning.

## 2.4 Memory

To understand why physical activity could seem to affect learning and the memorization of words positively, it is interesting to look into where memory is stored and formed, which is in the brain. As shown, students learn differently and, for some, recall in general could be challenging. Teachers could benefit from knowledge about memory and how to facilitate for memorization in regard to their students. Since creating a memory requires different parts of the brain, it could be beneficial to know in which areas that takes place, so that teachers can help the brain to make these networks and pathways as strong as possible.

In a classroom situation, including tests for instance, students will need to recall what they have learned, and therefore Jensen (2005) states that memory is an essential part of learning. He also adds that a teacher only has three opportunities to help the learners remember. The first chance is in the encoding, which occurs in the students first meeting with a new word. The second chance is to help with the maintenance of the memory. Finally, students could need help to recall what they have learned. He also describes memories as dynamic and not fixed, hence a memory could be changed. More importantly, he makes it clear that the most difficult things to recall are words, names, equations or facts.

Jensen (2005) states that it starts with thousands of neurons that become activated to retrieve a memory, however more complex memories require an activation of specific networks. He argues that all of these networks have variable levels of stability and flexibility depending on the type of the encoding and the person's life exposure, such as their experience with learning, if they have tried to remember things before and, for example, the impact of their parents. Learning could be seen as the result of the strengthening of the connection between two neurons, and a single memory will involve thousands of neurons (Jensen, 2005), hence, how to strengthen the connection is important to keep in mind. In my project there will therefore be an aspect of how to strengthen these connections.

Memories are stored in different places in the brain, according to Jensen (2005), visual memories are stored in the occipital lobe which could be called the visual processing centre and language memories are stored in the temporal lobe where sound and speech are processed. The spatial memories will be stored in the parietal lobe (Jensen, 2005) which could be called the major language area and it also contributes to sensory control (Brownsett & Wise, 2010). To know how the different parts of the brain take part in an vocabulary learning situation, it is interesting to look into a study conducted by Fletcher, Shallice, Frith and Frackowiak (1996). They compared imageable words to non-imageable ones, they discovered that imageable words were associated with activation of the precuneus (part of the parietal lobe). Moreover, they experienced that recall of non-imageable words was associated with activation of the left dorsolateral prefrontal cortex (frontal lobe).

Moreover, Jensen (2005) also mentions the amygdala, where intense emotion is mediated, and the hippocampus as important areas in learning. In other words, many parts of the brain take part in a learning situation and when having to memorize what is learned, so it will be beneficial to encode and strengthen multiple pathways in order to give learners a better chance of retrieving a classroom memory (Jensen, 2005). Therefore, teachers could teach with these aspects in mind, and to strengthen multiple pathways, it could be beneficial to include all parts of the brain. An example could be to

include image, emotions and sensory experience as the parietal lobe is seen as the major language area and also contributes to sensory control. To see, touch and feel the word could perhaps strengthen more pathways which results in a long-term memory.

Jensen (2005) mentions two categories for memories; explicit learning that could be semantic, episodic or implicit memories that could be reflexive memories and motor memories. He explains that semantic memories are the ones consisting of information picked up in conversations, lectures and reading for example. This is interesting when considering teachers who spend most of their time lecturing hoping that learning will occur, but it rarely does. This is caused by the fact that semantic memory is the weakest of our retrieval systems and has limitations in both time and capacity. It is also interesting that all learning provides contextual cues, such as the location you were at the time of learning (Jensen, 2005). Additionally, it is stated by Jensen (2005) that emotional responses triggered during or straight after learning will help embed the memories, which makes one think that amusement through physical activity could trigger memories. He argues that various attributes of memories could become strengthened by use and greater frequency of activation will influence them, which is important to keep in mind as a teacher. Recall is in fact stronger when we are in the same emotional state we were in when the memory was formed (Jensen, 2005). Memory is a vital part of learning and different parts of the brain will be activated when keeping these areas in mind. One could draw the line to visual learning and learning in an environment that triggers them emotionally, as these aspects can strengthen the pathway needed to create a long-term memory.

#### 2.4.1 Short term memory and working memory

There are different theories regarding memory, and researchers have also developed different models. The chosen model for memory in this thesis consists of short-term memory, working memory and long-term memory. Surprenant & Neath (2009) mention that it is discussed if there actually is a difference between short term and long term memory. They distinguish between primary, secondary, working and immediate memory. Moreover, one could believe that if the items in the short-term store were rehearsed appropriately, they were copied into the long-term store, otherwise they were lost to decay. Surprenant & Neath (2009) argue that there is no data which supports the theory that short-term memory and long-term memory are fundamentally different from each other. They argue that; *if you process items phonologically, you can remember only a few items for a short period of time, but if you process items semantically you can remember a far larger number for far longer. The processing is the key, not the store* (Surprenant & Neath, 2009, p. 35). Kibby (2012) explains that short-term memory is used to represent short-term storage of information when distracters are not present and that it is also believed to be a limited capacity system. Furthermore, she mentions that working memory goes past short-term memory by including both short-term storage and mental operations on the information stored. In Addition, Blair (2016) state that a part of executive function is also the ability to hold information in working memory.

To distinguish between short-term memory and working memory, it is beneficial to look into Baddley & Hitch (1974), who suggest that working memory represents a control system that has limits on both storage and processing capabilities. Moreover, they suggest that working memory transfer information to long-term memory. In 1981, Baddley (1981) states that the experiments that he and Hitch conducted started his modifying of the view of short-term memory and replaced it with the concept of working

memory. He explains that their finding was based on the fact that even though short-term storage was loaded with secondary tasks, one could still perform in verbal reasoning or learning lists of words. Therefore, he concludes that working memory refers to the role of temporary storage in information processing. Cowan (2008) conducted a literature review to investigate the difference between short-term, long-term and working memory. He explains working memory includes short-term memory and other processing mechanism that help to make use of short-term memory, however, he also mentions that this differs from the researchers who would like to reserve the term as only being attention-related aspects of short-term memory.

## 2.5 Physical activity, Brain and memory

Many parts of the brain will take part in creating a memory and restoring it (Jensen, 2005). More interestingly, Jensen (2005) raises an important question - how to strengthen the pathways between the different parts of the brain (Jensen, 2005). Even though there are some alterations in individuals learning, a memory will still consist of a connection between neurons, which will need strengthening to remain as a memory (Jensen, 2005). It seems like one way of strengthening the connection between neurons could include physical activity. As it is stated, dopamine and brain-derived neurotrophic factor (BDNF) could be factors that helps strengthening a memory (Shohamy & Adcock, 2010; Hötting et al, 2016; Dongen, et al., 2016). Furthermore, Hötting et al. (2016) mention that several studies argue that memory could benefit from physical activity and some studies indicate that exercising before or during learning could affect long-term memory.

There are findings which imply that the release of dopamine, before, after and during an event, will support the hippocampal memory formation (Shohamy & Adcock, 2010, Hötting, Schickert, Kaiser, Röder & Schmidt-Kassow, 2016). A Study led by Breitenstein et al. (2005) has shown that retrieval of new vocabulary relies on hippocampal activity during encoding. It is also interesting that hippocampus and fusiform gyros (part of temporal lobe) activities decrease with an increased vocabulary proficiency (Breitenstein et al., 2005).

Hötting et al. (2016) wanted to study what effect exercising had on learning vocabulary, and therefore they had three groups where two of them exercised for 30 minutes after they have learned new vocabulary in Polish. One group exercised with high intensity, while the other group had a low intensity in their 30-minute training. The last group relaxed for 30 minutes. The relaxing and low-intensity group did not differ in their brain-derived neurotrophic factor (BDNF) level, but there was an increase of BDNF in the high-intensity group. The increase in coherence to recalled words was not significant, but they did not seem to forget any learned words after 24 hours, while the relaxing group had a significant decrease. Hence the high-intensity group retained more of the initially learned words.

This finding was also discovered by Winter et al (2007), who studied the impact on running and vocabulary learning. The group who ran two sprints of three minutes at increasing speed, also shows the highest increases in BDNF. They also learned 20 percent faster compared to the other two conditions, the relaxed condition and 40 minutes of low impact running. More interestingly, Winter and his colleagues (2007) discovered that epinephrine (also known as adrenaline) concentrations correlated with long-term retention of vocabulary. In conclusion, they state that BDNF is related to short

term memory, and one could therefore take advantage of acute exercise when needing an immediate boost of learning. However, it is important to mark that BDNF could also affect long-term memory as discovered by Dongen et al. (2016). They conducted a report and argued that the long-term memory process requires factors such as dopamine, noradrenaline, and BDNF, hence without a release of these factors around the time of encoding, memories will decrease rapidly. Shohamy and Adcock (2010) reviewed recent studies on dopamine and memory. They argue that evidence applies that dopamine is released during physical activity and is also known as a factor in motivated behaviour as shown in the review of recent studies done by Shohamy and Adcock (2010). They argue that dopamine seems to be vital for animals' hippocampal long-term memory. Additionally, they state that the release of dopamine before, after and during an event, will support the hippocampal memory formation.

One could state that there is an obvious link between movement and learning, such as the fact that oxygen is essential for brain function and enhanced blood flow increases the amount of oxygen transported to the brain (Jensen, 2005). More importantly, the baseline of new neuron growth is increased when exercising as stated by (Jensen, 2005). Furthermore, physical activity could also prevent cognitive decline (Sofi et al., 2011). A meta-analysis was conducted by Sofi et al. (2011), and the analysis included available studies that investigated the association between physical activity and the risk of cognitive decline. Their results showed that individuals who performed a high level of physical activity were significantly protected (-38%) against cognitive decline. Additionally, low-to-moderate level exercise also showed a significant protection (-35%) against cognitive decline. All of these studies imply that dopamine and BDNF are factors that affect hippocampus long-term memory, and that physical activity seems to increase the production of these factors. This aspect seems to be the main argument for why physical activity could increase long-term memory.

## 2.6 Physical activity and learning

Clancy (2006) explains how new perceptions received through the senses are encoded, and the sensory area tries to match these patterns to what already is stored. Moreover, it is mentioned that if the new data does not fit, the sensory input is disregarded. If the pattern is recognized, or the sensory data captures the attention of the brain, you will become aware of it and the brain will then store the new data in working memory or short-term memory (Clancy, 2006). To be able to move new perceptions to long-term memory, the new data/sensory perceptions have to be associated with previous patterns or the stimuli has to get further conscious attention, as stated by (Clancy, 2006). It is also interesting that Clancy (2006) argues that long-term memory lets us recall what we have experienced previously, if we have processed or practiced that experience an adequate number of times. Furthermore, she makes a connection between physical activity and the brain when referring to Kinoshita (1997), who states that when the body is inactive for 20 minutes or longer, the neurons ability to communicate with each other declines.

Jensen (2005) problematizes that the school model for formal learning is still sit and listen. Moreover, the part of the brain that processes movement is the same part that processes learning, and that most neuroscientists agree that movement and cognition are powerfully connected (Jensen, 2005). It is also explained by Jensen (2005) that the area of the brain that is most associated with motor control is the cerebellum, where impulses travel through nerve tracts back and forth including the visual system and the

sensory cortex. More importantly, he marks that this area is vital to our attentional system, because it regulates incoming sensory data. Furthermore, it is stated that this interaction helps us keep our balance, turn thoughts into actions and coordinates movements (Jensen, 2005). It is interesting how the cerebellum can make predictive and corrective actions unrelatedly of whether it is dealing with a gross-motor task sequence or a mentally rehearsed task sequence (Jensen, 2005).

## 2.7 Physically active lessons

Physical activity at school could be integrated into the curriculum and the terms used are active learning or physically active lessons (Resaland et al., 2016; Mullender-Wijnsma et al., 2016). These lessons could consist of active breaks, relays, orienteering and similar activities to keep learners active while learning. Some studies conducted interventions including physically active lessons (Resaland et al. 2016; Mullender-Wijnsma et al., 2016; Donnelly et al., 2009), lasting for a regular lesson, while other studies investigating the effect of small bouts of exercise during a lesson (Bartholomew, Jowers, Errisuriz, Vaughn & Roberts, 2017). One of the most interesting aspects of these studies is if there are any findings of an increased academic performance. However, any effects are interesting and could influence the way teacher teach.

One of the studies was conducted in Norway between November 2014 and June 2015, including 1129 fifth-grade children on 28 intervention schools (Resaland et al. 2016). The intervention conducted by Resaland et al. (2016) consisted of: 1) 90 min/week of physically active lessons, 2) 5/day of physical activity breaks during classroom lessons and 10 min/day physical activity homework. Resaland and his colleagues (2018) studied the academic effect on their Active Smarter Kids (ASK) study. Among other tests, they also tested the children's ability to find information and to understand main content in an English text. The English language in Norway is some students second language, while children with other mother tongues might have English as their third or fourth language. The boys benefited from the physically active lesson in reading in Norwegian, however they discovered a small negative trend for English. On the other hand, the girls performed better on the English tests. Resaland et al. (2018) conclude that active learning had a positive effect on the boys, though, it seemed to have some negative effects on the girl's academic performance.

Contrasting the ASK study and Norway, Denmark extended their school day and included an extra 45 minutes of physical activity at all schools in 2014, as a part of the aim to perform better on international comparative tests (Romani & Klausen, 2017). This reform made Romani & Klausen (2017) want to study the effect of these extra 45 minutes by performing an intervention study, including four different interventions; 1) High intensity training, 2) physical test, 3) including organized sports and 4) individual health coaching. Group number one, had 20 minutes with 75%-85% of maximum heart rate twice a week either at PE or integrated in a subject. Their study was a randomized school-based intervention study including 1157 pupils from 30 school, where 18 of them were intervention schools and 12 were control schools. The conclusion of the study was that physical activity had no significant effects on school performance. Interestingly, they noted that the randomization lacked some validity since the intervention group on average had a lower socio-economic background compared to the control group. They also discovered that the control group overall performed better academically than the intervention group. However, despite their lack of positive associations between physical activity and academic performance, it is interesting that there seemed to be a positive

effect on high intensity and language, where the students in average improved the grade by 0,75 points compared to the control group.

In addition to the Norwegian study and Danish study, there is also a Dutch study, conducted by Mullender-Wijnsma et al. (2016) who looked into the academic effect on their intervention *Fit & Vaardig op School*. Their study included a two-year intervention, which involved a physically active lesson three times a week for 22 weeks. The participants were 499 children in second and third grade. They had a control group and both groups had their academic achievement tested, before and after the intervention. The focus was language and mathematics, and they discovered an improvement in both areas. More importantly, there was no significant improvement after a year, but after two years the results showed a significantly greater improvement in comparison to the control group (Mullender-Wijnsma et al., 2016).

Texas I-CAN is a cluster randomized control trial in 28 elementary schools conducted in Texas, USA, where they either had a spelling intervention or a math intervention (Bartholomew, Jowers, Errisuriz, Vaughn & Roberts, 2017). The schools who had active spelling lessons were control schools for the ones having active math lessons. Bartholomew & Jowers (2011) reviewed this ongoing trial and collected a small sample to see the academic effect on the Texas I-CAN spelling lessons, and their finding indicated that the students had a moderate but significant benefit from active spelling lessons. Donnelly et al. (2009) conducted a three-year trial to promote physical activity, called Physical Activity Across the Curriculum (PAAC) and included twenty-four elementary schools in the USA. All children from grades two and three were followed to grade four and five. Their active lessons involved 90 min per week of moderate to vigorous intensity, and in addition the students participated in 60 min PE per week. They tested the academic achievement for reading, writing, mathematics and oral language skills and the findings were that the academic achievement was significantly improved. The students were more active during the weekend than the control group, which indicates that PAAC caused them to be more active in the student's spare time. Active learning could not only improve their acquisition at the time of activity, but also after the physical activity. This aspect was studied by Bartholomew et al. (2018), who examined how active learning intervention could improve *time on task* (attentive to the teacher and engaged) in 4<sup>th</sup> graders. These active learning interventions lasted for 5-15 minutes and researchers observed the students *time on task* 15 minutes before and after the active learning intervention. They discovered that the students *time on task* increased significantly after the active learning intervention. Additionally, they argue that active learning seems to include academic learning and that it also increases the attention given to task straight after the intervention.

Children should experience the enjoyment of being active, and hopefully if they like to be active, they will continue to do so for the rest of their life. One of the aims with active learning is also to facilitate for a lifelong active lifestyle. Therefore, it is interesting to review the study conducted by Deng & Fredriksen (2018) named the Health Oriented Pedagogical Project (HOPP). This study included 2123 children in Norway, aged 6-12 years. They discovered that the level of physical activity is already in a decline from 6-7 years old and is likely to continue to decline. There was a steady decline from age to age, however the participants kept the level over the recommended 60 minutes a day. Physically active lessons could be a way of stopping this trend and help the students be healthy adults. Lahti, Rosengren, Nilsson, Karlsson & Karlsson (2018) followed up the 124 students in Sweden who participated in a 7-year program of 40 minutes of physical



activity a day. Four years after the intervention the students from the intervention were more physically active than those in the control group.

## 2.8 Low performing students

In Primary schools you might have students that are low performers, and every teacher would seek ways to increase their performance. Sibley & Beilock (2007) suggest that physical activity could also influence these students working memory. They studied how acute bouts of exercise affected healthy adults working memory, and they found out that the adults with the lowest cognitive performance were the only ones who benefited from the exercise manipulation. Although, the study only included adults, this might be an indication of a tendency for low performers in general. This is interesting in an educational perspective, where it is vital to get those low performing students to a higher level. This data is supported by Schmidt-Kassow et al. (2013), which also claim that simultaneous exercise supports low performers ability to increase their performance. Mahar et al. (2006) indicate that physical activity improves on-task behaviour in the classroom, and those students least engaged were the ones who improved the most. The participants were students in third- and fourth grade. They discovered that low on-task students who normally are on task less than half of the time had an increase of 20% after the 10 min of physical activity. Resaland and his colleagues (2018) had the same finding on low performing students and argue that both low performing girls and boys are the ones who benefit the most from active lessons.

## 2.9 ADHD and physical activity

In today's classroom, you will most likely see some students who are unconcentrated and some of them might also be diagnosed with Attention deficit hyperactivity disorder (ADHD). According to Bru, Idsøe & Øverland (2016) there is statistically one student with ADHD in each Norwegian classroom. It is therefore likely that teachers will meet students with this diagnosis. Nevertheless, as these students can struggle in the normal classroom situation, it is desirable to find methods which suits them better. There have been some studies on ADHD and physical activity and Vysniauske, Verburch, Oosterlaan and Molendijk (2020) conducted a meta-analysis on the effects of physical exercise on functional outcomes in the treatment of ADHD. In a total of 10 studies with a mean age of the participants at 9,3 years, they conclude that there was a significant and medium-sized effect of physical exercise on ADHD functional outcomes such as motor skills and executive functions. Medin, Medin, Hefte, Storm-Mathisen & Bergersen (2019) argue that low lactate production causes the symptoms of the disorder. They studied rats to see if this production increased with physical activity, which they discovered that it does. This is interesting because, as they mention, the hyperactivity could be a form of self-medication. Their statement is that individuals with ADHD are hyperactive in order to compensate for the low supply of lactate.

## 3 Methodology

In this section, I will present my research design and outline how I will answer my research question: *How can physically active lessons improve Norwegian 4<sup>th</sup> graders ability to remember English vocabulary?* The method chosen for the study is mixed-method, hence I have chosen three different methods; observation, tests and a questionnaire. Creswell (2014) explains it as a design that includes a collection of both qualitative and quantitative data at the same time. These three methods will be analysed separately and then both of the tests and the questionnaire will be reviewed for comparison. This study required different angles to be as valid as possible, so that every finding could be seen in the light of other findings. The aim is to have data which support and explain each other, so that the phenomena is easier to understand. First of all, the research design of my study will be outlined, then the data collection will be explained and finally ethical considerations, reliability and validity will be discussed.

### 3.1 Research design

The chosen method for the study is action research, which is explained by Skogen (2018) as a study that starts with an idea and develops into a plan that is put into action, with an evaluation of the plan afterwards. Moreover, McAteer (2013) explained the method as a way of preparing the path for your own change and she mentions action research as a practice-based approach that can contribute to the development of professional knowledge. One of the challenges that she mentions is that when the researcher is in the core of the research, there is a chance of lacking the objectivity needed to characterize "good" research. McAteer (2013) states that both types of data can be used, and quantitative data could for example broaden the study and give insight into the situation. In this study, the aim is to examine if the students could learn more with a specific learning method, which might end up changing the way some teachers teach vocabulary. Elliot (1991) argues that the understanding of a problem appears through changes. To be able to change teachers' practice, one could implement new practice and then assess the results. McAteer (2013) suggests using reflective diaries, interviews, questionnaires, document analysis and observations of practice in an action research study. Both a questionnaire and observations had been a useful data collection method in my study.

#### 3.1.1 Mixed Methods

This study required different methods, and triangulation was chosen. Thomas (2009) states that the triangulation could be looked at as we do in Mathematics; when we know the length of two sides, one could calculate the other side, as well as do a cross-check. In other words, one could try to find answers in your material by looking at it from different angles. Creswell (2014) argues that by using both the qualitative and quantitative methods, one could neutralize some of the weaknesses with each form of the method. I will do as Creswell (2014) mentions could be normal in mixed methods. I will collect data using a test and then use observation to collect detailed views from the participants to help explain my quantitative data from the questionnaire and test. Hence, the short-term test was used to indicate their short-term memory and their vocabulary proficiency. These results helped explain their results on long-term tests. The questionnaire was in order to gain a deeper understanding of the results and the

students experience of the intervention. The mixed method was therefore the suitable method for this study, caused by the possibility to get these different perspectives from the diverse methods within the data collection.

Creswell (2014) mentions several benefits with mixed methods, such as the ability to compare different perspectives and understand experimental results by incorporating the perspective of individuals. He also mentions Convergent Parallel mixed methods design, which is the design chosen for my study. As explain by Creswell (2014), this design includes a collection of both qualitative and quantitative material at the same time. Moreover, one will analyse them separately and then compare them to see if they confirm or disconfirm each other. The students were observed while doing the test, intervention lessons and questionnaire, so there is a parallel data collection.

### 3.1.2 Participants

This study was conducted in Norway at the primary school where I also have been teaching. The selection for the study was a group of fourth graders aged 8-10 years old, 20 of them boys and 16 of them girls. The fourth grade at this school consisted of 70 children in total, however, only thirty-six of them had their data collected. These students were familiar with me, and I had been teaching some of them for several months, but not full time. Thomas (2009) emphasizes that there is an assumption that the researcher chooses a sample that is representative of a larger population, and even though the sample is at my own workplace, it is still representative for a normal school class. As in other classes, this was a group that was blended with different nationalities and also included students with different levels of English proficiency. Because some of them also have a low proficiency of Norwegian, it was decided to use pictures in this project, to avoid using two foreign languages for these children.

## 3.2 Data collection

The data collection consisted of a short-term test, observation, questionnaire and long-term tests. The short-term test was conducted before the intervention started, in order to get an insight into their vocabulary proficiency. The intervention lessons were the foundation for the further data collection, and the questionnaire supplemented the understanding of the students experience with the intervention lessons. The long-term tests show the results on which method made the students remember the most words.

### 3.2.1 Intervention lessons

The intervention consisted of three lessons where the students met five new words sitting at their desk in the classroom and writing them down. The students looked at the screen displaying five words that each had a picture illustrating the word. Myself or their teacher pointed at the pictures and pronounced them out loud in English. They repeated each word, and at the end they got to know what the word meant in Norwegian. Their piece of paper showed only the pictures and they had to write the word underneath. When they finished writing they could draw on the backside. After this part of the lesson, they had a relay with five new words. These words were also displayed on the screen and the same procedure followed with them hearing the English word, repeating it and then getting to know what it is in Norwegian. The students were randomly divided into teams, varying from four to six students. The relay took place on the stairs, where two teams stood on one floor while the other two teams stood in the next floor. They ran up one floor one by one to collect one note from the box. The box consisted of five different notes with a word and an illustration of the word. When they had collected their note,

they had to write the word next to the correct picture on their piece of paper. In total they ran five times up the stairs, and the relay lasted for approximately 10 minutes. It is difficult to know the intensity of the relay, since some students ran faster than others. Since the students have different levels of fitness and have different experience with running, there was likely a difference in intensity among the students. Although, when observing the students, there were many of them who did get out of breath and wanted their water bottle after the relay. They only ran the stairs from one floor to the next floor, but it is long enough for them to get out of breath if they give an effort. However, it is difficult to make sure that the student exert effort needed to be in high intensity, and since heart rate monitors were not used it is difficult to state the exact intensity.

### 3.2.2 The role of the researcher in the intervention

One of the important aspects in the intervention is the fact that I, as a researcher, took part in the intervention. I taught two of the intervention lessons and observed the one lesson when their regular teacher taught. The fact of me being present could affect the results and the Hawthorne effect is worth mentioning. Cook (1962) explains that Hawthorne effect can be shown in intervention studies where the intervention group perform better than the control group. He states that the participants in the intervention group can perform better as they know that they are taking part in an experiment. Intriguingly, he also mentions that the same effect can be explained when the control group and the intervention group show similar results, which can be caused as a control group might also be aware of that they are a part of a project. The Hawthorne effect can therefore explain why the students performed better when I taught, since the students then more likely got the feeling of being a part of a project. Even though we tried to not focus on the project, when conducting the intervention lessons and the tests, the participants did most likely understand that it was a project. They were told that the classroom and relay method was to help them remember words, and they knew that there would be a test as well.

### 3.2.3 Tests

A short-term and long-term test were conducted to get an insight into their ability to remember words in general. The aim of using a short-term test was to see if there was a connection between the student's ability to remember words in the short-term in comparison to remembering words in the long-term. The test was similar to the test that Gausland & Haukås (2011) performed in their study on word learning strategies in Norwegian students learning German. The test conducted by Gausland & Haukås (2011) started with the students having to learn as many word pairs out of 30 Norwegian and German word pairs as they could for twelve minutes. Eight minutes later, they wrote down as many words as they could remember. The number of words chosen for the test was based on the proficiency and age of the participants, and twenty words were assessed to be appropriate. Although there was a mistake made and the word battery was included twice, which resulted in the short-term test consisting of nineteen unique words. Some students had Norwegian as their second or third language and therefore it was necessary to use illustrations instead of a Norwegian translation to the English words. The test consisted therefore of nineteen words with a picture illustrating the word, such as a picture of a computer and then the word *computer* written underneath. The participants were asked to look at these nineteen pictures and words for twelve minutes. The aim was to try to remember as many of the nineteen words as possible, with a chosen method by the individual. Some said them out loud, others wrote them down and some cooperated with their peers. After twelve minutes the participants relaxed for 8

minutes before they got the same sheet, then they had to fill in the correct word underneath the picture. Gausland & Haukås (2011) used the score from this test to categorize them in low performing and high performing students in their work of discovering the students learning strategies. However, they also emphasize that one should be careful of stating that this indicates their general language proficiency. Additionally, they add that their test could indicate a student's ability to acquire vocabulary. During the short-term test, it was found that some of the students already knew some of the words. This was not accounted for when the test was designed and may have affected the results. It is therefore important to take this into account when reviewing the results. This issue will be further discussed in the chapter of reliability.

This project focused mainly on word-learning and the ability to remember the words learned, since it is desirable that the learned vocabulary is remembered in the long-term. Therefore, it was interesting to test their memory after nine weeks. The students participated in one lesson per week for three weeks, where they learned ten words each lesson, a total of thirty words. They learned five words sitting at their desk in the classroom, and five words during a relay. After nine weeks they were tested to see how many words they remembered from each week. This test was similar to what they had done each week; they filled in the missing words underneath the pictures. Regarding the validity of the test, it was important that as many aspects from the intervention lessons were similar. The two first long-term tests were completed using Microsoft forms, while the last test was on paper. This was because the students discovered that there was a translation function in Microsoft forms.

#### 3.2.4 Observation

Observation was the first of the methods chosen as a part of mixed method, and was used as a part of triangulation to get the whole picture of the intervention. The observation was conducted during one of the lessons, while I was teaching two of the other lessons and therefore only observed while teaching. When I observed the lessons I noticed for instance, who cheated and who lacked concentration, as well as other factors that could affect the results. It was also interesting to hear the comments of the children and observe how they reacted to the intervention. I had an unstructured observation as Thomas (2009) explains as a way of observation where the researcher takes part and interact in the situation. It was impossible not to interact in the situation caused by the students knowing me and needing me as an assistant. When interacting with them I also got to talk to them and hear their points of view, while on the other hand some aspects were overlooked causing a hectic lesson. Thomas (2009) also argues that it can be difficult to disentangle where one kind of participation begins and ends, hence I might move from different kinds of participation and observation methods. When observing the pupils participating in physically active lessons, I got some information which was missing on the tests. Moreover, I spotted who was struggling and discovered perks and advantages with the methods. The observation added to the understanding of the students test performance. The long-term tests showed what words they remembered, and the observation was used to understand the test results.

#### 3.2.5 Questionnaire

The second method chosen is a questionnaire, where the aim was to collect data on their thoughts about the two different methods, hence learning words in the classroom and the relay. Additionally, it was desirable to find out what method they believed helped them learn and made them remember the most words. In addition, it was interesting to

know which method they liked best. One of the questions also included what challenged them during the different methods. This was to see if one or of both of the methods made them uncomfortable or if they might experience the class as more noisy for instance. Thomas (2009) mentions that questions in a questionnaire could either be closed or open. A closed question demands a certain response such as yes or no, or a multiple-choice answer (Thomas, 2009). Moreover, he explains that in an open question the participant can reply what they desire. Students in year 4 will need a structured and easy questionnaire with closed questions. Some basic guidelines are mentioned by Thomas (2009), such as keeping it short, be clear and precise and be aware of prestige bias. The aspect of prestige bias could be especially important factor when assessing the reliability in my data, even though the participants are young, some of them want to answer "correctly" even in a questionnaire like this. This aspect is interesting, and as I went through the test with them, I tried to guide them to be as honest as possible. Regarding prestige bias, it could be difficult for them to know what I would like them to answer, due to their age. The purpose was always to not make them understand the aim of my study, but rather explain to them that they like different methods and that both methods can make them remember words.

### 3.3 Ethical considerations

This project was approved by the Norwegian Centre for Research Data and all parents received the consent form, of which thirty-seven of them signed the consent form. There will also be some ethical consideration when working with and studying people, and Creswell (2014) holds that researchers need to protect their participants. The study included nine to ten year old children, which can be challenging since they do not understand the importance of reliability in a research project. Some of the students cheated on the tests and two students ran only one time up the stairs before they sat next to the box and wrote the four next words. These sources of error could be typical for their age, as they might not understand what they are supposed to do. It is also important to protect their privacy and in this case, make them anonymous. At this age they might not understand what a research project is, and they did not seem to understand why they were tested. Therefore, I tried to protect them from the pressure of tests by talking to them about it and explaining that it was more of a fun quiz than a test. To keep them anonymous, they were assigned a number and colour according to their group, so on the test they wrote "blå 3" instead of their name for instance. It should also be mentioned that they went through, in total, four tests, which could be seen as a lot. Some liked it and some did not like the tests, so the students who really disliked the test were not forced to complete it.

### 3.4 Research credibility

It is important to address the different sources of error that occurred during this study. There are some limitations in this study, for instance the small sample out of an original group of seventy fourth graders. The sample of only sixteen students, when comparing the short-term test and the long-term tests, should have been larger to get significant results. Since there seemed to be some interesting findings when comparing the student's vocabulary proficiency and learning method, it would be desirable to study a larger sample.

### 3.4.1 Reliability

There are some reliability concerns when using converged parallel mixed methods design mentioned by Creswell (2014) such as collecting an unequal sample size, as well as different variables and a lack of follow-up on conclusion when the scores and themes diverge. However, the creditability increases when using the same selection in both observation, intervention, tests and questionnaire. This strengthens my study, because I had the same selection, although it is important to mark that it turned out to be a uneven amount of students participating in each lesson, and in total only 16 out of 36 participated in questionnaire, short term, and at least two of the intervention lessons.

Observation was one of the ways of decreasing the sources of error, since younger children might not always do as they are told. One of the variations that happened was, for instance, some of them writing before they were asked, and therefore writing the words one more time than the others. Some of them also said the answers in the long-term test out loud, so I made notes and included this aspect when correcting their test. Even though there were these alternations, it was possible to discover the sources of error when observing the lessons and tests. The observation aimed to increase reliability, however, it is important to keep in mind that as a researcher the chance of bias is present. It was desirable to be as neutral and objective as possible when observing, so that they could not get any feeling of answering that they liked the relay the best for instance. Although, the Hawthorne effect could also be present in this study, caused by me being present in every part of the project. They most likely got a feeling of being a part of a project, but since they knew me from before, they could also be comfortable. This could weaken the Hawthorne effect, since they did not have to relate to a known teacher. Even though I tried to be as objective as possible, they could have gotten a feeling of me wanting them to like the relay, which could of affected their performance in the relay method and their replies in the questionnaire.

Concerning the conveyance of the short-term test, there was an aim of testing their short-term memory. When observing the students participating in this text, some of the students commented that they knew all of these words from beforehand, while it was also noticeable that some did not know where to start when trying to remember the words. The score from the short-term test also indicated that some did remember all the nineteen words, while others remembered only a few words. The ones who only remembered a few words, could also reason in them knowing these words from before. Since some of the students knew the words from before, it could be viewed as a vocabulary test. Thus, the short-term test gives some indication on how many words they know from beforehand. Consequently, the short-term test can give some indication on the student's vocabulary level.

It is also noteworthy to mention that week two was led by their teacher, while I led the other two weeks. The reason for me teaching was because their teacher was away when the intervention lessons was planned to occur. When looking at the long-term test results from week two, it differs some from the other weeks, especially when looking at one of the groups. Week two was the only week where the students in general remembered the most from the classroom method, and I observed that one of the groups ended up having an unstructured lesson. This lesson started with the students coming from a recess where there had been some disagreement in the schoolyard. Even though the students calmed down, they seemed to be a bit unsettled. Additionally, one of the students had an outburst and walked in the hall screaming while the students had the relay right next to the hall. Finally, one of the students in the other class was feeling sick

and threw up in the hall. To summarize, these aspects seemed to stress both the teacher and the students, and it felt a bit chaotic for everyone involved. Therefore, I would argue that the students and the teacher were affected by these distractions, and this could be one of the reasons for the results differing from the other weeks.

One of the other factors is that some of the students might not got the chance to write down all five of the words during the relay. However, this did not happen often and most of the students ran five times up and down the stairs and wrote down every word. The time spent on the words in the classroom and in the relay was also timed in one of the weeks, and both methods lasted approximately 10 minutes. Though this could vary, and it is difficult to know how much time they spent looking at the pictures and writing.

There was also a source of error that occurred when words from week two were tested. Around three students discovered the translate function in google forms, which helped them to write some of the words, and this aspect plays a part on the validity of the study. These student 's results were removed from the data material. The last test, which tested them for words learned week three, was completed on paper. Nevertheless, here also one of the words was said out loud in one group. However, it was easier to control and less sources of error occurred. The long-term test could therefore include some sources of error which play a part when assessing the validity of this study.

Concerning the reliability of the analysis there are also some parts that are noteworthy to mention. To be able to correlate the long-term test with the short-term test and the questionnaire, I needed to summarize each individual 's score from all of the weeks. This is a source of error, since they had two different teachers, had different states of mind and perhaps some of the words that they were about to learn in the classroom were more difficult from them than the ones in the relay. Consequently, the score from the long-term test could also be affected by different variables. When summarizing their score from each week, there were five students who only participated in two of the weeks. These students remembered most words from relay the first week and then remembered most from classroom the second week. The chosen way to analyse this was to look at the highest score in total. The data material is small, and one should also look at the findings in the light of the possible source of errors.

### 3.4.2 Validity

When considering the validity of this study, the important question is what makes the data relevant for the research question. The data collection consisted of observation, short-term test, questionnaire and long-term tests. All of these methods contributed to different views on the research question. The observation conducted was limited as a result of myself being active as a teacher most of the time, although, I did observe while teaching that I could be present during every intervention. This gave me insight into how the lesson was conducted and what happened during the lessons. The teacher who was instructed to teach could have missed some sources of error, such as the students who cheated during the intervention lessons and the tests. Nevertheless, it is important to mark that I had three roles; researcher, observer and teacher, this could easily be mixed and there is a chance of bias. This chance was outweighed by the benefit of having control over possible sources of error during the lessons, tests and questionnaire.

The short-term test did have some challenges regarding validity, as the words chosen might not give all the students enough challenge. Some of the students did know the words from beforehand, but others did not know a single word. As mentioned, it ended



up being a vocabulary proficiency test, which did give some indications that were useful in the analysis. When discovering the student 's prerequisites for learning vocabulary, it was also interesting to discover the other findings that could be seen in relation to their vocabulary proficiency.

The long-term test was conducted to be able to examine if there were any advantages with the relay method. The results indicated if they remembered most words from the relay method or the classroom method. It was also important to make sure that there were nine weeks between the learning and the long-term test, and therefore they participated in a long-term test three times. Since some test results were affected by some students who cheated, these tests lost some of their validity. However, these were only some minor cases and it was decided to use the results without the participants who cheated.

The questionnaire was conducted to get an insight into the participants thoughts and meanings about the intervention lessons. This method resulted in interesting findings such as the preferred method among the participants as well discovering that they seemed to have a metaknowledge about their own learning. This aspect is of course questionable, because the students are young, and they might not understand the questions correctly or have the metaknowledge to answer them. However, as mentioned it seemed like the students were able to answer questions about their learning, because the findings of some of their answers correlated well with the actually results from the long-term test.

## 4 Analysis

Convergent parallel mixed-methods design could cause some difficulties when analysing, such as how to converge or merge the data (Creswell, 2014). Observation is the qualitative data which is used to explain the results in the quantitative data from the tests and questionnaire. According to Creswell (2014), it is common to do a side by side comparison in the discussion section, which is the analysing method in this study. Regarding the two tests, these will most likely be in numerical form, which is common as explained by Thomas (2009). The data from the tests are in numerical form, and the variables in the questionnaire are also coded into numbers. Thomas (2009) differs between norm-references and criterion-referenced tests, so this study will include criterion-referenced tests because the participants are assessed by criterions. The aim is to examine if each individual could remember most from method A (classroom) or Method B (relay).

According to Thomas (2009), eyeballing is important to get an overview over one's material, so one could have a look at the total data material to see what it is telling you. Next step will be to do data analysis in the statistical software SPSS, which is needed for analysing my questionnaire and when looking for the tendencies between different values. Crosstabs is a SPSS procedure that cross-tabulates two variables to discover a tendency between for example short-term test and long-term test. The long-term test was divided into three parts, one test for each intervention lesson, and each individual got a score in each method. Out of this table, one could see who remembered best from method A or Method B. The purpose was to examine which method helped them remember the most words. The students who participated in at least two of the weeks have gotten their scores summarized, which gave a total score for each method. Each individual was categorized into a relay group and a classroom group based on which method helped them remember the most words. This was a process to reduce my material as Rennstam & Wästerfors (2015) emphasize is important in an analysis process.

Analysing the questionnaire starts with a univariate analysis, to examine how many units have responded on each value (Postholm & Jacobsen (2018). This analysis consisted of a crosstab presenting each value for each variable. After the univariate analysis, each value for the variables was sorted and I could conduct a bivariate analysis using crosstabs. Cohen, Manion & Morrison (2011) mention crosstabulations which will help one to examine one variable in coherence to another variable. The use of cross tables helps show variations in gender and in the categorized methods for instance. One of the cross tables displays the relay group's answers on their favourite method in the questionnaire. Only specific questions were chosen to correlate with their long term and short-term test. Without the aspect of sorting and reducing the data material, it would have been too much to handle within the frames of this study (Rennstam & Wästerfors, 2015).

### 4.1 Conducting the analysis

This study was conducted in a Norwegian primary school in year 4 and 36 of the students agreed to participate in the study. The boys accounted for 57% and the girls accounted for 43 % of the total. The intervention took place in their English lessons for a period of

three weeks plus a pilot lesson the week before for two of the groups. There was also an additionally week including the questionnaire. These students started learning English at the age of 5-6 years when starting in year 1. Even though they have been through the same English education since year 1, their proficiency differed greatly. Some play video games and watched English videos online that could increase their exposure to English at home, while others are rarely exposed. The parent's involvement in the students learning could also play a part in their academic performance.

#### 4.1.1 Questionnaire

The questionnaire consisted of nine questions, where five of them guided the respondent to choose only one alternative. The other four questions were multiple choice, meaning they could choose numerous alternatives. The five questions with only one alternative were coded, relay got the code one and classroom code two. The coding was necessary for the conducting of crosstabs in the software *Statistical Package for the Social Sciences* (SPSS) and thereafter be used in context to the short-term and long-term test. Thirty-five students participated in this questionnaire.

#### 4.1.2 Short term test

When marking the short-term test they got the maximum of two points for each answer. Since the picture of battery was included twice, they could only get points for this word, if they wrote it correctly at the first page. Two points were given for the correct answer and one point if there was one letter missing or misplaced. The scores were categorised into these groups: below nine points, above ten points, above twenty points and above thirty points. Then each student was given a code indicating his or her results on the short-term test, below nine points got code nine and above ten points, code one and so on. When comparing the score results with their replies in the questionnaire, the codes from the score were used so that one could add this variable with their answers and then make a crosstable in SPSS. Six students did not do the short-term test so their answers had to be removed when comparing the questionnaire with the score test.

#### 4.1.3 Tendencies in Questionnaire and Short term test

The ones who did not do the short-term test were not included in this frequencies analysis, so the sample was 30 students. Three questions from the questionnaire and the score from short term test were included in the frequency analysis. The chosen questions were:

*Are you a girl or a boy?*

*What method helps you remember the most words?*

*What method do you learn the most from?*

The chart shows their score on the short-term test and their reply on the gender question, and it is possible to see a pattern. The score is also displayed in percentage, and it shows that 44% of the boys scored above 30 points, while 50% of the girls scored above 50%.

		Under 9p	Above 10p	Above 20p	Above 30p	Total
	Girl	0 (0%)	3 (25%)	6 (50%)	3 (25%)	12
	Boy	2 (11%)	4 (22%)	4 (22%)	8 (44%)	18
Total		7(7%)	10 (23%)	11 (33%)	2 (37%)	30

**Table 1 Short term test scores sorted by gender and score interval**

#### 4.1.4 Long term test

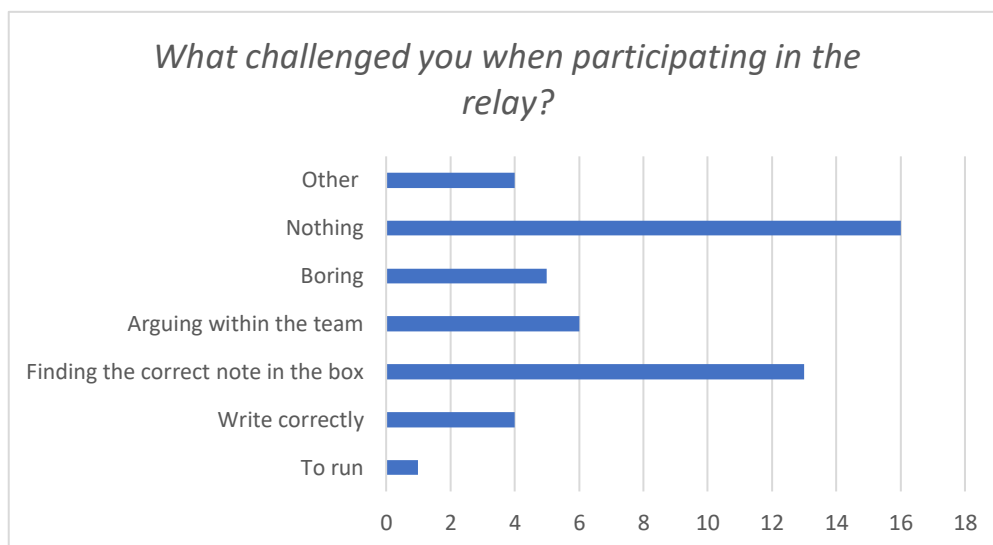
The long-term test consisted of three tests, conducted over a period of four weeks. The intervention lessons were conducted three times during a period of four weeks, because week three included the questionnaire. The long-term test took place nine weeks after the intervention lesson. The tests were spread out over four weeks so that they were tested after exactly nine weeks for each set of words. Two of the tests were performed online but, after discovering that some of the students had discovered the translate function, the last test was done on paper. Every reply was studied and graded with two points for the words that were correctly written and one point when missing a letter or misplacing a letter. Points were sorted into two groups depending on if the words were learn during the classroom or relay method. Finally, to determine if there was any gender difference, the girls and boys got their scores summarized separately.

## 5 Results

This mixed-method study includes different data material that will be analysed separately but also in association with each other. The questionnaire is analysed separately, and some questions were also compared with other variables. Moreover, it was interesting to difference in gender when displaying the short-term results. One of the first frequency analysis included the two variables; short-term scores and questionnaire. Hereafter, the results from the long-term test were divided into weeks, before the results from the frequency analysis with the long-term and short-term test are shown. The frequency analysis conducted with long-term results and short-term scores required a new sample and the sample from the short-term was split by gender. In the end, long-term results were reviewed by gender and the question about what helps them remember the most words.

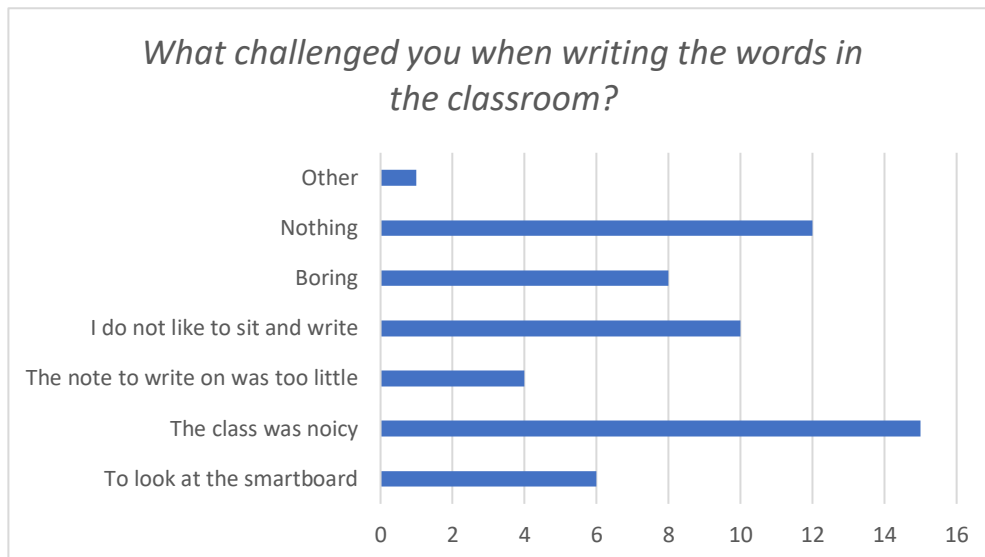
### 5.1 The questionnaire

The following four questions were organized so that the students could tick the statement they felt related to them. The questionnaire was in Norwegian so that the students could understand the questions. These questions are translated to English in this chapter. The sample for the questionnaire was thirty-five.



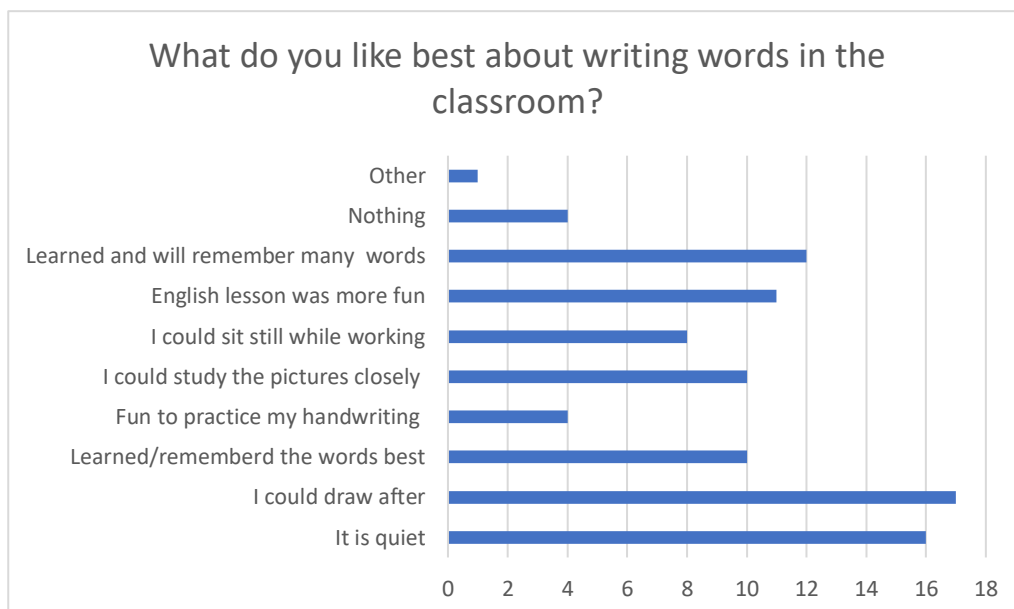
**Figure 1** The students answers on the question: *What challenged you when participating in the relay?*

Figure 1 shows how many students who ticked of each of the variables, as they could choose several factors to describe what challenged them. Figure 1 shows clearly that the only thing that challenged the students was to find the correct note in the box. Sixteen of them answered that nothing challenged them. It is therefore interesting to view the answers for what challenged them in the classroom.



**Figure 2** The students answers on *What challenged you when writing the words in the classroom?*

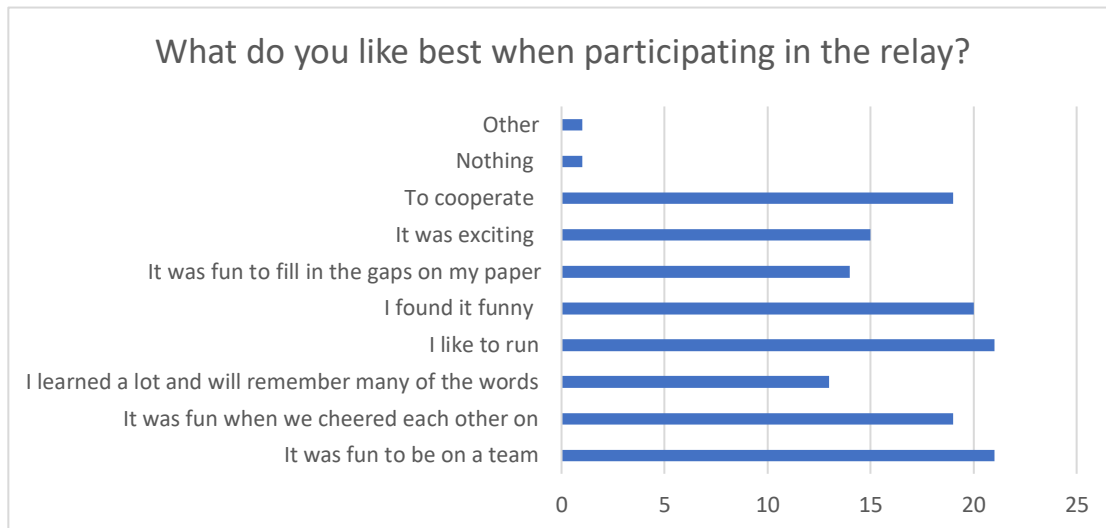
This question displayed in figure two was organized as question number one, thus, they chose the variables they felt challenged them. There are twelve students who answered that nothing challenged them in the classroom (Fig. 2). While as many as fifteen experienced that the class was noisy. Some also replied that they did not like to sit and write (fig.2)



**Figure 3** The students answers on *What do you like best about writing words in the classroom?*

They were also asked what they liked best about each method, to determine the positive aspects of the methods. They reported drawing as the most fun aspect of the classroom situation. Moreover, sixteen of them answered that they like to be in the classroom because it is quiet (fig. 3). It is assumed that the students categorize *quiet* as a calm

classroom where there is not any fuss around them and all of the students around them are quiet. Although, this finding could be reviewed in comparison to figure 2, where fifteen students found the class noisy during the classroom method.

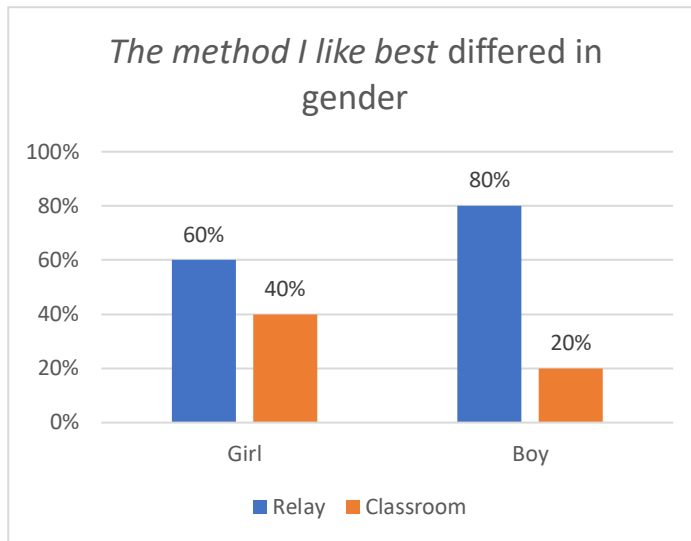


**Figure 4** The students answers to *What do you like best when participating in the relay?*

Figure 4 shows what they liked about relay as a method. This figure differs from figure 3, because the students clearly liked different aspects of the relay. Eight variables were chosen by at least ten students, which shows that many of the participants answered that they liked more than one of the available aspects. The fact that they liked to cooperate and twenty-one liked students liked participating in teams is especially noteworthy (fig. 4), since they learn a lot by having to cooperate and interacting with others. Twenty-one out of thirty-five answered that they like to run, in addition, fifteen found the relays exciting (fig. 4).

### 5.1.2 Tendencies within the questionnaire

Four of the questions were suitable for the frequency analysis, to examine if there are any tendencies. The aim is to review their answers by regarding them in comparison to their other answers, for instance it is interesting to review their favourite method in comparison to the method they believe helps them learn, or in comparison to the method that helps them remember the most words. The gender aspect is reviewed to examine the differences in their replies based on their gender.



**Figure 5 The method I like best – split by gender**

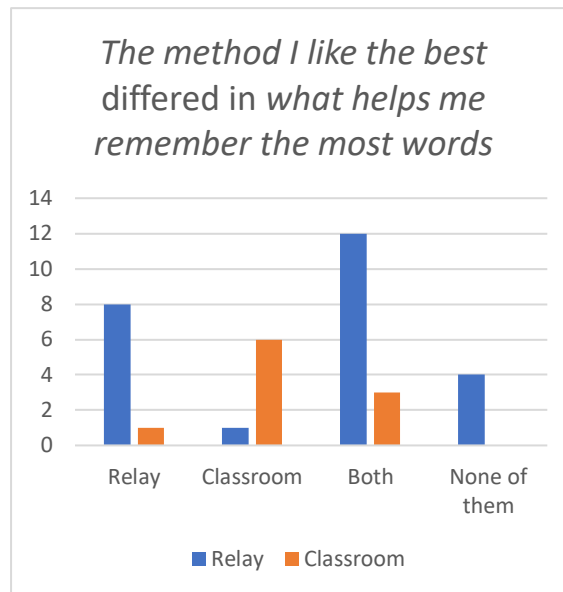
In figure 5, it is visible that most students prefer relay, 60% of the girls and 80% of the boys preferred relay compared to writing the words in the classroom. This figure shows some noteworthy gender differences, but it is also clear that both boys and girls prefer relay.

		I learn the most from:		Total
		Relay	Classroom	
<b>I like best:</b>	Relay	13	12	25
	Classroom	1	9	10
<b>Total</b>		14	21	35

**Table 2 The method I like best - differed in I learn the most from this method**

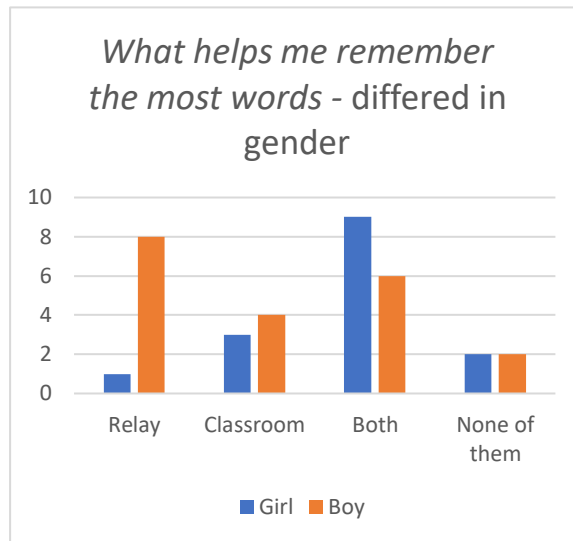
Table 2 shows the preferred method and how many who, within that method, replied that they learn the most from relay or classroom. It is also noticeable that even though some students like relay the most, they still believe they learn the most from writing the words in the classroom (Table 2).





**Figure 6** *The method I like the best - differed in what helps me remember the most words*

As the question of what method they learnt the most from might be too vague, it was also asked what helps them remember the most words. Figure 6 shows some patterns within the aspect of what they like the most. An interesting aspect to examine is if the method they like the most is the same method that they believe helps them remember the most words. Out of the students who like classroom most, one replied that relay helps him remember the words. Six students replied that the classroom method helps them remember the most words, while three students thought both methods helped them. Regarding the respondents who like relay the most, eight of them believed relay helped them the most. In addition, one of them believed that classroom helps him/her the most and twelve believed both methods helped them remember (fig 6). To summarize, most of the students who liked relay the most, believe that relay helped them remember the words or that both of the methods helps them remember the words. There were also four students who replied that none of the methods helped them remember the words.

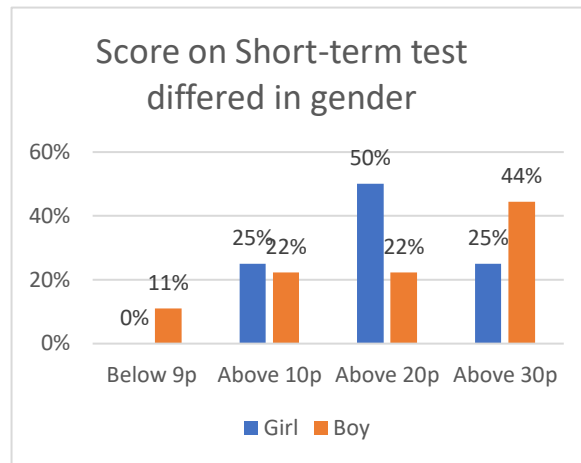


**Figure 7** *What helps me remember the most words – split by gender*

One of the most interesting finds is that one can clearly see that boys believe that they will remember the most words from when they were running (fig. 7). On the other hand, figure 7 also shows that only one girl believes that relay will help her remember the most words. Fifteen students believe in both methods and seven students answered that the classroom method helps them remember the most words (fig. 7).

## 5.2 Short-term test

Words stored in the Short-term memory will need to be rehearsed appropriately to get stored in the long-term memory (Surprenant & Neath, 2009). So if we assume that this is the memory process, it is interesting to see the students ability to remember words in the short term. The words remembered in the short-term memory will then be appropriate for a long-term memory. Therefore, it was fascinating to examine the student's short-term memory, because if they find it difficult to acquire words in the short-term, they might also struggle with the long-term memory. Since some students knew the words in the short-term test from beforehand, it was right to regard the short-term test as an indication of their vocabulary. The score from the test can imply if they have an extended vocabulary or a limited vocabulary. Even though this score is only a vague indication of the students vocabulary proficiency, it is interesting to review their score in comparison to gender and two of the questions from the questionnaire.

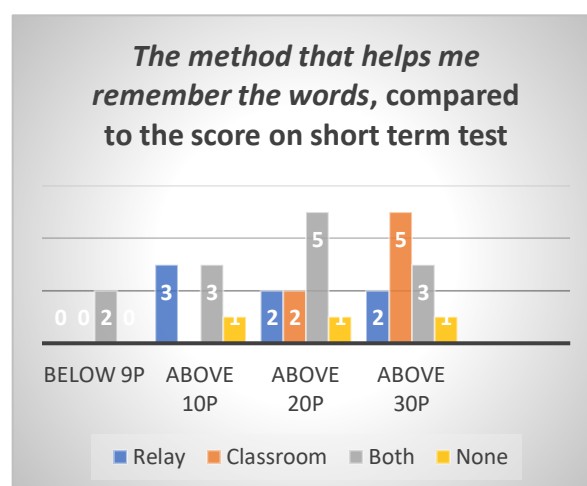


**Figure 8 Short-term score split by gender**

Figure 8 displays the score from the short-term test split by gender. When looking at the score on short term test one could see that 44% of the boys scored above 30p and only 25% of the girls scored above 30p (fig. 8). It is also clear in figure 8 that 50% of the girls scored above 20p , and 25% of them scored above 10p. The remaining boys' performances are spread out from below nine points to above 20p (fig. 8)

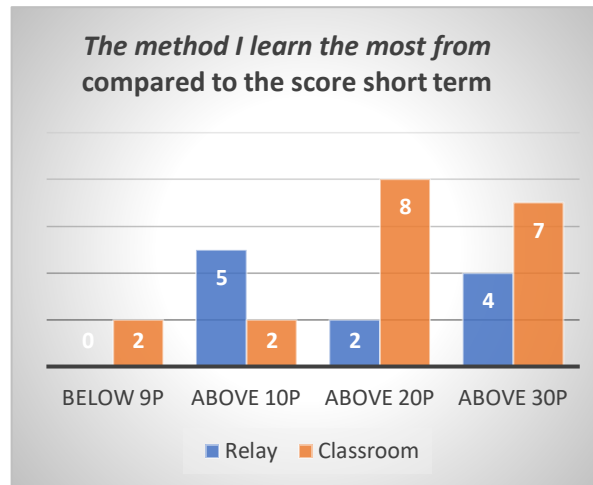
### 5.2.1 Questionnaire reviewed in comparison to score on short-term test

The short-term test, questionnaire and long-term test are all a part of understanding how physically active lessons could improve student 's ability to remember English vocabulary. To get a wide understanding it is important to analyse the material both separately and in comparison to each other. The first comparisons made are some of the questions from the questionnaire and the score from the short-term test. Thirty-five students participated in both the short-term test and the questionnaire. It is interesting to review their answers from the questionnaire in the light of their performance on the short-term test. To see the difference between what they answer they learn the most from and what the method they remember the most from, both of the questions are reviewed again in comparison to the short-term test.



**Figure 9 The method that helps me remember the words, compared to the score on short term test**

When they are asked to choose the method that helps them remember most words, it is interesting to see that the ones with the highest score believe that writing in the classroom helps them remember the most (fig. 9), while it is quite even on the ones with scores above 20p. I will also like to point out that not one person who performed below 19 points reported that they believe that writing in the classroom would help them remember the most words.



**Figure 10** *The method I learn the most from compared to the score short term*

However, when asked which of the methods they felt they learnt the most from, in this case the two participants below 9 points choose classroom, as do those above 20p (fig. 10). Two of the participants who scored above 10points preferred both or neither of the methods, but when asked to choose, picked the relay (fig.10).

### 5.3 Long-term test

Memory is an essential part of learning, since it is desirable to remember what is learned (Jensen, 2005). It is mentioned by Jensen (2005) that it will be beneficial to strengthening multiple pathways to give learners a better chance of retrieving a memory. The long-term test was to investigate if physically active lessons could contribute to strengthen pathways needed for the words to be restored in a long-term memory. Nine weeks was assessed to be a sufficient amount of time to examine if the words were stored in the long-term memory. Nine weeks after the first lesson in the intervention the first long-term test could be conducted. There was one more test the following week, then a week ´s break before the last long-term test was conducted. The tests consisted of ten pictures illustrating the words learned, five of them were learned in the classroom and five of them were learned during the relay. To find out which method had helped them remember the most words, the tests were marked with 1 point for a missed placed letter or missing a letter in the word. 2 points were given for a correctly written word. The students then got a score from 0 to 20 points on each test. The results from the long-term test has been displayed as a summarized score consisting of the students score in total. The first two tests were completed on an online form, while the last one on paper. The sample for the long-term test varied from week to week depending on which

students were present. It also varied depending on how many students remembered a word at all. The table below (table 3) will give an overview of how many students remembered words from each week.

	<b>Did not remember any word</b>	<b>Remembered at least one word</b>
<b>Week 1</b>	5	15
<b>Week 2</b>	4	23
<b>Week 3</b>	8	21

**Table 3 Overview long-term test**

<b>Week 1</b>	
<b>Relay total points</b>	44
<b>Classroom total points</b>	16

**Table 4 Total score from each method, week 1**

The results from the first long-term test shows that the recall of words from week one had results favoured relay (table 4). Fifteen out of twenty students remembered at least one word (table 3). This week has the greatest gap between the results from the classroom and the relay (table 4). The students seemed to have remembered most from the relay, although this was also the week they remembered fewest words in total, hence the total score of 44 (relay) and 16 (classroom) is lower than the other two weeks.

	<b>Relay</b>	<b>Classroom</b>	<b>Total</b>
<b>Girls</b>	6 (100%)	0 (0%)	6 (40%)
<b>Boys</b>	5 (55,56%)	4 (44,44%)	9 (60%)
<b>Total</b>	11 (73%)	4 (27%)	15 (100%)

**Table 5 Score long-term test from words week 1, split by gender**

This first long-term test indicated that it is actually the girls who remember more from the words learned during the relay (table 5). 55-56% of the boys remembered most from the relay and in total 73% remembered most from the relay, while 27% remembered most words learned in the classroom (table 5).

<b>Week 2</b>	
<b>Relay</b>	66
<b>Classroom</b>	75

**Table 6 Total score from each method, Week 2**

When looking at the results from the second test, it looks a bit different from the other weeks, with total points favouring the classroom method (table 6). 30 out of 36 participated in the test, and after excluding four who remembered nothing and three who cheated, 23 were left to analyse.

	Relay	Classroom	Both	
Girls	4 (40 %)	4 (40 %)	2 (20 %)	10 (43%)
Boys	4 (31 %)	7 (54 %)	2 (15 %)	13 (59%)
	8 (36 %)	11 (50 %)	4 (14 %)	23(100%)

**Table 7 Score long-term test from week 2, split by gender**

In week two there was an interesting difference between the boys and the girls; the girls recalled just as many words from the relay as from the classroom, while the boys remembered most from the classroom (table 7). These two findings also differ from week 1 and 3, since the boys clearly learned most from the classroom this week.

<b>Week 3</b>	
<b>Relay</b>	69
<b>Classroom</b>	61

**Table 8 Total score from each method, week 3**

The last test shows the results from words learnt in week 3, and the words from the relay ends up with 8 points more (table 8). The score from this week are almost evenly split between the two methods. 21 students remembered at least one word, while 7 out of the 28 students participating remembered nothing (table 8).

	Relay	Classroom	Both	Total
<b>Girls</b>	6 (67 %)	2 (22%)	1 (11%)	9 (43%)
<b>Boys</b>	6 (67%)	4 (33%)	2 (17%)	12 (57%)
	12 (67%)	6 (29%)	3 (14%)	21 (100%)

**Table 9 Score long-term test from week 3, split by gender**

Table 9 shows the results from week 3, which shows that 67 % of the students remembered most from the relay, while 29% remembered most words from the classroom. Three students had equal results, recalling the same amount of words from relay and classroom (table 9).

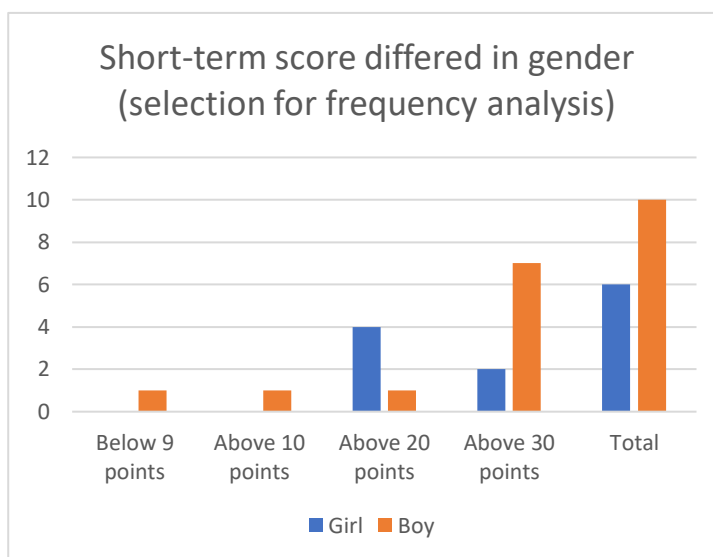
## 5.4 Tendencies when reviewing the total data collection

When considering the tendencies within the total data collection, it was necessary to create two new samples. The first sample included sixteen students and was used in the frequency analysis including short-term and long-term test. The requirements for this sample were:

- Participation in at least two lessons in the intervention
- Participated in the short-term test
- Participated in two long-term tests (These two results will be summarized)

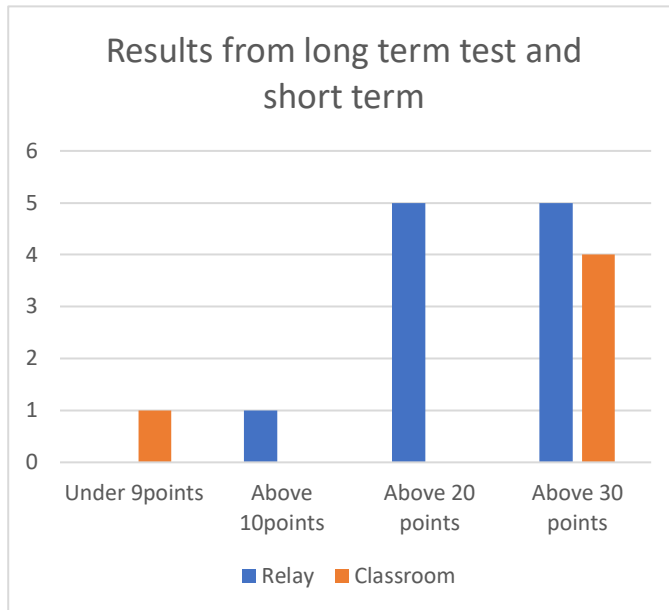
The second sample is for a frequencies analysis including long-term tests and the questionnaire. This sample consisted of nineteen students and the requirements were:

- Participation in at least two lessons in the intervention
- Participated in two long-term tests (These two results will be summarized)
- Participated in questionnaire



**Figure 11 Short-term score split by gender (selection for frequency analysis)**

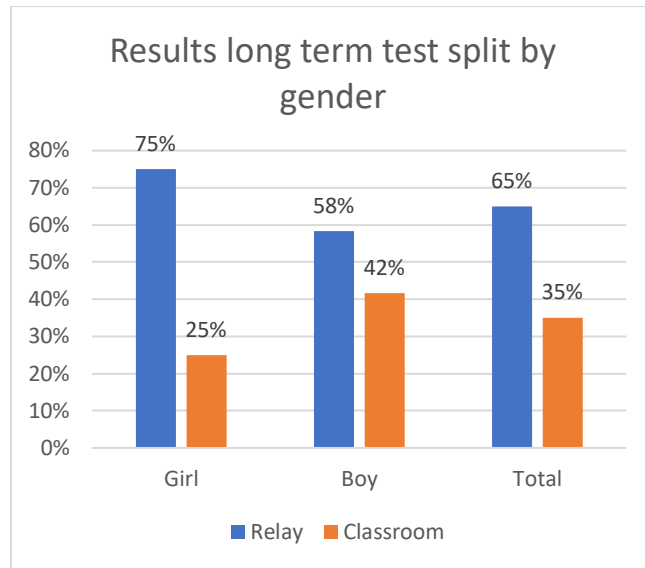
Figure 11 shows the first sample that consisted of ten boys and six girls. It also shows that most of the boys perform at a high level in the short-term test. There are more girls who score above 20 points than above 30 points, however they still perform at a high level. This outcome is a precondition for the following analysis conducted with this selection.



**Figure 12 Results from long term test and Short term score**

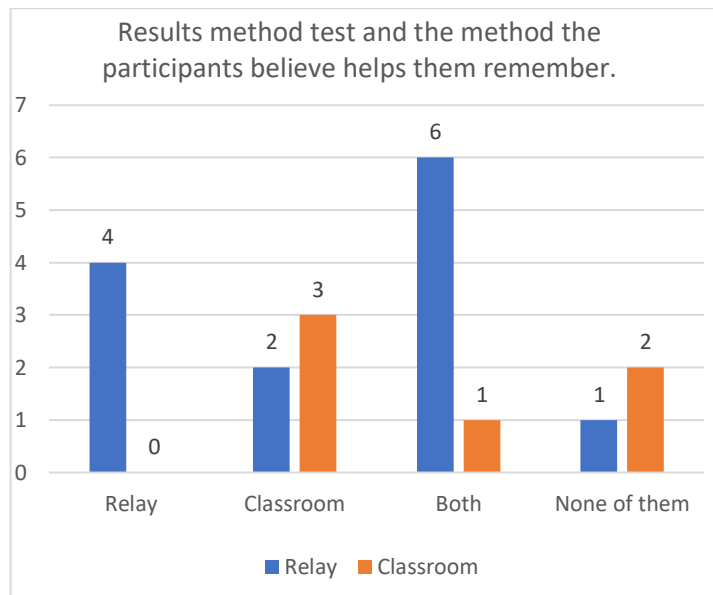
The frequency analysis with long-term and short-term required a new sample consisting of 16 students, and their short-term results are shown in figure 12. It is interesting to explore figure 12 which shows that the person who scored under 9 points remembered most from the classroom, while the one who scored above 10 points remembered most from relay. There are fourteen students who scored above 20 points, five students scored above 20 points and nine students scored above 30 points. Consequently, the selection made for frequency analysis with two variables consisted of mainly students who performed at a high level on the short-term test. The students who scored above 20 points remembered the most from relay, and so did five of the students who achieved above 30 points. The last four students performing above 30 points learned the most from classroom.





**Figure 13 Results long term test split by gender**

Since the selection consists of more boys than girls, figure 13 illustrates the results from the long-term test split by gender and displayed in percentages. When looking at this illustration, figure 13 could help explain the results. The boys seem to perform at a higher level than the girls (fig. 13). 75% of the girls and 58% of the boys benefited the most from the relay, while 25% of the girls and 42% of the boys benefited the most from the classroom method (fig 13). In total 65% remembered most from the relay and 35% remembered most from the words learned in the classroom (fig. 13).



**Figure 14 Results method and the method they believe helps them**

When comparing the long-term results with the questionnaire the sample was nineteen. Figure 14 indicates that out of nineteen students, the four who believe that relay helps them remember the most words are correct, and so are the three students who believe

that the classroom helps them remember the most words. However, two of the students who think classroom helps them remember, actually remember most from words learned during the relay. Six out of seven students who answered both, remembered most from relay. The remaining students remembered most from the classroom. Three students answered that none of the methods helped them remember words, but two of them remembered the most from in the classroom while one remembered most from relay.

## 5.5 Summary of main findings

One of the main findings is that students like relay the most. 60% of the girls and 80% of the boys preferred relay compared to writing the words in the classroom (fig 7.). One should note that the boys liked relay the most (fig. 7). When looking at the short-term results, the boys performed the best (fig. 10). However, the sample that was available for the frequency analysis consisted of ten boys and six girls, which is a small sample. Although, it did give some indications that could be interesting to look into. Since boys performed the best at the short-term test, it could have caused the interesting finding shown in figure 12, where the girls in total remembered most words from the relays. The ones who scored best on the short-term test could be seen as students who have a higher proficiency they either knew the words from before or since they have the competence to remember words in the short-term. In addition, it is interesting that the ones who scored the best were also the ones who had the highest response on preferring the classroom method (fig. 11). The most interesting finding was that the students who scored the below 29points on the short-term test, seemed to have benefited the most from the relay method (fig. 12)

## 6 Discussion

In this chapter, I will discuss my findings in relation to previous research and in light of the theoretical background for this thesis. First of all, the main findings will be outlined, before the findings are discussed. The theories in word learning are seen in the light of my findings. The questionnaire gives an insight into the students and will, in this chapter also be discussed in relation to previous research. Finally, the main aspect of physical activity and learning will be discussed when connecting previous research with my findings in the area.

### 6.1 Main findings

The first finding that was noticeable was the fact that the participants like relay best (fig. 5) and they answered that the factors they liked about the relay were: to run, to cooperate and to be on a team (fig. 4). There is also a clear link between high performance on the short-term test and what they believe helps them remember the most words (fig. 9). In addition, in figure 12, it is shown that out of five students who remembered the most words from the classroom method, four of them were the ones who scored above 30 points. There could also be some indications that a fourth grader could have a metaknowledge about their own learning. This is displayed in figure 14, where the students actually seemed to know what method helped them remember the most words. There are also some gender tendencies as, for instance, the boys are clearly the ones who like relay the best, with 80% of them preferring relay compared to the classroom method (fig. 5). The boys also believe that relay will help them remember the most words (fig. 7). When reviewing the findings from the long-term test, it is clear that it is actually the girls who remembered the most from the relay method and the boys had quite even results from both methods with a slightly higher result for the relay method (fig. 13). One explanation for girls benefitting the most from the relay method could be that the boys scored higher in short-term test (figure 11). This explanation is reasoned in the theory that low-performing students seem to be the ones who benefit the most from physically active lessons (Resaland et al., 2018). Figure 11 shows that in the sample for the long-term test, seven out of ten boys scored above 30 points in the short-term test.

### 6.2 Word-learning

This study aimed to investigate two different methods to teach vocabulary, and in a multicultural classroom I found it important to facilitate learning for all learners despite their prerequisites. One way of doing so is to acknowledge that students have Norwegian as a second or third language and therefore might not be as proficient in Norwegian as their peers. Therefore, pictures were used to avoid them having to remember a Norwegian translation as well as the English word. In addition, the use of pictures could be an aspect of helping them acquire new words in general, considering the dual coding theory. Clark & Paivio (1991) mentioned the dual coding theory and that pictures could make a word easier to comprehend and remember. This is caused by the connection between the verbal and non-verbal systems. Moreover, it is interesting that Barcroft (2007) argues that copying words could decrease vocabulary learning as the learner should instead focus on form and meaning. When using pictures, they could look at the picture to acquire meaning, while writing. Folse (2006) mentions that meeting the word numerous

times could be beneficial for the retrieval of the words, therefore, one could perhaps use both methods with the same words to increase the chance of the students remembering the words.

### 6.3 The students experience with the project

One of the interesting findings in the questionnaire was that fifteen students out of thirty-six students found the classroom method noisy (fig. 3). The classroom method was planned to be calm and quiet, since firstly, they listened to their teacher and pronounced the words, and secondly, they could sit at their desk and write the words. Some of the lessons seemed to start a bit noisy either because of something happening in the lesson before or during the recess. However, they were not asked about if the relay was noisy so they could have found that method noisy as well. In general, they listened and did what they should during the classroom part. On the other hand, when reviewing the findings on what they liked the best in the classroom sixteen answered that it was quiet.

Nevertheless, some of them did most likely experience some noise, which could also be because of the new situation that felt a bit overwhelming for them. A classroom consists of many different children, who have different backgrounds and might find different aspects of a learning situation difficult. Some students could find it difficult to sit still in the classroom and others can find it difficult to wait for their time to speak in the classroom. Varying teaching methods can be important in the aim of finding teaching methods that suit each student. Statistically there is one student with ADHD in each Norwegian classroom (Bru, Idsøe & Øverland, 2016). Therefore, it is interesting that findings indicate that physical activity could be beneficial for students with ADHD (Vysniauske, Verburgh, Oosterlaan and Molendijk, 2020; Medin, Medin, Hefte, Storm-Mathisen & Bergersen, 2019). Relays could therefore be a beneficial method for these students. Therefore, when taking these students out of the classroom, they might find themselves in a new area that does not have these negative associations. It is therefore good to see that only six students mention arguing as a challenge during the relay (fig. 2). In addition, figure 4 and 5 have more replies on each variable, which could indicate that students found many different aspects positive of these two methods.

When looking at the aspects the students enjoyed when participating in the relay, one notices that the five most popular answers were, « it was fun to be on a team, «It was fun when we cheered on each other», « I found it fun» and «To cooperate» (fig. 5). The findings indicate that the students enjoyed participating in a relay, which again could increase their motivation for learning English, and as Vingdal (2014) mentions; motivation has great importance in their learning. Jensen (2005) argues that it is beneficial to strengthen multiple pathways in order to get a better chance of retrieving a classroom memory. Moreover, one of these pathways could be an emotional response that is triggered, which therefore could help embed the memories (Jensen, 2005). That trigger could be enjoyment and the exciting part of being on a team and cheering on each other could be such a memory that is connected to the words learned during that lesson, these factors are shown in my findings in figure 5. It is also interesting that Jensen (2005) states that these emotional responses could also have an effect straight after learning. My students went straight to the stairs to participate in the relay after being in the classroom. Therefore, one could believe that the physical activity straight after their time in the classroom, could also increase their learning in the classroom.

## 6.4 The aspect of gender

Boys clearly like relay best, but only eight of them believe that it also helped them remember the words. Resaland et al. (2018) stated that boys at all academic levels benefited the most from physically active lessons, which could result in them really liking the method as shown in figure 7. When looking at gender specific differences and the score on short-term memory, the boys are the ones who scored the best (fig. 10). Figure 22 shows that 75% of the girls and 58% of the boys remember most from the relay, which gives a total of 65% that remembers most from the relay. One of the reasons for the girls remembering most from the relay, could be that the boys performed better in the short-term test and could therefore be higher achievers in acquiring vocabulary. Therefore, the gender differences observed might result in the chosen sample including high achieving boys. A larger sample with students at all performing levels could perhaps have strengthened the assumption; that there seem to be few gender specific differences in word-learning. Although, Kaushanskaya, Gross & Buac (2013) indicate that girls could have some advantages in word learning, such as when the word-learning tasks involved learning of familiar information. However, Langeland (2012) did not find any gender differences in word learning.

## 6.5 Low performing students

When they are asked about which method helps them remember the words, none below 19 points chose classroom as the option, but most of them choose both methods. Those below 19 points scored low to medium, where those above 30 points could be considered as high performers. Resaland (2018) mentions that the low performing students benefit the most from physically active lessons, and it seems like students who struggle with short-term memory could prefer relay or at least both methods. While for those above 30 points, five of them chose classroom as the method that helps them the most (fig. 11). The short-term test could be considered as a vocabulary test, since some of the students mentioned that they knew all of these words before. While the ones who scored poorly, did perhaps not only struggle with short-term but also struggle with remembering vocabulary in general.

The aspect of low-performing students is really interesting in my project. None of the participants who performed below 19 points in the short-term test reported that they believe that writing in the classroom would help them remember the most words (fig 12). These students are most likely correct, because when viewing figure 20, it is clear that only one student below 29 points remembered most from the classroom method. Some studies indicate that physical activity could benefit the working memory and *time-on-task* in low performing students (Sibley & Beilock, 2007; Mahar et al., 2006). More importantly, there are also studies that indicate that physical activity increases the academic performance in low performing students (Schmidt-Kassow et al. (2013), and that especially the findings in the ASK-study (Resaland et al., 2018) are relevant when looking at my study. Since the ASK-study included relays and physically active lessons there are similarities to my intervention, and therefore it is interesting that their main finding was also that the low performing girls and boys were the ones who benefited the most from active lessons.

## 6.6 Physical activity during the school day

The data provided in this study is not enough to state that relay or the classroom method helps students remember more words, however there are some indications that are

interesting. Students seem to like the relay and if it makes the low performing students remember the words, it could be a reason for including the method in teachers' practice. Especially when considering the energy young students have, they should all be more active during the school day. Even though it seems to be difficult to find significant conclusions on physical activity and memory/academic performance, the meta-analysis of Sofi et al. (2011) did find a direct correlation between physical activity and cognitive decline. Moreover, they state that even participants exercising at a low-to-moderate level showed a significant protection against cognitive decline. More interestingly, they mention that BDNF and dopamine are the important factors that cause the beneficial effect on the brain.

There have also been numerous studies lately that emphasize that physical activity indeed does have a positive effect on memory, because of the increased positive factors that are released in the brain during physical activity (Shohamy and Adcock, 2010; Jensen, 2005; Dongen et al., 2016; Winter et al. 2006). These findings give teachers enough proof to start including physical activity during the school day. Even though organising some physical activity for the students might interfere with the curriculum, it could seem like physical activity could have a positive effect both before, during and after learning (Shohamy & Adcock, 2010, Hötting, Schickert, Kaiser, Röder & Schmidt-Kassow, 2016). This aspect is particularly important in my study, since the students learned some words and participated in the relay afterwards, that also included some new words. Because of an activity straight after the learning in the classroom, this could have the same effect as actually learning during the activity.

## 6.7 Physically active lessons

Physically active lessons during the school day have been studied, and it is noteworthy that Resaland et al. (2018) did not find a significant improvement in their academic performance. However, he also mentions that it could result in the short intervention period. In the Dutch *Fit & Vaardig op School* intervention (Mullender-Wijnsma et al., 2016) they found significant improvements first after two years, while the PAAC study (Donnelly et al., 2009) which lasted for three years did also found significant improvement. When linking the long-term effect aspect to my study, the long-term memory was tested, but the intervention was not on a long-term. Perhaps other findings may have occurred if the intervention lasted for a longer period of time. The teacher in my study was not familiar with the method, so there seem to be some difference in the results and probably in the teaching during the intervention weeks. When observing their teacher organising them in the active part of the lesson, it was clear that it was unfamiliar to him and the students also seemed to perform better from the classroom lessons that week than the other weeks when I taught them (figure 16). The aspect of me teaching them English could perhaps have an effect since it was unfamiliar to them and a bit exciting. One of the other factors could be that I was as confident when teaching the relay method as when teaching the classroom method, and this could play a part in their learning. To succeed in physically active lessons, it seems to be important to let both the teachers and students get used to the method.

## 6.8 Social aspect of physically active lessons

An average primary school class in Norway consists of twenty to twenty-nine students, and all of these students spend every day of the week together. Some are friends, others might not get along, and there might be some tension that affect lessons. The social

aspect of teaching is important, because we do teach human beings who are consistently in a social relation to the ones around them. As my observation in week two showed, students could have a bad day, they could argue, and they can easily get distracted and unconcentrated. I believe that students who like their classmates and feel that they have a good relation to every student in the class, will not only thrive better, but also learn more. Conversely, teachers aim for a good classroom environment, and as Vingdal (2014) mentions; one way to succeed could be to include physical activity. When students enjoy their time together, they will also more easily create stronger relations to each other. Out of thirty-six students twenty-one students answer that they like to run (figure 5), which can indicate that these students like to be active. Moreover, when they were asked what they liked the best about the relay; twenty-one answered that they found it fun to be on a team, and twenty found it fun, as well as nineteen students liked that they could cooperate (figure 5). Additionally, figure 5 also shows that nineteen students enjoyed cheering each other on. These findings show that they enjoy themselves when participating in a relay. Additionally, it is pleasant that they appreciate the social aspect of the relay. These findings can support a theory about how emotions play a part in learning, if physically active lessons can make the students feel happy and thrive in their school environment, there will most likely also occur more learning (Masuhara (2016; Immordino-Yang and Damasio, 2007). To have fun together is therefore a significant part of physical active lessons.

## 6.9 Word-learning methods

There are several methods to conduct when teaching vocabulary. Students can practice with each other and they might learn more because of the social interaction it provides. There are also many games and boardgames that can enhance their vocabulary acquisition. Teachers in Norway have the possibility to choose the exact method they want when teaching, as long as they teach within the curriculum. This opportunity gives the teachers many possibilities and they can choose methods that fit their students. Since the students have different prerequisites they might also prefer and learn from different methods, which requires the teacher to vary the methods used in their teaching. I would argue that one of the methods should be physically active lessons, not only because it might increase their learning, but also because of the health perspective. A method that keeps the students active and moving instead of sitting still could provide a positive contribution to their school day.

## 6.10 Methodology

The aim was to study how physically active lessons could improve Norwegian pupils' ability to remember English vocabulary. The triangulation method was conducted, and it included a questionnaire, short-term test and long-term test. The data collected with these methods did give tendencies that can answer the research question. I will therefore answer that I did find what I aimed to find, although, there are some sources of error that is important to acknowledge. The relay method was conducted straight after classroom method, which could mean that the words learned in the classroom can be increased by the physical activity straight after the learning situation (Shohamy & Adcock, 2010). This aspect could therefore weaken the results, although it is interesting that despite this aspect there was indications that they remembered most from the relay method (fig. 13). The changes that could strengthen my results could be a larger sample and a longer intervention. For instance, a period of three weeks numerous times during a year with a strategic testing routine. With only one period of intervention, my data

material ends up being too thin to state that physically active lessons can increase Norwegian fourth graders ability to remember English vocabulary. Nevertheless, the findings presented indicated that the students like relay and they like to cooperate and to be on teams, which give great indications for increasing the extent of physically active lessons.



## 7 Conclusion

The research question asked was: *How can physically active lessons improve Norwegian 4<sup>th</sup> graders ability to remember English vocabulary?* This study aimed to understand how and why physically active lessons could improve Norwegian pupils' ability to remember English vocabulary. In this last chapter, I will bring this study to a close by re-entering the theoretical framework in the light of the study's findings. I will also discuss the further implications of this study in a Norwegian school context and finally make suggestions for further research.

The fundamental learning view for this thesis was social-cultural theory, hence the part of social-interaction is important to consider when teaching. Could physically active lessons create a positive and social learning environment? Students should enjoy their time at school and also their English lessons. It could be difficult to make younger students wanting to learn by themselves, however, if they experience a positive and enhancing environment, learning would more likely occur. Emotion and learning are strongly attached (Immordino-Yang and Damasio, 2007) and an environment that they like to be in will then have positive associations, which is an important base for their learning. Vingdal (2014) also address that where learning occurs and who you learn it with matters. The social-cultural perspective on learning could also be present when teaching vocabulary. Instead of instructing students to practice a list of vocabulary, they could instead be active, use their bodies and interact with each other while learning this list of words.

There seem to be different aspects of the physically active lessons that could improve the students' ability to remember English vocabulary. Through this paper, it is clear that physical activity increases learning and memory (Shohamy & Adcock, 2010, Hötting, Schickert, Kaiser, Röder & Schmidt-Kassow, 2016; Jensen, 2005; Dongen et al., 2016; Winter et al. 2006). The findings in the brain during physical activity are also enlightening, since it explains that the proteins released in the brain can explain why physical activity can benefit learning and memory (Shohamy and Adcock, 2010; Jensen, 2005; Dongen et al., 2016; Winter et al. 2006). We should also focus on Jensen (2005) who mentions the multiple pathways that needs to be strengthened, and both positive experiences during learning and factors released in the brain can all be part of the strengthening. I will also emphasise again that active learning is not only beneficial in the learning moment, but it could also increase the learning that occurred before and after (Shohamy & Adcock, 2010).

The physically active lessons could be in the classroom, in the hall or outside, and it can include the whole class or parts of the class. During a physically active lesson they can for instance learn how to write a correct sentence in English, learn to categorize words into word classes or they can also easily practice their oral, reading and writing skills. There are no limits of what a physically active lesson could include, and they might also end up learning just as much as if they were seated at their desk in class. My findings indicate that they learn more from the relay method, they like it better, and especially the students with low short-term memory seem to learn more from the relay method.

Since the Norwegian parliament set a suggestion for one hour of physical activity each day for students at year 1 to year 10, it is likely that this might be completed at one time in the future. Physical activity could be a larger part of the students' school day in the future, and teacher might need to include physical activity in their teaching of other subjects. This study can be a contribution to challenge the way teachers teach vocabulary. It has been important to show how physically active lessons could easily be involved in English education. Physically active lessons could include vocabulary learning, but also reading and oral skills. To change a tradition of glossary tests could be difficult and might require the teachers to discover different methods. Moreover, teachers would want reliable research projects that shows that other methods increase the students learning.

This study included a sample of thirty-six students which limits this study, as it could have resulted in significant results if the sample was larger. The first enquiry for further research is therefore, to study the effect of physically active lessons on word-learning with a larger sample. It could also strengthen the study if there was a proficiency test at the start of the project, to establish their proficiency level. A class will consist of different levels of proficiency, and as shown in this study, it can be difficult to find words they have not met before. Conversely, further research could consider different aspects of English education as well as recall of vocabulary such as oral skills and reading skills. With a larger sample and a larger area of research some correlation could be made that could expand the understanding of the effects of physically active lessons in English education. Moreover, the social aspect of physically active lessons should be considered when studying the effect of physically active lessons, as it can establish a positive and active environment for the students.

# Resources

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# Appendix

Appendix 1: Consent form

Appendix 2: Approval NSD

Appendix 3: Questionnaire

Appendix 4: Short-term test

Appendix 5: Long-term test for week 1, with answers

Appendix 6: Long-term test for week 2, with answers

Appendix 7: Long-term test for week 3, with answers

Appendix 8: Overview of words learned during the classroom method and the relay method



## Appendix 1: Consent form

### **Samtykkeerklæring foresatt/elev**

Vil dere delta i forskningsprosjektet:

*Ordlæring og fysisk aktivitet i engelsk som andrespråk?*

#### **Formål**

Mitt navn er Kathrine Dalane og jeg er masterstudent ved studieprogrammet fagdidaktikk med Engelsk ved NTNU. I den forbindelse planlegger jeg et forskningsprosjekt som har som formål å kartlegge hvordan ordlæring med fysisk aktivitet kan fremme læring av gloser i engelsk undervisning. Mine hovedfag er kroppsøving og engelsk, og det er derfor interessant å se på en tverrfaglig tilnærming med læring i bevegelse. Mitt forskningsprosjekt vil handle om å innføre en time med ordlæring i uken i 5 uker. Elevene vil da delta i en undervisningstime hvor de øver på å huske ord ved hjelp av to ulike metoder.

#### **Hva innebærer deltakelse i studien?**

Elevene vil gjennomføre en standardisert test for å kartlegge deres engelsk kompetanse, samt en kort ordpar test for å sjekke deres evne til å huske ord. Til slutt vil det være en test hvor elevene møter alle de ordene de har gått gjennom i undervisningsøkta, og de vil da testes for hvor mange ord de husker. Det er også ønskelig at de svarer på et kort spørreskjema i slutten av studien slik at vi kan se elevenes tanker om undervisningsøkta. Disse testene vil ses i en sammenheng for å få et best mulig bilde av hvilken effekt de to ulike metodene har. Hvis dere samtykker til at barnets kontaktlærer informerer om eventuelle lærevansker/diagnoser vil også dette bli sett på som en faktor i resultatene på testene.

#### **Hva skjer med informasjonen om deg?**

Informasjonen som samles inn vil lagret på et valgt alternativt navn, og listen over hvem som tilhører hvilket navn vil bli oppbevart på en separat harddisk, samtidig vil det kun være jeg og veileder som har tilgang på all informasjon. Både sted og navn vil bli anonymisert slik at deltakerne ikke kan gjenkjennes i publikasjonen. Prosjektet skal avsluttes juni 2020 og all data vil da bli slettet. Det er frivillig å delta i studien, og du kan når som helst trekke ditt samtykke uten å oppgi noen grunn. Dersom du eller ditt barn trekker deg, vil alle opplysninger om du eller deg bli slettet. Du har rett til:

- Innsyn i hvilke personopplysninger som er registrert om ditt barn

- Å få rettet personopplysninger om ditt barn
- Å få slettet personopplysninger om ditt barn
- Å få utlevert en kopi av dine personopplysninger om ditt barn
- Å sende klage til personvernombudet eller datatilsynet om behandlingen av dine personopplysninger.

Vi vil behandle opplysningene om ditt barn basert på ditt samtykke. Prosjektet er også godkjent av NSD (Norsk senter for forskningsdata).

**Dersom du har spørsmål om studien, ta kontakt med:**

Kathrine Dalane

kathrdal@stud.ntnu.no

95177038

Veileder av prosjektet; Karen Bauer, førsteamanuensis ved NTNU

karen.bauer@ntnu.no

**Samtykke til deltakelse i studien**

Jeg har mottatt og forstått informasjon om prosjektet *Ordlæring og fysisk aktivitet i engelsk som andrespråk*, og er villig til å delta.

Jeg samtykker at (navn på elev) \_\_\_\_\_ får delta i prosjektet. Samtykket innebærer at han/hun får tillatelse til å:

**Kryss av for det eleven vil delta i**

Gjennomføre Engelsk test

Gjennomføre Ordpar test

Gjennomføre slutt test hvor hukommelsen av ordene sjekkes

Utføre et kort spørreskjema om metodene

Jeg samtykker også at Øyvind Holmedal gir informasjon om mitt barns eventuelle lærevansker eller diagnoser

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(Signatur og dato)

# Appendix 2: Approval NSD

24.5.2020

Meldeskjema for behandling av personopplysninger



## **NSD sin vurdering**

### **Prosjekttittel**

Ordlæring og fysisk aktivitet i engelsk som andrespråk

### **Referansenummer**

596288

### **Registrert**

13.06.2019 av Kathrine Dalane - kathrdal@stud.ntnu.no

### **Behandlingsansvarlig institusjon**

Norges teknisk-naturvitenskapelige universitet NTNU / Fakultet for samfunns- og utdanningsvitenskap (SU) / Institutt for lærerutdanning

### **Prosjektansvarlig (vitenskapelig ansatt/veileder eller stipendiat)**

Karen Bauer, karen.bauer@ntnu.no, tlf: 95177038

### **Type prosjekt**

Studentprosjekt, masterstudium

### **Kontaktinformasjon, student**

Kathrine Dalane, kathrine.dalane@hotmail.no, tlf: 95177038

### **Prosjektperiode**

12.08.2019 - 01.06.2020

### **Status**

24.07.2019 - Vurdert

### **Vurdering (1)**

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#### **24.07.2019 - Vurdert**

Det er vår vurdering at behandlingen av personopplysninger i prosjektet vil være i samsvar med personvernlovgivningen så fremt den gjennomføres i tråd med det som er dokumentert i meldeskjemaet 24.07.2019 med vedlegg, samt i meldingsdialogen mellom innmelder og NSD. Behandlingen kan starte.

#### **MELD VESENTLIGE ENDRINGER**

Dersom det skjer vesentlige endringer i behandlingen av personopplysninger, kan det være nødvendig å melde dette til NSD ved å oppdatere meldeskjemaet. Før du melder inn en endring, oppfordrer vi deg til å lese om hvilke type endringer det er nødvendig å melde:

[https://nsd.no/personvernombud/meld\\_prosjekt/meld\\_endringer.html](https://nsd.no/personvernombud/meld_prosjekt/meld_endringer.html)

## Appendix 3: Questionnaire

Ditt nummer:

1. I am:
  - a. Boy
  - b. Girl
  
2. Tallet ditt:
  
3. Jeg liker best:
  - a. Stafett
  - b. Skrive i klasserommet
  
4. Jeg lærer mest av:
  - a. Stafett
  - b. Skrive i klasserommet
  
5. Det som er vanskelig med stafetten er:
  - a. Å løpe
  - b. Å skrive ordene riktig
  - c. Å finne riktig lapp i boksen
  - d. Krangling på lagene
  - e. Kjedelig
  - f. Ingenting
  - g. Annet:
  
6. Det som er vanskelig med å skrive ordene i klasserommet er:
  - a. Å se på smartboarden
  - b. Klassen var bråkete
  - c. Lappen å skrive på var for liten
  - d. Liker ikke å sitte å skrive
  - e. Kjedelig
  - f. Ingenting
  - g. Annet:
  
7. Det som hjelper meg å huske ordene best er:
  - a. Stafett
  - b. Skrive i klasserommet
  - c. Begge like godt
  - d. Ingen av dem
  
8. Hvis jeg skal lære meg ord på egenhånd, ville jeg:
  - a. Løpt stafett
  - b. Skrive dem ned på et ark
  - c. Si dem høyt for deg selv
  - d. Si dem høyt til andre
  - e. Tegne ordet
  - f. Annet:

9. Det jeg liker best med å skrive i klasserommet er:

- a. At det er rolig
- b. Fikk lov til å tegne etterpå
- c. Lærte/husket ordene best
- d. Gøy å øve på å skrive fint
- e. Fikk se nøye på bildene
- f. Fikk sitte rolig mens jeg jobbet
- g. Engelsk timen ble mer morsom
- h. Lærte mye og kommer til å huske mange av ordene
- i. Ingenting
- j. Annet:

10. Det jeg liker best med å løpe stafett er:

- a. Det var gøy å være på lag
- b. Det var gøy når vi heiet på hverandre
- c. Jeg lærte mye og kommer til å huske mange av ordene
- d. Jeg liker å løpe
- e. Jeg synes det var morsomt
- f. Det var gøy å ha et brett å fylle ut
- g. Det var spennende
- h. Samarbeide med andre
- i. Ingenting
- j. Annet:

## Appendix 4: Short-term test



To think



Camera



To clean



To dream



Family



To open



To buy



Umbrella



Watermelon



Guitar



Battery



Alligator



Vegetables



Computer



To wait



Battery



Wolf



Butterfly



Temperature



Pancakes



Appendix 5: Long-term test for week 1, with answers



Promise



Agree



Freeze



Cough



Break



Dislike



Care



Forget



Shake



Stand

Appendix 6: Long-term test for week 2, with answers



Bucket



Reindeer



Cloud



Dolphin



Receipt



Donkey



Shovel



Stomach



Building



Bridge

Appendix 7: Long-term test for week 3, with answers



Skeleton



Carpet



Highway



Exercise



Celebration



Octopus



Knowledge



Ladybug



Turquoise



Award

Appendix 8: Overview over words learned during the classroom method and the relay method.

	<b>Week 1</b>	<b>Week 2</b>	<b>Week 3</b>
<b>Classroom</b>	Promise Agree Freeze Cough Break	Donkey Shovel Stomach Building Bridge	Octopus Knowledge Ladybug Turquoise Award
<b>Relay</b>	Dislike Care Forget Shake Stand	Bucket Reindeer Cloud Dolphin Receipt	Skeleton Carpet Highway Exercise Celebration

