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Learning Technical Vocabulary: A Study Exploring Approaches and Material to Support Learning L2 Vocabulary in Norwegian Upper Secondary Schools

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Abstract

The aim of the study was to shed light on how a technical vocabulary is best learned with vocational pupils in upper secondary school. Two approaches, implicit and explicit, were chosen and lesson plans were made for a six-week period, for two VG2 classes. In addition to the quantitative study of the approaches, surveys and interview was conducted to examine the pupils' experiences with the approaches, material and content. The latter was done in order to determine which factors contribute to making English, as a common core subject, relevant to pupils in vocational classes.

Test results and pupil feedback both suggest the explicit approach is favorable. However, different choices in material and lesson content could have influenced both the results and pupils' attitude towards the implicit approach. Other considerations such as likely use of the language, proficiency level and personal traits in the learner are also important when choosing approach, or a mixture of approaches.

Preface

Originally, I intended to write my master's thesis within the field of literature. However, after a few years of teaching, other fields emerged as more relevant to my profession. Working at an upper secondary school with almost exclusively vocational programs lead to a change in focus. Consequently, I decided that exploring ways of teaching English as a common core subject to vocational pupils would be very interesting. Subsequently, the focus was narrowed into technical vocabulary acquisition, which is naturally central in teaching vocational classes. It was essential to me to choose a topic central to my work that I, and others, can utilize in teaching practices.

First of all, I want to express my gratitude to my supervisor Anita Norman whose guidance, support and feedback has been invaluable throughout the whole process of this thesis. Next, to each the pupils of the two classes participating; I am profoundly impressed by your patience, positivity, humor and dedication through six weeks of intensive learning and testing. Thank you to my partner Karel Eriksson for your support and the time to be able to finish this thesis. To my mother May Knarud Ulmo for travelling for hours several times for babysitting. Lastly, to our beautiful daughter Nelly who lets us sleep all night and makes us smile every day.

Marit Knarud Ulmo,

Sandefjord May 2018

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1 Introduction

In 2011, the Norwegian Ministry of Education and Research stated that they wished to direct focus to the common core subjects in vocational programs in Upper Secondary School. The principal of adapting these subjects to each individual education program was anchored in the 2010 Education Act §1-3.[1] The FYR framework's core assumption is that is that vocational direction and relevance will contribute to higher quality in the education and consequently help increase the completion rate in upper secondary education. The Ministry further specifies that a vocational direction and relevance entail using subject matter, learning strategies and vocabulary in the subject that are relevant to the specific profession and can prepare pupils for adulthood. As a teacher in an upper secondary school with almost exclusively vocational programs, the concept of making English as a subject relevant to the students' chosen profession is very central to me. Consequently, finding a way to make English language learning relevant to my students and their future jobs was the inspiration for this research project.

Based on the purposes of the FYR framework, the focus for this thesis is:

Learning a technical vocabulary within a vocational education program in Norwegian upper secondary schools.

To shed light on this topic, the main research question has been developed:

Which approach, implicit or explicit, is most helpful for learning a technical vocabulary?

A relevant additional research question relates to what the pupils consider important in choices of approach, material and content, to assist in the process of learning technical vocabulary:

Which aspects related to approach and material are important to consider in order to support pupils in the process of learning technical vocabulary?

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[1] FYR stands for fellesfag, yrkesretting og relevans – common core subjects, vocational focus and relevance. Utdanningsdirektoratet, Rammeverk for FYR-prosjektet 2015, https://www.udir.no/globalassets/upload/fyr/rammeverk-fyr.pdf, Accessed 15.11.2017

Thus, the purpose of this study was two-fold. First, to explore different ways of learning a technical vocabulary for L2 learners. Second, to find a way to teach L2 vocabulary to vocational classes in a way that is perceived as relevant for the learners. In consequence, lesson plans were structured using two approaches for vocabulary learning; implicit and explicit. After each of the lessons, testing was conducted in order to get comparative data for analysis and discussion. In addition, the pupils answered three surveys about the research project and approaches, and an interview was held with two pupils from each group.

Following this introduction, is a theoretical background covering acquisition of L2 vocabulary, with a particular focus on technical vocabulary/low frequency words. Moreover, the two approaches implicit and explicit are discussed. The theoretical background also covers theory pertaining to the second research question by presenting theory on content and relevance in the L2 classroom. The method chapter presents the participant groups, my role as a teacher and researcher and the methods for collecting and analyzing material. Then, the analysis and results of both the quantitative and qualitative testing is presented in the chapter Results an Analysis, before these results are discussed in connection to the theoretical background. Finally, the conclusion attempts to settle the discussion and revisit the research questions.

2 Theoretical background

The importance of vocabulary in Second Language Learning (L2) is a matter of course, and has long been acknowledged by researchers.[2] In order to communicate and acquire knowledge using L2, a certain vocabulary is required. However, whether or not learning vocabulary should be done explicitly or implicitly is another question. The main part of the theoretical background for this research project will thus be theories and reported research into vocabulary in L2 learning. Within this field, a particular focus will be given to teaching and learning a technical vocabulary (low frequency words), and the explicit and implicit approach to learning this. This focus will provide a background for the main theme and research question: *Which approach, implicit or explicit, is most helpful for learning a technical vocabulary?* In addition, this section will also discuss theoretical perspectives related to the second research question of the thesis: *Which aspects related to approach and material are important to consider in order to support pupils in the process of learning technical vocabulary?* The latter question relates to the relevance of English as a common core subject in vocational classes. Supporting the premise for this research project, Hestetræet and Ørevik state that the unique words of each vocational program are especially important to learn.[3]

2.1 Vocabulary in Second language learning

2.1.1 The Importance of Vocabulary

"Without grammar very little can be conveyed, without vocabulary nothing can be conveyed".[4] This is David Wilkins take on the importance of vocabulary, and it is impossible to argue even if many language courses focus more on grammar.[5] Supporting Wilkins statement, discoveries made by the science of Corpus Linguistics in the 1960s led to developments that would challenge the role of grammar in L2 learning. The lexical syllabus

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[2] Bee Choo Lee, Tan Ai Lin Debbita and Ambigapathy Pandian, *Language Learning Approaches: A Review of Research on Explicit and Implicit Learning in Vocabulary Acquisition*, (Penang: Elsevier, 2012)

[3] Torill Irene Hestetræet and Sigrid Ørevik, *'English in Vocational Studies' Teaching English in the 21st Century*, (Bergen: Fagbokforlaget 2018), 326.

[4] Scott Thornbury, *How to Teach Vocabulary*, (Essex: Pearson Education Ltd., 2002), 13.

[5] Ibid., 14.

and the lexical chunks, which developed from the discoveries of the Corpus Linguistics has helped raise awareness to the importance of vocabulary development.[6] Lee refers to Nation (1990) who says that language learners themselves also regard vocabulary knowledge to be of primary importance. Difficulties for many language learners for both receptive and productive language stem from inadequate vocabulary.[7] In addition, Laufer (1998) and Lewis (2000) reaffirm the importance of vocabulary by stating that the biggest difference between L1 and L2 speakers is vocabulary size and the single most important task for language learners is acquiring a sufficient vocabulary.

2.1.2 Learning and Knowing a Word

Thornbury presents the learner with two challenges in acquiring L2 vocabulary.[8] Firstly, to make the correct connections between the form and meaning of words, and secondly to use the correct form of a words for the intended meaning when producing language. Nation supports this with the receptive/productive distinction. Receptive vocabulary perceives the form of the word while listening or reading and retrieves its meaning, while productive vocabulary expresses a meaning by speaking or writing with an appropriate form.[9] Thus, regardless of how vocabulary learning is practiced, there should be factors that aim to master both understanding and production of the L2 language vocabulary, in both oral and written forms.

Exploring Nation's terms further, the scope of knowing a word becomes more complex. Recognition orally and in writing, word parts, related words, context and collocations are all examples of receptive word knowledge. In the same way, productive knowledge includes pronunciation, spelling, placing words in context and using a word in an original sentence.[10] Nation moves on to give four possible explanations to why productive knowledge is more difficult than receptive, first stating that it is not clear why receptive is easier, but stating that in general, this is the case. As early as 1929, Stoddard conducted tests on receptive and productive learning and found that the results were clear; receptive tests are easier than perceptive.[11]

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[6] Ibid., 14.
[7] Lee et al., *Language Learning Approaches*
[8] Thornbury, *How to Teach Vocabulary,* 2.
[9] Nation, I.S.P., *Learning Vocabulary in Another Language*, (Cambridge: Cambridge University Press 2001), 24
[10] Ibid., 26-28
[11] Ibid., 31

Thornbury states that when it comes to learning vocabulary "…learning is remembering."[12] In the classroom teachers aim to impart knowledge their pupils can utilize, not only in the classroom, but also later in life. Therefore, according to Thornbury, the purpose is not only to learn many words, but to remember them. Researchers working with memory identify three different systems.[13] Firstly, is the *short-term store* has the ability to remember limited information for up to a few seconds. Obviously, this is not the aim of vocabulary learning. Moving on to the second system the *working memory*. Thornbury says that by placing the word in an articulatory loop (repetition of the word) the word can be remembered long enough to be used for a certain purpose. The ability to use this loop is one determining factor in the ability to learn languages. However, it can hold more L1 than L2 words, and is susceptible to interference such as noise, which can disrupt the function.[14]

The third, and perhaps the most important system, is the *long-term memory*.[15] With an enormous capacity and its content durable over time, it is the desired placement of new words. However, even if a word is placed in the long-term memory, it can still be forgotten. This is where Thornbury introduces the terms 'the quickly forgotten' and the 'never forgotten'. In 'the quickly forgotten', a word is stored in the long-term memory, but forgotten by the next lesson[16]- a familiar phenomenon. Consequently, measures must be taken to ensure that new words become part of 'the never forgotten'. Thornbury moves on to summarize some of the research findings relevant to long-term memory word learning.[17] A short presentation of those most relevant to this research project follows.

The first method is *repetition*, which is a way of memorizing through repeated rehearsal while a word is still in the articulatory loop. It is important to note that it is the number of encounters with the word that is important, not simply repeating an item. Secondly, another repetition method called *retrieval* is crucial. To remember a word, simply having to retrieve it from memory is helpful. Thirdly is *spacing*, meaning practice must be distributed over time, both in the same lesson and over a sequence of lessons. The fourth method is *pacing* which means giving each individual time to process words at their own pace. *Putting the words to use* is the fifth method, which follows the principle 'use it or lose it'. Other methods include other ways of utilizing the words, such as completing or making sentences, imaging and

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[12] Thornbury, *How to Teach Vocabulary*, 23.
[13] Ibid 2002
[14] Ibid 2002
[15] Ibid 2002, 24
[16] Ibid 2002,
[17] Ibid 2002,

mnemonics. Lastly, motivation to learn and attention to the learning process is, of course, important.[18]

As revealed by the many factors that contribute to the long-term memory, several considerations must be made when planning and conducting lessons that aim to expand vocabulary. Nation says that it is important to focus not only on learning the words, but also in developing strategies for learning words. Furthermore, pupils must be comfortable using words in all aspects of language learning and production, and be comfortable utilizing the strategies they have learned.[19] These factors, along with Thornbury's methods for remembering words form a basis for all vocabulary learning, regardless of types of words or teaching approach. These theories are thus used in planning the lessons for both the implicit and explicit approaches to vocabulary learning in the research project, complemented by theories regarding learning low frequency words - or a technical vocabulary – in the subsequent section.

2.2   Technical vocabulary/ low frequency words

In frequency based word lists, for example a corpus based frequency count, there will be a rapid drop in frequency. Nation uses these lists, described by Zipf, to conclude that a person's vocabulary consists of high frequency and low frequency words.[20] Technical vocabulary is a type of low frequency words and is defined by personal interests and what is important to individuals.[21] In the case of the pupils who are part of this research project, part of their technical vocabulary will be low frequency words related to working as an electrician. There seems to be a consensus in L2 learning that, until a sufficient high frequency words vocabulary is learned, the focus of teaching should remain on high frequency words.[22] [23] Naturally, a certain vocabulary is necessary in order to utilize low frequency words or technical vocabulary. Still, in some cases, such as with the words chosen for the pupils to learn here, the importance given to a certain technical vocabulary will be an exception.[24] In

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[18] Ibid 2002,
[19] Nation, *Learning Vocabulary in Another Language,* 380.
[20] Nation I.S.P, *Thinking Allowed*, (Cambridge: Cambridge University Press 2011)
[21] Nation, *Learning Vocabulary in Another Language,* 20.
[22] Ibid., 13.
[23] Thornbury *How to Teach Vocabulary*, 21.
[24] Nation 2001, *Learning Vocabulary in Another Language,* 395-396.

addition, as shown in the results of the mapping test presented in the Method chapter, the pupils participating in the project already have a good vocabulary for L2 learners their age.

Nation sorts technical vocabulary into four categories, based on how specific they are to the particular field, topic or discipline.[25] For the purpose of this research project however, no such distinction has been made as it would require first-hand knowledge into the field of electrical installations and automated systems. A list of technical vocabulary can be made in two ways.[26] The first is using a dictionary. The second, which has been used here, is a simplified version of a corpus based frequency count where the technical vocabulary has been extracted from the texts, videos and audio material used in the lessons using an implicit approach.

The distinction made between high frequency and low frequency words is an important one because, according to Nation, teachers should deal with them differently.[27] Despite the teacher not knowing the scientific field, thus having a disadvantage in learning the words, he or she could still make a useful contribution to help pupils learn a technical vocabulary.[28] The role of the teacher will then be to help their pupils with techniques to learn vocabulary and to assist with useful aids.

2.3   Explicit and Implicit Vocabulary Learning

DeKeyser explains the difference in implicit and explicit learning by stating that the former is unconscious processing of a linguistic feature while the latter is conscious.[29] Alemi and Tayebi cites Hulstijn (2003), who points out that because implicit knowledge is incidentally acquired, stored implicitly and is also used automatically it means more than incidental learning. However, they make no similar distinction between intentional and explicit learning, and state that both are similar.[30] Consequently, for the remainder of this thesis, the terms implicit and explicit will be used to describe the two approaches used in the research project. No further distinctions will be made between the terms incidental and implicit, and intentional and explicit.

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[25] Ibid., *198.*
[26] Ibid., 201.
[27] Nation, *Thinking Allowed*
[28] Nation, *Learning Vocabulary in Another Language,* 203.
[29] DeKeyser, R. M., "*Implicit and explicit learning.*" *C. Doughty & M. Long (Eds.), Handbook of Second Language Acquisition,* (Oxford, UK: Blackwell: 2003): 313-348.
[30] Alemi Minoo and Tayebi Alireza, "*The Influence of Incidental and Intentional Vocabulary Acquisition and Vocabulary Strategy Use on Learning L2 Vocabularies." Journal of Language Teaching and Research*, Vol 2, No 1, Academy Publisher 2011: 81-98

2.3.1 Implicit Approach

Implicit learning takes place naturally and without conscious operation.[31] Accordingly, the implicit approach includes reading, listening to audio files, watching videos and other sources where the learner does not consciously attempt to memorize words. Research into the effect of both extensive reading and the reading of specific texts and genres is numerous and increasing. On the one hand, claims are made that extensive reading is the main opportunity to learn new words and that vocabulary learning largely transpires through guessing the meaning of unfamiliar words in extensive reading.[32] Thornbury supports this approach by stating that texts have enormous advantages in that learners will appreciate context and see collocations and grammatical structures.[33] On the other hand, several studies suggest that for L2 learners in particular, extensive reading results in only a small vocabulary increase.[34] Conflicting results in studies on the approaches may have several explanations, such as type of texts and type of vocabulary. This is where this research project comes in, as an attempt to determine the effectiveness of the two approaches for a particular group on a technical vocabulary.

2.3.2 Explicit Approach

As explained above, an explicit approach to vocabulary learning is a conscious process, meaning the learner has an awareness of the purpose and learning process. With research showing only small gains in vocabulary using an implicit approach, and with more credit accorded to explicit instruction when tested,[35] the latter approach appears preferable. Examining the definition of an explicit approach to vocabulary, there are several activities that could be utilized; mnemonics, word lists, word families and word cards, to name a few.[36] According to Thornbury word cards, or flash cards, are arguably the most effective and it is possible to train all learners in using a set of cards.[37] Thornbury moves on to suggest several uses and activities with the cards, many of which can be found in the lessons here using the explicit approach.

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[31] Lee et al., *Language Learning Approaches*
[32] Ibid.
[33] Thornbury, *How to Teach Vocabulary,* 53.
[34] Lee et al., *Language Learning Approaches*
[35] Ibid.
[36] Thornbury, *How to Teach Vocabulary*
[37] Ibid., 145

The most frequent argument against an explicit approach to vocabulary learning is that it does not promote deeper mental processing, thus leading to less retention.[38] Citing Nation (2001) Ahmad writes that inferring the meaning of words from context is crucial for promoting the acquisition of words, and concludes his research by stating that the explicit approach promotes cramming, which in turn leads to less retention.[39]

2.4 Content and Material in the English Vocational Classroom

As stated in the introduction, the Norwegian Ministry of Education and Research has decreed, in the Education Act §1-3, that all common core subjects in the Norwegian upper secondary schools must be adapted to each individual education program. One of the specifications made to ensure this entails using subject matter that is relevant to their future professions and adult life. [40] Despite this specification, it is still up to each teacher to find and decide what this subject matter or material will be. Few, if any, schools will have ready to use material for each vocational program. Books for each vocational program has been made for VG1, but not VG2.[41] There are some clear advantages to these books' modified input. Polat states that modified input is usually more comprehensible to learners, because it has been made to meet specific language objectives for a particular group.[42] As a result, the difficulty level will be appropriate for the target group.

The material used in the lessons in this project is a mixture of material made for teaching purposes, modified material, and authentic material. Umar Umar, citing Ellis and Johnson (1994), state that "authentic material is any kind of material that is taken from the real world not specifically created for the purposes of language teaching."[43] Thornbury says that using authentic short texts will be advantageous for vocabulary learning because they will provide lexical chains. There is no reason to believe this would be any different from other authentic material such as videos and audio files. According to Polat, authentic material can offer a

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[38] Dr. Jameel Ahmad, *"Intentional vs. Incidental Vocabulary Learning." Interdisciplinary Journal of Conteporary Reasearch in Business,* Vol 3, No 5, Jeddah Community College Saudi Arabia: 2011
[39] Ibid.
[40] Utdanningsdirektoratet, Rammeverk for FYR-prosjektet 2014-2016, https://www.udir.no/globalassets/upload/fyr/rammeverk-fyr.pdf, Accessed 15.11.2017
[41] Cappelen Damm – Tracks. https://tracks.cappelendamm.no/ Accessed 08.04.2018
[42] Nihat Polat, *L2 Learning, Teaching and Assessment, A Comprehensible Input Perspective*, (Bristol: Channel view Publications, 2014). 129.
[43] Umar Umar, Irmayanti Irmayanti, *"Improving Students' Vocabulary Mastery by Using Authentic Materials through Communicative Approach", Ethical Lingua: Journal of Language Teaching and Literature*, Vol.4(2), (August 2017): 151-164.

more accurate representation.[44] Thus, this material will have content that close resembles the pupils' own experiences, and therefore seem relevant. However, in cases with low proficiency with the learner or where the topic is unfamiliar, authentic texts can prove to be very difficult.[45]

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[44] Polat, *L2 Learning, Teaching and Assessment,* 133.
[45] Ibid., 133.

3   Method

Perhaps the most important motivation for the study was to lay the foundation for lesson plans that could be easily adapted and used in any vocational English classroom. Therefore, I wanted to use more than one group of students and more than one approach to teach vocabulary, in addition to both a qualitative and a quantitative gathering of data. Using John W. Creswell's methods[46] for conducting and evaluating data, I wished to get a good foundation for an analysis and way forward.

Firstly, the participants will be presented and relevant information about the pupils, groups and choice of subjects elaborated on. Secondly, reflections on being both teacher and researcher are presented. Thereafter, this chapter will present the aims and preparations for the now completed lessons. This entails an overview of the content in the lessons using the different approaches, implicit and explicit. Next is the material used, where the methods for the data gathering will be addressed. It will answer why and how the different methods were used. After the presentation of the methods, the procedure which deals with the execution of the testing follows. Finally, this chapter will deal with how the analysis of the material was carried out.

3.1   Participants

The students in the Electrical Power vocational class was selected as the participants in the project. One reason for the selection was that it was the only class I was teaching which was divided into two parallels, thus allowing for comparing different teaching methods taught between the two groups. I had also taught this program previously, which meant I had familiarized myself with the program and the curriculum for the vocational subjects. After some research and assistance from the vocational teachers, I chose mainly to focus on the subject Electrical Power Systems. My reasons for this is that it is a subject where it is easier for a non-professional to understand the basics than for example Automated Systems, which was only used once in lesson six. However, this research project and its results are not meant

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[46] Jon W. Creswell, *Pearson New International Edition- Educational Research: Planning, Conducting and Evaluating Quantitative and Qualitative Research, (*Essex: Pearson Education Limited, 2014)

to be specific for these subjects or this vocational program. Accordingly, the results and following discussion will not be dependent on any specific vocational program.

In total, the number of participants was 31, comprising of 16 or 17 year-olds. Group A had 15 males, while group B included fifteen males and one female. Both are VG2 classes, i.e. second year of upper secondary school. All 31 pupils agreed to participate in the study and signed the consent form. It was made clear that the participation in the study was voluntary, and that consent could be withdrawn at any time during the study. Given the fact that all pupils were aged at least 16 and no sensitive personal information was collected, they did not need parental consent. Inquiries were made to Norsk senter for forsksningsdata, and the study does not need a notification requirement. The study and testing took place in January and February 2018, and was approved by the school administration.

Whereas the type of vocational program is irrelevant, the student mass is not. One should, when reading and studying these results, take into considerations the level of the pupils. All participants except one are Norwegian native speakers with English as their L2. One is a native speaker of German. At the beginning of the school year, all pupils at the school were subjected to a test, *Kartleggeren.* This mapping test measures the students' level and compares it to the national mean. Out of 31 pupils, only six had a score below the mean, and none of these six were far off. The test also measures existing vocabulary and in this category, only two pupils were below the mean. Equally important is the group results. The mean of Group A was 114, with 100 being the national mean, and Group B's mean was 115. For vocabulary, the score was 122 for Group A and 120 for group B. With all of this taken into consideration, it is not necessary to discuss results in relation to preexisting differences in the groups. At the same time, it is important to keep in mind the strong level of both groups throughout the result and discussion chapters.

3.2 Teacher and Researcher

When you conduct research in your own classroom there are some ethical considerations that must be taken into account. The pupils in your class are adolescents, and as their teacher you have an ethical responsibility not to offend someone. This had to be taken into consideration when choosing how to gather data and, of course, the treatment of the data gathered. Still, the use of quotes and descriptions could be revealing, especially to fellow pupils in the research

project. [47]   Therefore, it is important to consider this throughout the whole process, starting with the pupils' consent. Here, it is very important to be as forthcoming as possible about the data that would be gathered, and how it would be used. Hopkins states that the participation must be voluntary and in no way coerced.[48] Therefore, it is important to make sure the consent forms are not signed out of an obligation to me as their teacher. Because of this, the pupils were told specifically that not participating would have no consequences and that their consent could be withdrawn at any time. This way, the pupils will know what they have consented to and that not participating will have no consequences, and are thus comfortable with the situation. In addition, it is very important to be aware of the two roles you get in the classroom, as both teacher and researcher. First and foremost, the obligation to the pupils as their teacher is the most important, meaning the role of researcher should not affect the pupils' learning negatively. Secondly, the existing relationship between teacher and pupils should not influence the research, results and analysis.

3.3   Lesson Planning and Procedure

In order to obtain comparable results, the two groups participating in the study worked with the same words, but different approaches for three weeks, before they switched to the other approach. Before making lesson plans for the groups, the decision was made to focus on oral activities. In their future profession as electricians, the most likely use of English will be in communication, and mostly oral. This assumption corresponds well to the replies from the pupils when they answered a question about when they believe they will need English in their future profession. More on this in the Results and Analysis chapter.

Due to the mapping test mentioned above, no further testing to measure proficiency was deemed necessary. As I was already these pupils' teacher, I had knowledge of background information and factors that could affect their performance in testing. Well aware of documented cases of different diagnoses that could influence results, no participants were excluded, as they contribute to the study's authenticity. All testing, except Test 3, was done in

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[47] Jacquelyn Schachter and Susan Gass, *Second Language Classroom Research – Issues and Opportunities*, (Mahwah: Lawrence Erlbaum Associates, 1996), 21.
[48] David Hopkins*, A Teacher's Guide to Classroom Research*, (Open University Press, Berkshire 2008): Appendix

the pupils' learning platform It's-learning. Test 3 was recorded using PowerPoint Mix and handed in on It's-learning.

3.3.1 The Implicit Approach

As covered in the Theory chapter, this approach entails an implicit exposure to vocabulary. Each of the lessons within this approach included both video(s) and text(s) on the topic. Audio files were also used in three of the lessons. A list of the material used can be found in Appendix G. In addition, on one occasion, a marine electrician came to speak about a day in the life of a marine electrician. The selection of words each week were all collected from these sources, meaning these were also the words that were tested. Each week, the pupils were given mostly oral, but also some written tasks, to the different activities. Most activities were done in pairs.

3.3.2 The Explicit Approach

All the words introduced to the explicit group were extracted from the texts, videos and audio files used in the group with the implicit approach. Three sets of flash cards were made using these technical words. All sets had the English words on one side while the back of the card had a translation, an English explanation or a picture. Each week, student pairs performed different tasks with three sets of flash cards. Due to most of these tasks being oral, almost all activities were done in pairs.

3.4 Material

Collecting data from the pupils in this research project was done using both quantitative and qualitative methods. Both methods were required in order to examine both parts of the project. Quantitative methods were mainly used in the testing of vocabulary learning, while qualitative methods were used to examine the pupils' experiences concerning relevance to their future profession. This section will deal with why the types of tests were selected, while the details on each of the tests can be found in the Results chapter.

Both the quantitative and qualitative part of this research project follows the six steps in the process of research identified by Creswell.[49]

1. *Identifying a research problem*
2. *Reviewing the literature*
3. *Specifying a purpose for research*
4. *Collecting data*
5. *Analyzing and interpreting the data*
6. *Reporting and evaluating research*

How the steps were used follows in the next sections of this chapter.

3.4.1 Vocabulary and quantitative testing

Determining the use of qualitative data gathering was done using Creswell's research process, which identifies the characteristics of qualitative and quantitative research.[50] Two of the characteristics for quantitative research are "Creating purpose statements, research questions, and hypothesis that are specific, narrow, measurable, and observable" and "Writing the research report (…) taking an objective, unbiased approach".[51] Both of these characteristics are central when examining which of the approaches, implicit or explicit, are best in teaching technical vocabulary, without being biased.

As discussed in the Theory chapter, there are different aspects to consider when determining what is involved in knowing a word. This must be considered when choosing methods for conducting and analyzing the data. In consequence, the quantitative data is collected using different testing methods. Nation presents this in his table *Aspects of word knowledge for testing,*[52] which shows what is involved in knowing a word, and it can be used to determine which aspects of vocabulary knowledge that are to be tested.

Regardless of approach, the pupils were tested each week and the two groups were given the same test to ensure a good foundation for comparison and discussion. As mentioned in section 3.3, the goal was primarily that the students be able to use the words in conversation and discussion, in addition to understanding manuals and instructions. In his table, Nation lists nine aspects of word knowledge and eighteen control questions to determine if a word is

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[49] Creswell, *Educational Research*, 20.
[50] Ibid., 26
[51] Ibid., 27
[52] Creswell, *Educational Research*, 20.

known.[53] Naturally, it is impossible to test all of these with the time available in the lessons. As a result, a few tests were selected with the purpose of testing the word knowledge these pupils would most likely use in the future.

In the first week of testing, three different testing methods were used. The first was a choice test where the words were to be matched with the correct definition. Originally, the intention was to use this test each week as it is widely used in standardized testing,[54] however it was only used the first week. The abandonment of this method is explained in the Results chapter. Another reason for including this test from the beginning was that, at first, I was skeptical of having translation tests be a too central part of the data, because the activities and tests in English schoolbooks seem to prefer the use of L2 explanations and definitions.

However, after further research following that first week, these concerns were abandoned. Nation states that translation is one of the ways of conveying meaning and is no better or worse than other methods of testing.[55] In addition, considering the pupils' likely application of this vocabulary where a large percentage of the words are tools and components, translating the word will in most cases be the word knowledge they need. Using translation tests is also valuable because it does not draw on second language knowledge beyond what is directly tested.[56] Consequently, the results of the translation tests do not need to be discussed with regard to individual levels. At the same time, there is an opportunity to discuss a comparison with the other tests that do require second language knowledge. As a result, the translation tests are central in the quantitative data of this project.

Even though Nation states that a translation test is good for conveying and testing meaning, he also says it is important to distinguish between how well a word is known and how well a word is used.[57] As mentioned, sometimes knowing the types of words and being able to translate them is enough, but in some situations, these pupils may need to utilize the word in different ways where first language cannot help them. Because of this, the pupils were, with the exception of week three where they did not have a translation test, always tested in a second way. The purpose of the second test was to see how well the pupils could utilize the words by using them in sentences, giving definitions and/or using them in explaining the topic. These tests will measure more of the aspects of word knowledge presented by Nation,

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[53] Ibid., 347
[54] Ibid., 349
[55] Nation, *Learning Vocabulary in Another Language,* 351.
[56] Ibid., 351
[57] Ibid., 362

but considering these are more time-consuming tests, fever words can be tested, meaning differentiating the results will be more difficult. A more detailed description of the tests follows in the Results chapter.

3.4.2 Relevance and qualitative testing

Gathering data for the second part of this research project was done differently from the vocabulary testing in the first part. The purpose of the second research question was to gather information and uncover how teaching English as a second language can be done in a way that the pupils feel is relevant. As explained earlier, this question stems from the Norwegian Department of Educations' project *FYR- Fellesfag, Yrekesretting og Relevans,* a national program which aims to make common core subjects relevant to the pupils' vocational program. Even though some of the data gathered to answer this is collected from many participants and to some degree are numeric, the other characteristics and the analysis of the data belong to a qualitative approach of research. The data collected is presented in the Results chapter, and how the qualitative approach is used follow in this chapter.

Creswell also lists the major characteristics of qualitative research, firstly exploring a problem and develop a detailed understanding of a phenomenon.[58] For this research project, that problem is how to make English relevant. In order to answer that and to develop an understanding, data must be collected using methods for qualitative research. Creswell says the data must be collected from a small number of individuals so that the participants' views are obtained. This was done using surveys, questionnaires and through an interview. All of the pupils were asked to answer both the survey and questionnaires to insure enough quality data. Two pupils from each group participated in the interview. Details of the questions and answers are found in the Results chapter, while the method for analysis follows in this chapter.

3.5 Analysis of the Material

The fifth step in Creswell's research process is the analysis and interpretation of the data. This involves studying and drawing conclusions about data.[59] The results and findings of this

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[58] Creswell, *Educational Research,* 30.
[59] Ibid., 24

research project are presented in the Results chapter, while the interpretation and discussion follows in the Discussion chapter. How this research project used Creswell's steps in analyzing and interpreting data follows in this chapter.

3.5.1 Analysis and Interpretation of Quantitative Data

Scoring

The first step in analyzing and interpreting quantitative data is to prepare the data for analysis.[60] In order to make scoring easier, numbers or points were preassigned in all the vocabulary tests. For all of the tests, except the oral test in week three, this was assigned using integrated options in the tests on It's-learning, which is the pupils' learning platform. Due to the nature of the tests, scoring the data was fairly easy. For all the translation tests, the numeric value was one point for each correct answer. The likely use of the words these pupils learn are oral and practical, not academic. Therefore, points have been awarded in all tests where the meaning is clear. In other words, pupils get points even if a word is misspelled or exact synonyms are used. The remaining written testing was also given a numeric value prior to the testing. As fever words were tested and the questions required more from the pupils, one point was given for correct definition and one for correct use of the words.

Statistical Program, Input Data, and Clean and Account for Missing Data

Considering these are not complicated numbers and my experience with statistical analysis programs is limited, the data was analyzed using Microsoft Excel. This program contains all the tools necessary for input and for structuring the data needed for answering the research questions in the project. Pupils' names were put in a random order and given a number to ensure anonymity. After the data was entered into excel, a few scores were removed. On two occasions, a pupil got a zero score on the translation test and had not attempted to answer a single word. The result was removed as I assume the question was skipped by accident. A repetition test was also removed from the results, because the pupil was not there when the words were learned the previous week.

The Analysis

The analysis of the data was conducted using both descriptive and inferential analysis. The descriptive analysis is used to describe general tendencies in the data and is used to present the results that do not include a comparison. In order to analyze and discuss the differences

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[60] Ibid., 195

between the groups as well as the approaches (implicit and explicit), an inferential analysis is used, which allows for the comparison of groups and can relate two or more variables.[61] It is worth noting that it is mainly the theory behind these analytical approaches that have been applied, and not the detailed execution, which would require too much from a research project of this scope and limitations.

3.5.2   Analysis and Interpretation of Qualitative data

As mentioned, the qualitative data of the research project are comprised of a questionnaire, surveys and an interview. The first step in analyzing and interpreting qualitative data is to organize it.[62] For the surveys and questionnaire, that meant collecting the replies and sorting them by group where that was suitable. The interview was transcribed and made ready for a hand analysis. All quantitative data was then analyzed manually using color coding, which Creswell recommends for a small database.[63] As a qualitative approach seeks to answer specific research questions, only data relevant to answering the research question regarding L2 relevance was coded. The results from the questionnaires are reported in the results chapter along with the narrative discussion of the interview. Further details on how the qualitative material was handled has been included as part of the results chapter, because it is easier to present and discuss it together with the actual results. Finally, the interpretation of the qualitative data is discussed in the Discussion chapter.

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[61] Ibid., 207
[62] Ibid., 262
[63] Ibid., 264

4 Results and Analysis

The results and analysis chapter is comprised of quantitative data based on weekly testing of vocabulary learning along with a selection of the pupils' response to the teaching methods and – approaches they have been exposed to. All testing was executed and handed in using It's-learning and structured using Microsoft Excel. Some data, such as testing of vocabulary where the students were absent during the learning process, have been excluded. The discussion chapter will elaborate on all the numbers, results and analysis presented here.

4.1 Vocabulary testing

Group A was exposed to the implicit approach for the first three weeks and the explicit the last three weeks. Group B the opposite. As revealed by the combined scores and past mapping test, there is no notable difference in proficiency level in the two groups. Consequently, no further considerations of proficiency level need to be addressed in further discussion and comparison of the groups. Nevertheless, individual results and differences between pupils will be elaborated upon in the discussion chapter.

Table 1 | Percentages of the total words tested throughout the research project for each method and then combined for each of the groups. The retention test is not included.

	Implicit approach	Explicit approach	Mean
Group A	61%	69%	67%
Group B	60%	74%	66%

The results presented in Table 1 show the percentage scores for each group of all testing done. It shows the score for each approach and then a mean for each of the groups where the approaches are combined. The table shows a clear difference between the explicit and implicit approaches of vocabulary learning. A higher possible score, 136 versus 120 the last three weeks, can explain why Group B has a lower mean, despite having a higher percentage if the numbers are added. If the possible scores for each method were the same, this means Group

B's mean would have been slightly higher, though it would not change the percentage of the methods.

As explained in the method chapter, Group A had the implicit approach for the first three weeks and the explicit approach for the last three. Group B had the opposite. In consequence, all tests starting with 1-3 for Group A are implicit results, while they are explicit for group B. Tests 4-6 are explicit for Group A, and implicit for Group B.

Table 2 | Maximum point scores and average scores for both groups

	Test 1:1	Test 1:2	Rep 1:2	Test 2:1	Test 2:2	Rep 2:1	Test 3	Test 4:1	Test 4:2	Rep 4:1	Test 5:1	Test 5:2	Rep 5:1	Test 6:1	Test 6:2
Maximum points	10	20	20	20	10	20	20	20	16	20	20	10	20	20	10
Group A	8,6	11,6	11,4	13,7	5,4	12,7	8,3	16,4	13,1	13,9	16,5	5,5	13,2	16,7	4,0
Group B	9,9	17,2	15,3	16,1	6,2	13,6	8,9	10,1	11,7	9,3	13,6	6,9	12,7	11,8	5,0

____: Results following an implicit approach, ____: Results following an explicit approach
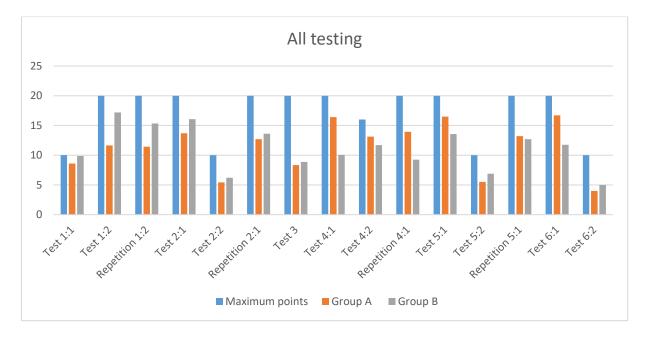
Diagram 1 | Maximum point scores and average scores for both groups

As shown in the table above, in addition to feedback from the pupils, Test 6:2 proved to be difficult for both groups due to the nature of the topic and test method. Further explanation in Test 6:2 below.

As shown in both table 2 and diagram 1, the pupils were tested all six weeks. On four occasions, the pupils were tested on the same words the following week. The result is shown as group mean in number of words learned. With the exception of Test 3, all tests were written. Points have been awarded where there are minor spelling mistakes and where synonyms have been used.

4.1.1 Test 1:1

The object of this task was to match the English words with the pertaining function or explanation in English. The test had a total of ten words and descriptions with 10 possible points. As Table 2 and Diagram 1 shows, both groups scored very high on this test with a mean score of 8.6 and 9.9 out of ten words. In group B, using the explicit approach, fourteen out of fifteen pupils got all ten combinations correct, as opposed to nine out of fifteen in group A, who used the implicit approach. Although these are good results for both groups, the difference is worth mentioning when seen in context with the other test results. This testing method was abandoned for the remainder of the period for being too easy for most pupils. Consequently, these results will play a minor role in the discussion.

4.1.2 Tests 1:2, 2:1, 4:1, 5:1 and 6:1 – Translation testing

These are all tests where the pupils translate words from Norwegian to English and English to Norwegian, divided equally. All tests have twenty words and twenty points available. Points were awarded for misspelled words where the meaning was still clear, and for exact synonyms. The reason for this is explained in the discussion chapter. Group A was subjected to the implicit approach for tests 1:2 and 2:1 and to the explicit approach in tests 4:1, 5:1 and 6:1. Vice versa for group B. Due to the fact that the oral test in week three was very time consuming, no translation test was given this week.

Table 3 | Group result from translation tests. 20 points/words possible.

	Test 1:2	Test 2:1	Test 4:1	Test 5:1	Test 6:1
Group A	11,6	13,7	16,4	16,5	16,7
Group B	17,2	16,1	10,1	13,6	11,8

___ : Results following an implicit approach, ___ : Results following an explicit approach

Table 4 | Result from translation tests. 20 points/words possible.

	Test 1:2	Test 2:1	Test 4:1	Test 5:1	Test 6:1
Implicit	11,6	13,7	10,1	13,6	11,8
Explicit	17,2	16,1	16,4	16,5	16,7

Without exception, these results point to the explicit approach being the most effective for the pupils being able to translate words. As shown in Table 2 and 3, there is no clear difference between the groups when they use the same approach. Group A with 0.9 more words when both groups use the implicit approach, and no difference at all in the explicit approach.

Table 5 | Approach result for each test and mean for each approach for both groups. 20 points/words possible.

	Test 1:2	Test 2:1	Test 4:1	Test 5:1	Test 6:1	Mean
Implicit	11,6	13,7	10,1	13,6	11,8	12,2
Explicit	17,2	16,1	16,4	16,5	16,7	16,6

A great difference however, become apparent when a comparison is made between the approaches – explicit and implicit – as shown in Table 4. Without exceptions, the group using the explicit approach translates more words correctly. As revealed by the table, the smallest difference being 2.4 words and the largest 6.3 words, always in favor of the explicit approach.

4.1.3 Tests 2:2, 4:2, 5:2 – Definition and Explanation testing

As mentioned, Group A had the implicit approach for the first three weeks, which includes test 2:2, meaning they had the explicit approach for Tests 4:2 and 5:2. Vice versa for Group B. In consequence, a comparison between the groups' mean is not included, due to the different basis. However, a comparison between the approaches is included in table 8.

Definition and Explanation are all tests where pupils were asked to define the word and explain its function related to the topic. Points were given for a correct definition, for a satisfactory explanation, or for an example from the lesson's topic. Tests 2:2 and 5:2 had a maximum score of 10, while Test 4:2 had a maximum score of 16 due to more words tested this week. Therefore, both number of words and percentages are presented in tables 6 and 7 respectively. It is worth noting that fewer words are tested using this method than the translation method, which could give larger fluctuations in the results.

Table 6 | Results from Definition and Explanation testing measured in words. Test 2:2, 4:2 and 5:2

	Test 2:2	Test 4:2	Test 5:2
Maximum points	10	16	10
Group A	5,4	13,1	5,5
Group B	6,2	11,7	6,9

___: Results following an implicit approach, ___: Results following an explicit approach

Table 7 | Results from Definition and Explanation testing measured in percentages. Test 2:2, 4:2 and 5:2

	Test 2:2	Test 4:2	Test 5:2
Group A - %	54	82	55
Group B - %	62	73	69

___: Results following an implicit approach, ___: Results following an explicit approach

Table 8 | Results from Definition and Explanation testing by approach, measured in percentages. Test 2:2, 4:2 and 5:2

	Test 2:2	Test 4:2	Test 5:2	Mean
Implicit - %	54	73	69	65
Explicit - %	62	82	55	66

The results presented in Table 6 and Table 7 show mixed results between both groups and approaches. Group B scores higher in two of the tests, first in test 2:2 after using the explicit method, than in 5:2 after using the implicit approach. Still, when the mean is calculated in percentages in Table 8, there is no notable difference, meaning Group A did equally well all over and better in Test 4:2.

Looking at Table 7, the difference between the groups vary from eight to fourteen percent. It is, however, important to note that Table 6 shows the difference to be between 0.8 and 1.4 points, which directly translates to words as one point is given for each satisfactory definition and explanation.

4.1.4 Tests 3 and 6:2 – Oral and written test

Test 3 was given the last week Group A had the implicit approach and Group B the explicit. This was an oral test where the pupils were asked to record their discussion and explanations on the subject that day. They received a list of talking points, which gave them a basis for using the words of the day. In both groups, the pupils sat in pairs or groups of three. They were given a collective score based on how many of the words were used and explained correctly during the recording.

Similarly, Test 6:2 was given at the end of Group 1's explicit period and Group B's implicit period. This test, however, was written and individual. Just as in Test 3, the pupils were given a task where they explained something from start to finish, and received a list of talking points to help them utilize as many words as possible.

Table 9 | Results from oral and writing test

	Test 3	Test 3 %	Test 6:2	Test 6:2 %
Maximum points	20		10	
Group A	8,3	41,5	4,0	40
Group B	8,9	44,5	5,1	51

___ : Results following an implicit approach, ___ : Results following an explicit approach

Table 9 immediately shows lower scores for both approaches. Both groups expressed difficulties with both tests for various reasons. Firstly, embarrassment over being recorded in

Test 3 was, according to several pupils, a hindrance for them. Secondly, the topic for test 6:2, how electric induction motors work, was difficult enough to understand in Norwegian for many. Accordingly, this will be taken into consideration when including these results in the discussion. However, it does not affect an approach comparison when looking at the results.

As the table shows, there is no notable difference in the results between approaches in Test 3. The difference is slightly bigger with test 6:2 with the implicit group (B) averaging retention of 1.1 words more.

4.1.5   Repetition tests

With the exception of test 6:1, the pupils were given the same translation test the following week in order to measure how much they could remember. These are named "Repetition x:x" in the tables and diagrams. Only the translation tests were repeated, as time was limited. As presented in "Tests 1:2, 2:1, 4:1, 5:1 and 6:1 – Translation testing" the group using the explicit approach exclusively scored higher in the initial translation testing. Table 9 shows this testing adjacent to the repetition tests done one week later.

Table 10 | Translation tests with repetition. 20 points/words possible.

	Test 1:2	Test 2:1	Test 4:1	Test 5:1
Group A	11,6	13,7	16,4	16,5
A - Repetition	11,4	12,7	13,9	13,2
Group B	17,2	16,1	10,1	13,6
B - Repetition	15,3	13,6	9,3	12,7

___: Results following an implicit approach, ___: Results following an explicit approach

In the same way as the original translation tests, the explicit group has better results than the implicit group. Without exception, the groups as a whole score lower on the repetition tests. On average, the pupils score 1.6 points lower in the repetition tests. An interesting side note here is that some pupils actually scored higher in the repetition tests. Individual results can be found in appendix B.

Table 11 | Translation and repetition tests by approach. 20 points/words possible

	Test 1:2	Test 2:1	Test 4:1	Test 5:1	Mean
Implicit	11,6	13,7	10,1	13,6	12,3
Implicit - Repetition	11,4	12,7	9,3	12,7	11,5
Explicit	17,2	16,1	16,4	16,5	16,6
Explicit - Repetition	15,3	13,6	13,9	13,2	14,0

Table 11 clearly shows the correlation between approach and score in both the original translation tests and the repetition. As mentioned, the average score for all groups in both approaches was 1.6 words less a week after the words were learned. Equally important is the results found when comparing the two approaches. From one week to the next, the explicit group remembers less, compared to their initial result, with their score falling by 2.6 words. On the other hand, the implicit groups' score falls by only 0.8.

4.1.6 Retention test

The last test carried out was a retention test, where half the words from the repetition tests were selected, approximately seven weeks after the project was completed. The purpose of this test was to find out whether or not there were any differences in retention over time following the two approaches. These results are presented in Tables 12 and 13 below.

Table 12| Result of retention tests for Group A and B

	Implicit approach	Explicit approach
Maximum points	20	20
Group A	8,3	12,8
Group B	9,3	12,1
Groups' mean	8,8	12,5

Table 13 | The mean of the Retention test compared to the mean of the Repetition tests

	Implicit approach	Explicit approach
Retention test – Groups' mean	8,8	12,5
Repetitions tests – Groups' mean	11,5	14,0

Again, there is no notable difference between the groups' total scores. Table 11 shows that the explicit approach still holds the advantage over the implicit, several weeks after the words were learned, with 3.7 words more, on average. This is close to the same as in the repetition tests where the difference was 3.5, meaning the rapid drop for the explicit approach, seen in the repetition tests, has been neutralized.

4.2   Results from qualitative data gathering

In addition to being tested on vocabulary throughout the process, the pupils also answered questions in logs or surveys at the end of some classes. Four pupils were also interviewed after the project was completed. The purpose of this data gathering was to obtain information on the pupils' experiences of, and opinions on the approaches, subject, content and material, with the intention of answering the second research question: what considerations must be taken into account in order to make English, as a common core subject, relevant to upper secondary vocational pupils. In order to get more comprehensive data, the pupils were given the opportunity to give their answers in Norwegian, which most of them did. Thus, the quotes used here are translated.

Considering the fact that one of the objectives of this thesis was to find a way to make English, as a common core subject, relevant for the pupils, it was important to get feedback from the pupils on this. It is important to mention that the pupils were told, and reminded, that their answers in the logs and surveys were not part of any evaluation of them. Furthermore, with the exception of the interview, all logs and surveys were answered anonymously, something the pupils were made aware of before answering.

4.2.1   Survey – Lesson 1

The heading "Results from qualitative testing" strongly suggests this part will contain qualitative data, which, for the most part, is true. In the first lesson, however, some quantitative data was gathered to map how likely it is they would need English in their profession, and also how often they believe they would use it. The results are included here because the answers to these questions are relevant to the qualitative data rather than the other quantitative data that measures vocabulary.

Question 1: On a scale from 1-6, how likely do you believe it is you will need English in your profession?

Table 14

Group A Mean	Group B Mean	Combined Mean
4,2	4,4	4,3

Question 2: How often do you believe you will need English in your profession? This includes talking, writing and reading.

Table 15

	Every day	1-2 Times a week	1-2 Times a Month	1-2 Times in 6 months	Never
Pupils from group A	0	7	7	0	1
Pupils from group B	2	6	6	1	0

Table 14 shows the mean for each group and the combined mean for both groups. It is worth noting that none of the pupils in either class selected 1, and only one pupil selected 2 on the likelihood they would need English. Also, there is no notable difference in the groups when it comes to this, which supports the earlier claim that no considerations need to be made when comparing the groups in the discussion.

As these results show, the majority of pupils believe they will need English either 1-2 times a week or 12 times a month, and again the results show no significant difference between the groups. Table 15 shows one pupil answering never, which does not coincide with the result from question 1 where everyone believed they would need English. Therefore, this reply could be considered an anomaly, and will not be discussed further.

In conclusion, these results strongly suggest the pupils understands the value of learning English with regards to their future profession. This, along with the pupils' strong level, should be kept in mind when reading and discussing the results.

After the two mapping questions, the pupils were asked some open questions about the lesson and their immediate response and experiences. Considering that the groups had two different approaches, implicit and explicit, some of the phrasing in the questions was different.

Group A – Survey replies following a lesson using the implicit approach

During the first lesson this group learned words using an implicit method. They watched a video, listened to a conversation and read a text about tools and components you will need as an electrician. Detailed lesson plans can be found I appendices C-F. The questions asked afterwards were as follows:

Today you have watched a video, listened to a conversation and read a text about tools and components you will face in the daily life as an electrician.

1. *Which of these, video, conversation or text, do you believe was the most relevant to you? Why?*
2. *Which of them do you believe you learned most from? Why?*
3. *Is there a different method you believe would have worked better for you? Which?*

Firstly, it is important to note that not everyone answered all the questions. Only examples and tendencies will be presented here. In addition, several pupils did not distinguish between what was most relevant and what they learned the most from, which in hindsight is understandable. In consequence, the answers to questions 1 and 2 are presented together.

Out of the thirteen pupils who answered question one and/or two, two pupils had no preference or opinion on what was most relevant or instructive, and one claimed to learn most from the actual testing. Two pupils believed they learned most from discussions with fellow pupils or teacher, while three pupils believed the video was the best way for them to learn. A majority of five pupils said the text is what they learned most from.

Examples and reasons:

"I believe reading the text was the most relevant, because I learn best from things that are right in front of me"

"The video, then we could see which tool the man talked about and what they are called in English"

Out of the thirteen pupils who answered the survey, nine had no suggestions of other methods. Understandably, this is a difficult question considering it is the only method they had used at

that point. Among the ones who did have suggestions, there was no common denominator. The remaining stated:

"Perhaps seeing the actual tools while we learned about it in English."

"Games, because that is fun, and when something is fun you learn more."

"More videos would have worked better"

"If we had more time to practice before the test it would have gone better"

Group B – Survey replies following a lesson using the explicit approach

Just as Group A, Group B answered a survey after the first lesson following their explicit approach to vocabulary learning. Naturally, the wording about the lesson content was changed, but the rest of the questions were the same. The questions for Group B were as follows:

Today you used flash cards dealing with tools and components you will face in the daily life as an electrician. You used cards with an English definition/explanation, Norwegian translation and pictures.

1. *What do you believe was the most relevant to you? Why?*
2. *What do you believe you learned most from? Why?*
3. *Is there a different method you believe would have worked better for you? Which?*

In the same way as Group A, distinguishing between relevance and what they learned the most from was difficult, and are presented together for Group B as well.

Three pupils misunderstood the task and answered whether it was knowing tools or components that was most relevant. Two preferred and learned most from the pictures, two from the Norwegian translation and one from the English explanation. A majority of four pupils preferred a combination.

Examples and reasons:

"They were all relevant, good with variation. Would have been boring with for example just English-Norwegian"

"I believe the pictures worked best (...) because it is better to learn the word when you can associate it."

"They were all good, but I learned most from those that had English-Norwegian translation because then I knew what they were in Norwegian."

As for the last question about different methods they would prefer, two pupils suggested using "Quizzlet", a website with flash cards, games and other learning tools.[64] Besides that, no one had any other preferences

4.2.2 Survey – Lesson 4

After finishing three weeks with the same approach, the groups switched, meaning after they finished lesson four they could compare the two approaches. Therefore, the pupils were asked to answer a survey that week as well. The difference from the last survey was that the questions asked them to compare the approaches instead of just answering what they thought about the approach they used in the lesson. Both groups were asked the same questions.

Today you have tried a different approach to learning new words than the approach you have been using the past three weeks.

What are your immediate thoughts on the two approaches?

What did you like best? Why?

What do you believe you learned most from?

Which approach did you feel was most relevant to your future profession?

Group A

Group A answered this survey after their first week using the explicit approach, meaning they had implicit approach the previous three weeks. Thirteen pupils participated. Out of these thirteen, eleven liked the explicit approach best. One stated he learned best using the implicit method. When answering what they believe was most relevant for their future profession, they

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[64] Quizlet Inc, https://quizlet.com/, Accessed 10.03.2018

focused mostly on which topics they had found most relevant, not which method. As the topic is not relevant to this thesis, I have not included examples of these answers.

"I liked the method we used today. I think it was easier to discuss with small amounts of texts at a time. I think I learned the same from the methods."

"Both have been educational. I liked today's best because I learn best when we discuss and talk"

"I liked the last session, because it was easier to remember the words"

"Liked best the one we had today, because it's more the type of tasks I like. This made me learn more. I think I learned more because it was more practice and repetition."

As shown in these answers there are different reasons why they liked the explicit approach better. Several mention they liked that there was more room for discussion in addition to more repetition.

Group B

After three weeks using the explicit approach, Group B switched to the implicit approach and answered the same survey as Group A. Fifteen pupils in Group B answered the survey. Four pupils answered what they liked best in lesson four, which means they misunderstood the question. Six pupils said they liked the implicit approach best, while five preferred the explicit. Out of the six who said they liked the implicit approach best, four of them stated they learned more from the explicit. The other two did not say anything about what they learned the most from. Only examples from those who understood the question have been included.

"I answered better after the cards, but I liked reading and watching the video more."

"I liked today best, because I was getting a bit tired of the other method." "The cards" (What did you learn most from?)

In the same way as Group A, most pupils answered which topic or which specific activity they believed was most relevant. Consequently, these answers have not been included here. However, they can still be in included in the discussion and conclusion chapters in relation to relevance.

4.3   Interview

Two weeks after the project was concluded in both groups, four pupils were interviewed about the process. Two pupils from each group sat down for a discussion related to the six weeks of vocational English in class. The pupils in group A volunteered while the two from Group B were selected at random. Before the interview started, they were made aware of the purpose of this research project and that the interview would in no way affect their grade. In order to get answers that were more comprehensive, the interview was conducted in Norwegian. As described in the Method chapter the interview was transcribed and a hand analysis using color-coding was used to categorize answers. Consequently, replies in this interview are divided into two; answers and comments relating to approach, and answers relating to relevance with regard to subject and use of material. The parts of the interview that does not related to any of these categories have been excluded, as they are not relevant to answering the research questions of the project. The replies and comments are presented in the following sections of this chapter, and will be discussed in the Discussion chapter.

4.3.1   Relevance and approaches

The reason for including the approaches when discussing relevance is based on replies and comments from the pupils participating in the study. Two of the most frequent replies when asked what makes English relevant to their vocation is one, how much they learn, and two, the ability to utilize what they have learned. Both of which, are closely connected to the way in which they learn.

Findings related to the use of the implicit approach:

As one of the pupils point out below, he believes that awareness of the purpose in the learning process is important. The pupils agreed that this approach gave them the opportunity to understand the words in context, but on the other hand, watching videos and reading alone made it easier not to pay as much attention.

 "If we had been aware that the purpose was to learn all the words then maybe we could have learned more by focusing on that, because I always learn better when I know the purpose or know I will be tested because I want to do well."

Undoubtedly, context is a key word when discussing advantages of the implicit approach, while according to the pupil above, lack of awareness is a disadvantage.

Findings related to how the explicit approach worked:

Moving on to the pupils who started with the explicit approach, one said it felt like a "*kid way of learning*", but both of these pupils agreed it was a good way of learning words quickly. Having something physical in their hands was also something that helped them focus. The replies show a tendency to prefer the simplicity and concrete approach to learn the words. This is in accordance with these four pupils' views throughout the interview.

Findings related to types of cards:

All four pupils agreed the Norwegian-English and picture cards were most helpful, as they immediately understood what it was and could connect it to something concrete. As one pupil stated (to which the others agreed):

"With pictures, if you have used what is in the picture you know what it is and you can connect it to something concrete that you experienced."

None of these four seemed to like the English definition cards, saying it would be better to find and make their own definitions instead.

After giving the pupils the results from the repetition testing:

The pupils were informed that they still did better following the explicit approach, but also forgot more words. That they still did better following the explicit approach was not surprising as it matched their expectations. On why more words are remembered after the implicit method, they agreed that having seen/heard the words in context was a factor: "It is more visual and not as theoretical so it makes you remember better, and maybe you remember from context." Before giving the pupils the results from the testing, they were unanimous in favoring the explicit approach, which was also a clear tendency in the survey. After getting these results they were asked what they believed would be the best way of learning the words. They all still agreed that the cards, or the explicit, was best but also opened up for the possibility of a combination.

"*It depends on the time you have. If it meant less time for using the cards and discussing I would not use time on the other things like reading, watching films and such, but if it could be done in addition it's only positive to get and use the words in as many ways as possible.*"

4.3.2 Choosing Relevant Subjects, Content and Material

Five out of the six weeks, we worked with the subject Electrical Power Systems, while during the last week we worked with Automated Systems. The material was a mixture of authentic texts and videos, and material made specifically for teaching, in addition to the maritime electrician who spoke to the classes. The inclusion of content is to cover the concrete tasks and utilization of the words in class. Thus, this section will deal with the pupils' experiences and opinions on the choices of subject, content and material.

Findings related to choosing subject:

Most, if not all vocational directions in upper secondary school have more than one vocational subject, which deal with different parts of their future vocations. When asked about which vocational subject should be focused on, or if time should be divided between the different vocational subjects, the pupils were unanimous, as the following quite shows: "For us it should be Electrical Power Systems, because it's where we will most likely use it at the workplace." As seen in this quote, the most important thing is to find out where they are most likely to need English. In some subjects, and some topics within the subjects, there was little chance of them needing to use English at all and thus they felt it would be unnecessary to spend time on it in English class.

Findings related to content and situations they will need English:

The pupils in the interview also agreed that the most likely use they would have for English was in communication in the workplace. Based on this they also suggested that using the physical assignments they were working on in their vocational subjects would be a good way of practicing the words they learned.

"[replying to a previous comment] Yes, using the words when talking is most important. I don't think we will need to write English as regular electrician, but we should be able to talk to customers and other workers who doesn't speak Norwegian, so I think it's important to focus on talking when we learn the words too."

Naturally, the most likely use of English, which according to these pupils is in communication, should be a determining factor in choosing both approach and content in the learning process.

<u>Findings related to choosing material:</u>

When it came to material the pupils all agreed that it would be preferable with material that was similar to what they were used to from their vocational classes, meaning how things are done in Norway. They suggested that talking to professionals, like their vocational teaches, would be a good way of ensuring the right content and quality of the material. One said he really liked the authenticity of having a Maritime electrician come talk to them. Again, using something physical was brought up as something they would have liked. Thus, authenticity and a practical approach should be considered when planning lessons.

As mentioned, only comments related to approach, subject, material and content are included here. These were chosen because they appeared central to the pupils in the interview, and what was deemed relevant to answering the research question. The pupils who participated in the interview seemed to agree on almost everything. There were no direct disagreements, only different suggestions.

4.4   Points for Discussion

There are many interesting findings in the results of both the quantitative and qualitative testing. With the research questions in mind, four points for discussion have been extracted from the results and analysis, and selected for the discussion chapter.

- Immediate receptive word knowledge and application following approaches
- Receptive vs. Productive use following approaches
- Retention over time
- Selecting approach, subject, content and material.

5   Discussion

With the research questions in mind, and based on the results and analysis, four points for discussion were chosen for this chapter. The first three deal with findings related to the test results in the implicit and explicit approaches, while the last examines the qualitative data, attempting to uncover how the approaches and other choices in teaching English can be relevant for vocational pupils.

5.1   Immediate Receptive Word Knowledge and Application

The testing conducted each week had two purposes: as a part in the learning process, and to collect data for analysis and discussion. The repetition of words the pupils got through the testing, uses *retrieval*[65] which is of Thornbury's methods for placing a word in the long-term memory. However the testing conducted immediately after words have been learned must, according to Thornbury's classification of memory presented in the Theory chapter, be placed somewhere between the *working memory* and *long-term memory*. A discussion of this immediate application of words through testing follows, with focus on the differences between the two approaches.

As Table 1, page 25, shows, there is a significant difference in the results between the two approaches when looking at the totality of the testing conducted in the six weeks. The reason for the difference is found in Tables 3, 4 and 5. The tables show the result from the translation testing at the end of each lesson, and they unambiguously favor the explicit approach. As the mean in Table 5 shows, an average of 4.4 more words were learned using this method, which must be considered substantial with a total of 20 words/points possible. These findings support the claim in the Theory chapter that flash cards, which were used in the explicit approach here, are advantageous in learning numerous words. However, it is important to keep in mind that using translation tests do not measure the full scope of knowing a word. Using Nation's categorization,[66] only the receptive vocabulary is tested here.

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[65] Thornbury, *How to Teach Vocabulary,* 24
[66] Nation, *Learning Vocabulary in Another Language*, 24.

On the other hand, even though the test may be limited, it does require the pupils to retrieve words from memory, which contributes to placing the words in their long-term memory. Arguably, that is equally important, or even more so, than the scope of word knowledge tested. As mentioned, most activities and tasks in class were oral, due to the likely future use of the words. However, the immediate application through a combination of oral tasks and written translation tests gives more inputs which leads to better retention. Numerous encounters with the words are, according to Thornbury, important in order to make words part of the long-term memory.

Studying Table 4, page 28, closely, the differences between some of the tests are interesting. In Test 2:1 (week 2), the difference between the approaches is 2,4 words, while in test 6:1 (week 6), the difference is 4,9. Feedback from the pupils during and after lesson 2 and 6 was relatively clear. In lesson 2, the topic was heating cables, which was something they knew very well and was not very complicated. In contrast, the workings of an induction motor – the topic in week six – was a topic many struggled with, even in Norwegian. Seeing the results in light of the difficult level reveals that when the topic is easier, the advantage of the explicit approach is not as prominent as when teaching unfamiliar topics.

5.2   Receptive vs. Productive Use

As covered in the previous section the explicit approach is advantageous over the implicit when immediate receptive word knowledge is tested. Unlike the translation tests however, the other tests measure the productive vocabulary to various degrees. Tables 6, 7 and 8, page 29, show the results from the tests in which the pupils defined and explained the words. In addition to the receptive knowledge, these tests require the pupil be able to both spell and place words into context, which are characteristics of productive word knowledge,[67] as described in the Theoretical Background chapter. The Oral and Written tests, with results presented in Table 9, page 30, also cover the last two characteristics; pronunciation and using the words in original sentences. Thus, more word knowledge is needed for the definition tests than the translation test and even more so for the oral and written test. Consequently, the tests

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[67] Ibid., 26-28

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can be viewed as progressively more difficult in word knowledge, which makes for an interesting comparison.

Focusing on the immediate retention and testing, the results support Stoddard's claim[68] that receptive tests are easier than perceptive or productive, which in turn can be seen in connection to Nation's claim that productive word knowledge is more difficult than receptive. When looking at the mean percentage of words learned/used in the three types of tests, it is clear that the number of words utilized decreases when the demand for productive word knowledge increases. Here it is also important to keep in mind what was mentioned in the Results chapter, suggesting that another explanation for the relatively low scores in the oral and written tests can be embarrassment over being recorded and a difficult topic.

Equally important as the level of difficulty of the different tests is to see the results in the different tests in relation to the respective approaches. For both the oral and written tests and the definition/explanation tests, there is no notable differences between the implicit and explicit approaches. In itself, this may not be significant, but compared to the translation tests, where the explicit approach is highly favorable, the results are very interesting. This suggests a correlation between learning approach and intended use of the word. In the oral test the implicit approach scores slightly lower by 0.6 words and in the written test scores higher by 1.2 words. According to Thornbury, the advantages of the implicit approach to learning vocabulary can help explain this correlation. Being able to learn from context and see words in collocations and grammatical structures have enormous advantages.[69] Having already seen, read and/or heard a word in context will help when the pupils themselves need to utilize the word in context. Still, the implicit approach only scores slightly higher in one of these tests while the others are close in results. Thus, since the difference is minor, we cannot conclude that one approach is favorable to the other.

As covered in the Theoretical Background, technical vocabulary, which the learner is likely to need should be taught even if the proficiency of the learner is not very high, because to these pupils these words are important. Still, looking at the approaches in relation to proficiency unveils interesting findings. Nation claims that an implicit approach through reading will be more beneficial to L1 learners and learners with high proficiency. Exploring the individual test results can help shed light on this. Appendix B shows the individual test scores of all

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[68] Ibid., 31
[69] Thornbury, *How to Teach Vocabulary,* 53.

pupils. Comparing the other tests to the ones where productive word knowledge is required the most (Test 3 and 6:2), there is a greater disparity in the latter. Pupils who scored well above average in the mapping test, and have high scores in the other tests, such as "B3" and "A10", perform even better compared to the others in these tests. There is also less difference between the approaches in these pupils' results in the other testing. These findings support Nations claim and indicates that the implicit approach is effective in learners who are more proficient. Here, it is important to keep in mind that most of these pupils have above average proficiency, which means that only the best of these again, score well in the productive tests and in the other tests following the implicit approach.

Another consideration that must be made when discussing the results, is the intended use of the words. Because of the nature of their future trade as electricians, the most likely use will be in oral communication and understanding manuals, instructions and regulation documents. The need for a productive word knowledge is therefore mostly limited to speaking in conversation. In this particular area, the testing conducted has its limitations. Just because they were not utilized in the tests requiring productive word knowledge, it is not to say they could not utilize the words for other purposes such as reading manuals and instructions or use and understand them in conversation. Listening to the conversations between the pupils, my impression certainly is that they have utilized more words.

5.3   Retention over Time

It is impossible to argue with Thornbury's view that the purpose of vocabulary learning, regardless of approach, is not only to learn many words, but also to remember them.[70] A consequence of this was the choice of including the repetition tests. As the goal for these pupils is to prepare them for their future profession and adult life, it is important they remember as much as possible, as long as possible. In addition, I wished to find out if there were any differences between the two approaches in retention over time. The desired placement of new words is the long-term memory and, according to Thornbury, remembering the word the following lesson means the words have been placed there.[71] Results from the

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[70] Thornbury, *How to Teach Vocabulary,* 23.
[71] Ibid., 24

repetitions tests, as shown in tables 10 and 11, page 31 and 32, reveal the explicit approach still holds an advantage over the implicit approach one week after the words were learned. When looking at the large difference in the translations tests the previous week, this is not surprising considering that repetition tests are also translation tests.

However, the difference between the approaches is smaller, and significantly so. While the average score following an explicit approach is 2.6 words, it is only 0.8 for the implicit, as shown in Table 11. These results suggest that a larger percentage of the words learned are retained one week after an implicit approach to learning the words. To explain this relatively rapid drop for the explicit approach compared to the implicit, exploring Thornbury's theories on word knowledge is again necessary. As Table 11 shows, more words following the explicit approach ends up in "the quickly forgotten" part of long-term memory, rather than the never-forgotten. As presented in the Theory Chapter, both Nation[72] and Thornbury[73] suggest many different activities for learning words, which suggests that several different inputs of the same word contribute to retention. The explicit approach, in the form applied here, offers variations of one activity – flash cards – but does not give the same context and inputs as the implicit approach. As a result, fewer words are retained.

The difference between the approaches in the repetition tests is what prompted the additional test, Retention test, which was thus included to explore the development in retention exceeding the duration of the project. Accordingly, seven weeks after the last lesson, half of the words from the translation tests were included, in order to look at retention development. According to Thornbury, 80 percent of what is learned is forgotten within 24 hours, but that this rate levels out over time.[74] This suggests two things. Firstly, these are, as expected, very good pupils who retain well above average, as shown in all tests. Secondly, that the results from the retention test should show a smaller loss. Looking at the results, Table 12, page 32, shows that the scores from the retention test are still notably higher than what could be expected. Furthermore, the explicit approach still hold the advantage over the implicit by 3.7 more words on average, while the difference was 3.5 in the translation tests. Compared to the translation tests, the scores following an implicit approach has dropped by 2.7, while the explicit has dropped 1.5. An average drop of 1.7 in the first week and 2.1 the next seven to twelve weeks supports the theory that the "forgetting rate" levels out in time. Especially

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[72] Nation, *Learning Vocabulary in Another Language*.
[73] Thornbury, *How to Teach Vocabulary*.
[74] Ibid., 26.

important here is the fact that the more rapid drop following the explicit approach in the repetition tests is neutralized. In fact, more words are forgotten following the implicit approach, however not substantially.

5.4   Choice of Approach, Subject, Content and Material

The replies in tables 14 and 15, page 34, show that English will be relevant in their future profession, with the majority of pupils believing they will need English either 2-3 times a week or 2-3 times a month, as shown in tables 14 and 15. Consequently, mastering a technical vocabulary specific to their profession is important. The importance of vocational focus in common core subjects are found in the Education Act, and stipulated by the curriculum. However, choice of approach, content, material, and which subject to focus on is still left to the teacher, which is the reason for the second part of the project where the pupils' experiences with these factors are explored.

5.4.1   Approaches

The first three sections of the chapter deal with findings in the test results, and discuss which approach is preferable based on scores. Undoubtedly, the findings here are important to consider, however other factors should also be considered. The pupils' learning is ultimately the goal for teaching, which means their experiences and opinions should also be considered, not just their test scores. The framework FYR emphasize the importance of common core subjects, such as English, should be perceived relevant and motivational.[75] The findings in the surveys and the interview related to approach will contribute an additional view on the implicit and explicit approaches.

In order to uncover the pupils' preferences the findings in Survey 4, page 37-38, is relevant. At this point the pupils had tried both approaches, giving them grounds for comparison. As described in the results, a large majority of the pupils preferred the explicit approach, and out of the seven who preferred the implicit approach, four also said they learned more from the explicit. Although the feedback varied, as a whole the groups favor working with the explicit approach. Arguably, what the pupils like should not alone dictate choices, but it undoubtedly

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[75] Utdanningsdirektoratet 2015, 4.

matters to motivation. The main reasons for preferring the explicit approach was that they learned more and it gave more room for oral activities.

Much of the same arguments for the explicit approach were repeated in the interview, page 39-42, with a particular focus on the fact they learned more. In addition, they felt having something physical in their hands, and knowing the purpose of the lesson helped them focus. The proficiency level of the pupils here must be considered a factor, as they are especially focused on doing well. Even though the interviewees favor the explicit approach, they do open up to the possibility for a combination, after it is explained to them that the implicit approach can lead to better retention. Additionally, the material used in the implicit approach could affect attitudes towards the implicit approach, and is discussed further in the next section.

5.4.2 Subject and Material

In order to find the material most relevant to the pupils, a good start is choosing the right subject. Most, if not all vocational programs have several vocational subjects which all deal with parts of their future trade. However, in the interview it became clear that the likelihood of needing English varied between them. As explained on page 41, one subject in particular was much more favored that the others, Electrical Power Systems. The particular subject here is not what is important, the fact that one subject can be more relevant than others is. Apparent from the pupils in the interview, the reasons why this subject was more relevant was that it deals with the everyday work at construction sites and in dealings with customers. In order to ensure choosing the right subject or subjects, both pupils and vocational teaches can be consulted.

In addition to choosing the right subject, the material within the subject matters in making English relevant, according to the pupils who participated. Selecting material from English speaking countries has both advantages and disadvantages. One advantage is authenticity, which according to Polat creates an accurate representation.[76] In theory, the pupils agreed with this, as they stressed the importance of the material being close to reality. At the same time, the authenticity created by using this material is its own problem. When it comes to practical solutions and ways of doing things, there are differences between countries.

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[76] Polat, *Learning, Teaching and Assessment,* 129

Admittedly, whether or not this is an issue for other vocations is unknown to me, but I am assuming this is the case. Regardless, findings in the interview clearly show the pupils favoring using material that closely resemble what they know from their vocational subjects. This way, focus can be on learning vocabulary and language, rather than understanding the topic itself.

5.4.3 Content

As mentioned, the pupils agree the material should be authentic, however this proves difficult as discussed above. Another way of getting this authenticity is through the lesson content by making activities and tasks reflect authentic situations. Regardless of which approach is used to learn the words, activities to retain them can be authentic. Again, the likely use of English should contribute to dictate the choices made by the teacher here. As seen by the pupils' comments on page 41, they suggest using their actual physical work from vocational classes to practice. This creates a near authentic situation where technical vocabulary is practiced. Considering these pupils have chosen a practical profession one can also assume a practical and oral approach to retention of vocabulary is preferable.

6   Conclusion

The aim of the study was to shed light on how a technical vocabulary is best learned with vocational pupils in upper secondary school. The following questions were asked at the outset:

Which approach, implicit or explicit, is most helpful for learning a technical vocabulary?

Which aspects related to approach and material are important to consider in order to support pupils in the process of learning technical vocabulary?

To answer the questions two approaches, implicit and explicit, were tried out and lesson plans were made for a six-week period, for two VG2 classes. Admittedly, before embarking on the study, I had been skeptical of giving too much time and attention to an explicit approach, believing that vocabulary is best learned from context, in addition to having concerns that cramming and repetitiveness would affect the pupils' motivation negatively. Seeing that numerous tests and feedback from the participating pupils proved the explicit approach advantageous, my concerns are mostly abandoned. On the other hand, as discovered by pupils' feedback and discussion, different material could have influenced both the results and pupils' attitude towards the implicit approach. In addition, perhaps equally important is considering intended use, proficiency level and personal traits in the learner when choosing approach, or a mixture of approaches.

One of the self-imposed limitations in the study means that only minor attention has been given to the individual results. Further research and study into individual results would have been very interesting and is certainly encouraged if others embark on similar research. In addition, it would have been interesting to repeat the productive tests and see how the two approaches worked over time in productive use.

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Appendix A: Consent form

Forespørsel om deltakelse i forskningsprosjekt om yrkesrelevant vokabular

Bakgrunn og formål

Jeg jobber med en masteroppgave ved NTNU hvor jeg vil forske på hvordan man kan drive relevant og yrkesrettet innlæring av vokabular for yrkesfag i den videregående skolen. Deltakelse er frivillig, men jeg er svært takknemlig for alle som har mulighet til å være med.

Hva innebærer deltakelse i studien?

Deltakerne vil være med på et 7 uker langt undervisningsopplegg hvor målet er å lære inn et vokabular som oppleves relevant for det yrket du skal ut i. Målingen vil foregå ved bruk av digitale tester, samtaler og loggskriving. Samtalene kan bli innspilt.

Hva skjer med informasjonen om deg?

Alle personopplysninger vil bli behandlet konfidensielt. Enkeltpersoner vil ikke kunne gjenkjennes i publikasjonen. Datainnsamlingen og behandlingen av data gjøres i henhold til kravene i personopplysningsloven og forskningsetiske prinsipper. Alt datamaterialet som samles inn vil anonymiseres. Funnene fra undersøkelsen vil kunne brukes som data i vitenskapelige artikler og bokkapitler.

Frivillig deltakelse

Det er frivillig å delta i studien, og du kan når som helst trekke ditt samtykke uten å oppgi noen grunn.

Dersom du har spørsmål til studien, ta kontakt med:

Marit Knarud Ulmo

Maritknaruu@vfk.no, 959 15 927

Veileder:

Anita Normann, NTNU

Anita.normann@ntnu.no

Samtykke til deltakelse i studien

Jeg har mottatt informasjon om studien, og er villig til å delta:

Group A

Pupil	Test 1:1	Test 1:2	Repetition 1:2	Test 2:1	Test 2:2	Repetition 1:	Test 3	Test 4:1	Test 4:2	Repetition 4:	Test 5:1	Test 5:2	Repetition 5:1	Test 6:1	Test 6:2
Maximum points	10	20	20	20	10	20	20	20	16	20	20	10	20	19	11
A1	6						8	15	8	13	17	8	14	18	3
A2	8	8	9	11	4	10	6	19	13	18	20	9	17	17	4
A3	8	12	14	12	4	12	7	17	12	14	16	5	10	19	4
A4	10	13	11	15	6	13	9	15	15	14	15	4	11	11	3
A5	10	13	12	13	5	13	7	16	13	12	13	5	9	16	5
A6	6	11	11		3		8	14	13	10	14	2	11	14	1
A7	4	10	6	7	5	8	8	15	10	12	17	3	15	17	1
A8	10	13	13	13	7	12	12	20	15	18	16	7	16	17	3
A9	10	14	14	14	4	13	6	16	12	15	17	3	13	17	4
A10	10	14	15	15	7	15	12	17	16	13	-	-	-	19	11
A11	10	13	11	12	9	10	12	15	14	14	13	3	10	16	4
A12	10	11	11	18	4	18	8	18	12	15	18	6	16	18	3
A13	10	10	12	14	7	12	6	16	15	12	18	6	14	18	4
A14	10	13	12	17	7	14	7	18	15	17	19	9	16		
A15	7	8	9	17	4	15	9	15	14	12	18	7	13	17	6
Group total	52	67	63	58	27	56	53	111	84	93	112	36	87	112	21
Group avarage	7,4	11,2	10,5	11,6	4,5	11,2	7,6	15,9	12,0	13,3	16	5,1	12,4	16,0	3,0
Percentage	86 %	58 %	57 %	69 %	54 %	64 %	42 %	82 %	82 %	70 %	75 %	55 %	66 %	88 %	36 %

Group B

Pupil	Test 1:1	Test 1:2	Repetition 1:2	Test 2:1	Test 2:2	Repetition 1:	Test 3	Test 4:1	Test 4:2	Repetition 4:	Test 5:1	Test 5:2	Repetition 5:1	Test 6:1	Test 6:2
Maximum points	10	20	20	20	10	20	20	20	16	20	20	10	20	19	11
B1	10	19	14	14	8	12	6	8	14	7	16	10	15	16	4
B2	-	-	16	16	6	10	8	11	9	11	14	7	14	15	4
B3	10	19	18	18	9	17	9	12	16	10	16	10	16	16	11
B4	10	16	11	11	5	10	11	9	10	7	8	6	9	7	6
B5	10	16	15	17	4	14	11	12	13	9	14	6	13	13	3
B6	10	18	18	18	9	18	9	12	15	11	18	9	19	13	8
B7	10	18	15	18	7	15	13	14	15	14	15	8	14	13	5
B8	10	16	14	14	5	11	13	10	11	10	13	7	11	11	4
B9	10	18	17	17	4	13	8	8	14	8	13	7	12	14	5
B10	8	18	18	19	7	17	6	9	11	7	11	4	10	11	2
B11	10	14	-	-	-	-	6	9	10	8	13	5	13	9	4
B12	10	14	11	11	5	10	6	5	4	6	10	3	8	6	3
B13	10	18	14	14	4	11	8	8	10	9	13	6	12	9	6
B14	10	18	17	17	5	16	6	9	11	9	16	7	12	13	5
B15	10	18	16	19	7	15	13	11	14	9	13	9	12	10	5
B16	10	18	16	18	8	15	9	14	10	13	14	6	13	12	6
Group total	78	136	109	115	40	97	62	73	84	69	103	47	92	84	36
Group average	9,8	17	15,6	16,4	5,7	13,9	7,8	9,1	10,5	8,6	12,9	5,9	11,5	10,5	4,5
Percentage	99 %	86 %	77 %	81 %	62 %	68 %	45 %	51 %	73 %	47 %	68 %	69 %	64 %	62 %	46 %

Appendix C: Lesson plan 2A-Implicit Group

Lesson 2A

Aims:

forstå og bruke et bredt generelt ordforråd og et faglig ordforråd knyttet til eget utdanningsprogram

forstå hovedinnhold og detaljer i ulike typer muntlige tekster om allmenne emner og faglige emner knyttet til eget utdanningsprogram

innlede, holde i gang og avslutte samtaler og diskusjoner om allmenne emner og faglige emner knyttet til eget utdanningsprogram

Activity 1

Watch the film on installing a 3-way switch.

Task 1: Discuss in pairs what is explained in the video. Is this how you would do it? Are there any differences between the components and tools you see here and the ones you are used to?

You'll find the link on it's-learning if you need to see it again.

Activity 2

Ask for a copy of the text.

Task 1: Read the text and discuss the approach. Is this what you would do?

Ask for a list of symbols.

Task 2: Find you drawing of the 3-way switch you have done in class. Do you use the same symbols? Use the drawing to explain to your partner how you would install this. Explain it like your partner knows next to nothing about electrical installations. Include what tools you would use and name all the components.

Activity 3

Testing and survey on it's.

Appendix D: Lesson plan 2B – Explicit group

Lesson 2B

Aims:

forstå og bruke et bredt generelt ordforråd og et faglig ordforråd knyttet til eget utdanningsprogram

innlede, holde i gang og avslutte samtaler og diskusjoner om allmenne emner og faglige emner knyttet til eget utdanningsprogram

Activity 1

FC, 3-way switch, eng-no

Do you know the English word for these words? Quiz each other. Write down the words on the back. Check the answer right away. Switch sides and see how many you can translate from English to Norwegian

FC, 3-way switch, eng-eng (Ask for cards)

In pairs, try to explain what the different words are in English. Check to see if you agree with the explanation on the back.

For each of the words explain to your partner how it can relate to an installation.

FC,3-way switch, pic (Ask for cards)

Name the words in English. How many could you get? Make a note.

Activity 2

Find your blueprint (drawing) of a 3-way switch. Ask for a list of symbols.

Compare the symbols to the ones you are used to.

Use your drawing and the words from the flash cards to give your partner a detailed account of how you would do this installation.

Activity 3

Testing on it's-learning: "Lesson 2 testing" and Undersøkelse Lesson 2"

Appendix E: Lesson plan 6A – Explicit group

Lesson 6A

Aims:

forstå og bruke et bredt generelt ordforråd og et faglig ordforråd knyttet til eget utdanningsprogram

innlede, holde i gang og avslutte samtaler og diskusjoner om allmenne emner og faglige emner knyttet til eget utdanningsprogram

Activity 1

FC, eng-no

Do you know the English word for these words? Quiz each other. Switch sides and see how many you can translate from English to Norwegian

FC, eng-eng (Ask for cards)

In pairs, try to explain what the different words are in English. Check to see if you agree with the explanation on the back.

For each of the words explain to your partner how it can relate to the function of an electric motor.

FC, pic (Ask for cards)

Name the words in English. How many could you get?

Activity 2

Ask for the complete list of words.

Use the list of words as a basis for explaining, in as much detail as possible, how an electric motor works

Discuss what you would need to know as an electrician working with electric motors. Go into detail on problems that could occur and how you would solve them.

While you wait for others to finish, try to memorize as many of the words as possible and use them to make sentences.

Activity 3

Go to it's-learning to complete "Lesson 6 testing"

Appendix F: Lesson plan 6B – Implicit group

Lesson 6B

Aims:

forstå og bruke et bredt generelt ordforråd og et faglig ordforråd knyttet til eget utdanningsprogram

forstå hovedinnhold og detaljer i ulike typer muntlige tekster om allmenne emner og faglige emner knyttet til eget utdanningsprogram

innlede, holde i gang og avslutte samtaler og diskusjoner om allmenne emner og faglige emner knyttet til eget utdanningsprogram

Activity 1

Task 1: Read the text about how electric motors work.

Task 2: Discuss the text with your partner and make sure you have an understanding of the text. Practice explaining the functions of an electric motor to each other.

Activity 2

We watch the video on the functions of an electric motor.

Task 1: Discuss in pairs what is explained in the video.

Task 2: Re-watch the video without sound and try to explain as you go. You'll find the link on it's-learning.

Activity 3

Go to it's-learning for "Testing lesson 6"

Appendix G: Sources for lesson material

<u>Lesson 1:</u>

Text made from:

- https://home.howstuffworks.com/electrical-tools.htm
- https://www.thespruce.com/top-electrical-tools-1152575

Listening:

- http://tracks1el.cappelendamm.no/c107801/sammendrag/vis.html?tid=111792

Video:

- https://www.youtube.com/watch?v=SXZXtD60t2g

<u>Lesson 2:</u>

Text made from:

- http://www.how-to-wire-it.com/wiring-a-3-way-switch.html
- https://www.familyhandyman.com/electrical/wiring-switches/how-to-wire-a-threeway-switch/view-all/

Video:

- https://www.youtube.com/watch?v=EFcwL22Ekok&t=166s

<u>Lesson 3:</u>

Text:

- https://www.marineinsight.com/marine-electrical/how-to-find-an-earth-fault-on-board-ships/

Lecture:

- On being a marine electrician; Jon Viggo Solberg (Marine Electrician)

<u>Lesson 4:</u>

Text:

- https://media.wattswater.com/IOM-WR-WW-EN.pdf

Video:

- https://www.youtube.com/watch?time_continue=185&v=1kpInWAiPNc

<u>Lesson 5:</u>

Videos:

- https://www.youtube.com/watch?v=nbPmsBmo03Y&t=9s
- https://www.youtube.com/watch?v=4L31dHXP6i0

Text:

- https://media.wattswater.com/IOM-WR-WW-EN.pdf

<u>Lesson 6:</u>

Text:

- http://www.edisontechcenter.org/electricmotors.html

Video:

- https://www.youtube.com/watch?v=AQqyGNOP_3o

Appendix H: Word list (Without pictures)

English	English explanation	Norwegian
Hammer	A hammer is used to secure boxes equipped with nail-on brackets to studs in a home. You'll also need it to drive Romex straps when adding new wiring in a home.	Hammer
Side cutter diaganol pliers	These cutting pliers, sometimes called side snips, are used to cut wire. They are specially designed with a cutting edge that goes down to the tip of the pliers. The advantage being that you can get into tight areas to trim wires	Avbitertang
Wire stripper	Wire strippers are used to cut the insulation off of the wire. They are equipped with different sized cutting teeth for various sized wires. They also have a cutoff portion in order to cut the wire.	Avisoleringstang
Cable cutter	Cable cutters are used to cut the cables. Some use it to cut the insulation off the wire.	Kabelkutter (Kabelsaks)
Phillips screwdriver	A Phillips screwdriver has four blades used to install Phillips-head screws. The tip looks like a plus sign.	Stjernetrekker
Elko knife	A knife is needed to cut the insulation off of wiring. You will also need to open boxes when doing the installation and this tool will come in handy.	Elkokniv
Allen wrenches	Allen wrenches are used to tighten Allen-headed screws in your electrical panel.	Unbrakonøkler
Level (can use laser)	A level is used to make sure your work is level and plumb. A great installation starts with straight switch and outlet covers.	Vater
Tape measure or Metric measuring rod	A tape measure or measuring rod is used to measure heights for switches and outlets. You will also need it to center lighting fixture boxes.	Målebånd, Meterstokk
Wire crimpers	This tool strips the wire and also crimps lugs onto the wire.	Kabelskotang
Cable clip holder	This tool is used to hold the cable clips before you attach the cable to the wall.	Castor skaft/holder
Straight-blade screwdriver	This screwdriver is used for straight slot screws. You will likely need more than one size for your project. If you have to choose just one, pick a medium blade. It will suit most projects.	Flattrekker
Multimeter	A multimeter is an electronic measuring instrument that combines several measurement functions in one unit. A typical multimeter can measure voltage, current, and resistance.	Multimeter
Insulation tester	Is used to test if the insulation on the conductor to make sure there isn't any leakage.	Isolasjons-motstandsmåler (megger)
A switch	allows you to turn electricity on and off.	Bryter
A wire	transports electricity.	Ledning
A socket	is an outlet where you can plug in an electric appliance.	Stikkontakt
A fuse	breaks if too much power flows through the circuit.	Sikring
A plug	is inserted in the socket to bring electricity to, for example, a lamp.	Støpsel
A cable clip	secures the cable firmly to the wall.	Lednings-klemme
A circuit	is a full loop of electricity, with cables and sockets, etc.	Strømkrets
A conduit	is a plastic tube used for wiring inside walls.	K-rør
A circuit breaker	is a modern type of fuse that does not need replacing.	Automatsikring

A junction box	is a closed box where wires can be connected.	Koplingsboks
Connection terminal	A terminal is the point at which a conductor from an electrical component, device or network comes to an end and provides a point of connection to external circuits	Koplingsklemme
A strip of connectors	is a fixed connection between a cable and, for example, a ceiling lamp.	Rekkeklemme
A dim switch	allows you to adjust the light gradually.	Dimmer
English	**English Explanation**	**Norwegian**
Wiring	Electrical wiring is an electrical installation of cabling and associated devices such as switches, distribution boards, sockets and light fittings in a structure.	Ledningsnett
3-way switch	3-way switches are used to control lights with two switches.	Endevender
Switch	In electrical wiring, a light switch is a switch, most commonly used to operate electric lights, permanently connected equipment, or electrical outlets.	Bryter
Power cable	A power cable is an electrical cable, an assembly of one or more electrical conductors, usually held together with an overall sheath.	Strømledning
Circuit breaker	A circuit breaker is an automatically operated electrical switch designed to protect an electrical circuit from damage caused by overcurrent, typically resulting from an overload or short circuit.	Automatsikring
Electricity	Electricity is the set of physical phenomena associated with the presence and motion of electric charge.	Elektrisitet
Voltage detector	Voltage detectors are a quick way to check for the presence of live voltage on ac circuits, switches and outlets before working on them.	Spenningsføler
Power	Electric power is the rate, per unit time, at which electrical energy is transferred by an electric circuit.	Sterkstrøm/nettstrøm
Conductor	A conductor is an object or type of material that allows the flow of an electrical current in one or more directions.	Leder
Neutral conductor	The intermediate conductor in a three-wire electrical system usually grounded or maintained at zero potential	Nøytral leder
Hot conductor/ traveler wire	In the traveler system, also called the "common" system, the power line (hot, shown in red) is fed into the common terminal of one of the switches; the switches are then connected to each other by a pair of wires called "travelers"	Faseleder
Ground wire	The ground wire is an additional path for electrical current to return safely to the ground without danger to anyone in the event of a short circuit.	Jordleder
Bare wire	An uninsulated blank conductor.	Blank leder/Uisolert
Load wire	Load refers to devices on the same circuit that are downstream of the one in question. A second meaning for load is the magnitude of the energy consumed by the devices on the circuit.	Leder med last(med strøm)
Grounding pigtails	To connect two separate grounding points to create similar potential on both points.	Utjevningsjording
Lever nut	Lever nuts are use to connect conductors in a circuit.	Koplingsklemme (WAGO)

Terminal	A terminal is the connection point between the conductors and the components(switches etc) in an electric installation.	Tilkoblingspunkt
Green terminal	The connection point between the earth wire and the component(switches etc) in an electric installation.	Tilkoblingspunkt for jordleder
Bronze terminals	The connection point between the traveler wires and the component(switches etc) in an electric installation.	Tilkoblingspunkt for faseledere
To crimp	The act of shaping the conductor to fit so that the screw can faten the conductor to make a connection.	Klemme(ledning rundt tilkoblingspunkt)
Screw	To fasten screws using some kind of screwdriver.	Skru
Connect	To make a connection between two components in a circuit.	Koble til
Electricians tape	Electrical tape (or insulating tape) is a type of pressure-sensitive tape used to insulate electrical wires and other materials that conduct electricity.	Elektrikerteip
Wire stripper	A wire stripper is a small, hand-held device used to strip the electrical insulation from electric wires.	Avisoleringstang
Self grounding clip	The purpose is to make the connection between the earth wires to have a continuous earth system in the installation.	Selvjordingsklemme
English	**English Explanation**	**Norwegian**
Rudder	A rudder is a primary control surface used to steer a ship, boat, submarine, or other conveyance that moves through a fluid medium (generally air or water)	Ror
Roll on roll off	A ship where you can roll the cargo on and off	Ro-ro skip
Engine control room	The control room is the command center of the engine room in a ship and is the place where all sorts of controls are located.	Kontrollrom
Main switch board	The Main switch board is an intermediate installation in the ship's power distribution circuit connecting the power generators and power consumers	Hovedtavle
Integrated control system	A modern automation and control system is a fully integrated systems covering many aspects of the ship operation that includes the propulsion & plant operation.	Integrert kontrollsystem
Main engine	Drives the propulsion	Hovedmotor
Stearing gear	Gives power to the rudder	Styremaskin
Pumps	Transports liquids	Pumper
Ball bearings	Holds the rotor in place and is fastened to the frame.	Kulelager
Stator	Creates a magnetic field that makes the rotor rotate.	Stator
Bridge	The rom from where the navigators steer the ship.	Broa
Radar	Gives information of the surrounding ships and shoreline.	Radar
Auxilirary engines	Produces power	Hjelpemotor
End covers	Supports the bearing of the engine	Endelokk
Main breakers	plays a crucial role in the electrical system by offering the means of disconnecting power to the entire circuit breaker panel and hence shutting off power to the entire circuit.	Hovedbrytere
Galley	The kitchen on a ship.	Bysse(Kjøkken på båt)
Anomalies	Anomalies are irregularities you look for when you work to maintain any system on a ship	Avvik
Cargo	The load you transport on ships.	Skipslast
Earth fault	A fault in the system which causes the current to travel to and throught the earth wire into the ground.(	Jordfeil

English	English explanation	Norwegian
Test button (for earth fault)	Resets the alarm and rechecks the condition of the earth fault.	Testknapp for jordfeilbryter
IET regulations	sets the standards for electrical installation in the UK and many other countries.	FEL
English	**English explanation**	**Norwegian**
Thermostat	A thermostat is a component which senses the temperature of a system so that the system's temperature is maintained near a desired setpoint. Thermostats are used in any device or system that heats or cools to a set-point temperature	Termostat
Mortar	Mortar is a workable paste used to bind units such as stones, bricks, and concrete masonry together, fill and seal the irregular gaps between them. In its broadest sense mortar includes pitch, asphalt, and soft mud or clay, such as used between mud bricks.	Mørtel
Heating cables	A term for having a system which provides heat under floors, roofs, driveways etc.	Varmekabler
Inch	Measuring unit. 1"=2,54cm	Tomme
R-value	The R-value is a measure of thermal resistance, or ability of heat to transfer from hot to cold, through materials (such as insulation) and assemblies of materials The higher the R-value, the more a material prevents heat transfer.	R-verdi (Friksjonstap)
Amps (amperage)	the strength of an electric current measured in amperes.	Strømstyrke (Ampere)
End splice (Back splice)	a splice made by turning the end of a cable back on itself and interlacing the strands, thereby forming a loop.	Endeavslutning
Heating wire	The wire that heats up in order to give warmth to the floor.	Varme/ glødetråd
Power lead	Is the heating cable's electric power supply.	Strømtilførselsesledning
Trowel	Tool used to even out the mortar on the heating cables.	Tannsparkel
Spool	a cylindrical device on which film, magnetic tape, thread, or other flexible materials can be wound; a reel.	Spole/rull
Chisel	A chisel is a tool with a characteristically shaped cutting edge of blade on its end, for carving or cutting a hard material such as wood, stone, or metal by hand, struck with a mallet, or mechanical power.	Meisel/ huggjern
Hole saw	A hole saw also known as a hole cutter, is a saw blade of annular (ring) shape, whose annular kerf creates a hole in the workpiece without having to cut up the core material. It is used in a drill.	Hullsag
Square feet	The *square foot* is an imperial unit of area. It is defined as the area of a square with sides of 1 foot.	Kvadratfot
Resistance	The electrical resistance of an electrical conductor is a measure of the difficulty to pass an electric current through that conductor.	Ohmsk motstand
Mounting	The process/act of an installment.	Intallasjon/ montering
Knock-out	Points in junction boxes you can easily remove to tread wires or conduits through.	
Debris	Scattered pieces of rubbish	Avfall

Floor sensor	Floor sensors maintain consistent floor temperature. Floor sensing thermostats are the safest and most energy efficient floor heating regulators ensuring the floor does not overheated, and kept at the desired temperature.	Sensor
Sensor wire	The wire leading to the floor sensor which in turn works to maintain the desired temperature.	Sensorledning
English	**English Explanation**	**Norwegian**
Electrical grid	An interconnected network for delivering electricity from producers to consumers, created to eliminate the problem of distance between electricity production and consumption	Strømnettet
Consumers	Everyone and everything that uses electricity; namely industrial, commercial and residential.	Forbrukere
Transmission	The bulk movement of electrical energy from a generating site, such as a power plant, to an electrical substation.	Høgspentdistribusjon
Generation	The process of generating electric power from sources of primary energy.	Strømgenerering
Consumption	Refers to the electrical energy per unit time, supplied to operate something, such as a home appliance. Usually measured in units of watts (W) or kilowatts (kW).	Strømforbruk
Generation plants	An industrial facility for the generation of electric power.	Kraftverk
Transmission lines	Infrastructure which allows electricity to be transported over long distances.	Høgspentleding
Substations	Where electricity voltage is increased or decreased	Lokal transformatorstasjon
Distribution lines	Infrastructure for transporting lower voltage electricity	Fordelingsnett
Transformers	Mechanisms that actually increases or decreases voltage	Transformatorer
Voltage	Electric potential difference, electric pressure or electric tension is the difference in electric potential between two points.	Volt
Shaft	A component in a generator which I spun by a turbine to make electricity.	Aksel
Smart grid	Electrical grid enhanced by information technology	Smart Grid
Electrical gadgets	Any device that needs electricity to work.	Elektrisk innretning
Generator	A device that converts motive power (mechanical energy) into electrical power for use in an external circuit.	Generator
Turbine	A rotary mechanical device that extracts energy from a fluid flow and converts it into useful work. Can be used for generating electrical power when combined with a generator	Turbin
Pylon	A steel lattice tower used to support an overhead power line	Høgspentmast
Capacitor	Device used to store an electric charge, consisting of one or more pairs of conductors separated by an insulator.	Kondensator
Voltage regulator	An electronic circuit that provides a stable DC voltage independent of the load current, temperature and AC line voltage variations	Spenningsregulator
Centralized generation	Large-scale generation of electricity far from point of consumption.	Sentralisert strømgenerering
Decentralized generation	Generation of electricity close to point of consumption.	Desentralisert strømgnerering

English	English Explanation	Norwegian
Electric motor	An electrical machine that converts electrical energy into mechanical energy.	Elektrisk motor
Alternating current, AC	An electric current which periodically reverses direction	Vekselstrøm
Direct current, DC	An unidirectional flow of electric charge.	Likestrøm
Electromagnetic field	A physical field produced by electrically charged objects. It affects the behavior of charged objects in the vicinity of the field.	Elektromagnetisk felt
Secondary winding	The winding of a transformer that receives its energy by electromagnetic induction from the primary winding.	Sekundærvikling
Primary winding (magnet)	An induction coil that is the part of an electric circuit in which a changing current induces a current in a neighbouring circuit	Primærvikling (tenning)
Induction	Is the transmission of an electromotive force (i.e., voltage) across an electrical conductor in a changing magnetic field.	Induksjon
Stator	Is the stationary part of a rotary system, found in electric motors. Energy flows through a it to or from the rotating component of the system. In an electric motor, it provides a rotating magnetic field that drives the rotating armature	Stator
Wound insulated wires/coil (electromagnet)	Creates a magnetic field to drive the rotor.	Vikling
Poles	Magnets in the stator and rotor that attract and repel each other to create a rotation in the rotor.	Poler
Torque	Rotational force determined by the length of the electromagnet in the stator.	Dreiningsmoment
Armature	The rotating part of the motor. It supports the rotating copper coils.	Anker
Burning out	What happens if a motor is run for too long or at excessive load. The winding insulation breaks down or melts, then short and damage the motor.	Utbrent vikling
Squirrel cage	The second coil in an induction motor.	Trommelhjul
Commutator	Rotary electrical switch in certain types of electric motors and electrical generators that periodically reverses the current direction between the rotor and the external circuit.	Kommutator
Brushes	A device which conducts current between stationary wires and moving parts, most commonly in a rotating shaft.	Børster
Variable-frequency drive VFD	Is a type of adjustable-speed drive used in electro-mechanical drive systems to control AC motor speed and torque by varying motor input frequency and voltage.	Frekvensomformer
Torque motor	A specialized form of electric motor which can operate indefinitely while stalled, that is, with the rotor blocked from turning, without incurring damage.	Momentmotor
Universal motor	Is a type of electric motor that can operate on AC or DC power. It is a commutated series-wound motor where the stator's field coils are connected in series with the rotor windings through a commutator.	AC-DC seriemotor

Synchronous motor (Selsyn motor)	An AC motor in which, at steady state, the rotation of the shaft is synchronized with the frequency of the supply current; the rotation period is exactly equal to an integral number of AC cycles.	Synkronmotor
Line frequency	The amount of times a signal travels over a line in a 1-second period.	Linjefrekvens
Shaded-Pole motor	The original type of AC single-phase induction motor. It is a small squirrel-cage motor in which the auxiliary winding is composed of a copper ring or bar surrounding a portion of each pole. This auxiliary single-turn winding is called a shading coil.	Skyggepolmotor
Shaft	A mine shaft used for the purpose of pumping, irrespective of the prime mover.	Aksel