

Smartphone Applications

The future tool for vocabulary learning?

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Abstract

The usage of smartphones has grown extensively over the last years, and so has the services offered to the users. One can interact with other people, play games, surf on the Internet and much more on these small devices that easily can be carried around in a pocket.

There are many ideas about how smartphones can be integrated in schools and learning processes, often defined as mobile learning. This survey aims to study how smartphone applications for vocabulary learning can be used, and what effects it can have on high school students' learning processes.

In order to receive substantial results we chose to develop a prototype, FlashWords, which we tested on a group of students. Their usage was logged in a database and followed up by a focus group.

The results from the survey showed that students are very positive towards the idea of practicing vocabulary on their smartphones. It was also found that the students practiced more and began earlier when using the application compared to traditional methods. We believe the main reason for this is the smartphone's portability and the possibility of more spontaneous learning opportunities.

Sammanfattning

Användningen av smartphones har ökat i stor utsträckning under de senaste åren, och så har även de tjänster som erbjuds användarna. Man kan interagera med andra människor, spela spel, surfa på Internet och mycket mer på dessa små enheter som lätt kan bäras runt i fickan.

Det finns många idéer om hur smartphones kan integreras i skolor och lärandeprocesser, dessa går ofta under en gemensam term; mobil inläring. Denna undersökning syftar till att studera hur smartphone applikationer för glosinläring kan användas, och vilka effekter det kan ha på gymnasieelevers lärandeprocess.

För att få konkreta resultat valde vi att utveckla en prototyp, FlashWords, som vi testade på en grupp studenter. Deras användning loggades i en databas och följdes upp av en fokusgrupp.

Resultaten från undersökningen visar att eleverna har en mycket positiv inställning till att öva glosor på sina smartphones. Det visade sig också att eleverna övade mer och började tidigare när de använde applikationen jämfört med traditionella metoder. Vi tror att främsta orsaken till detta är smartphonens bärbarhet och möjligheten till fler spontana inläringstillfällen.

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1. Introduction

This section explains the background and purpose of this project. It communicates the reason for writing a degree project in the field of mobile learning as well as the main research questions and delimitations.

1.1 Background

Over the last years the usage of various forms of mobile devices, such as smartphones, tablets and laptops, has increased enormously. For example, the shipments of mobile phones went up over 60 % between 2010 and 2011 (Mobithinking.com, 2011). The opportunity to always stay connected opens up a lot of new doors within different contexts, such as social, business and educational. Today's possibility to, independent of time and geographical location, communicate, share and comment on data truly shapes the everyday life of people. One field that could really benefit from this is the field of language learning. Learners can make good use of the facilities to listen to audio at any time as well as the "always on" characteristics of portable devices which encourage spontaneous interaction (Kukulska-Hulme, 2006).

Even if the widely spread usage of mobile devices is a relatively young phenomena, there has already been a lot of studies focusing on the combination of mobile phones and language learning (Başoğlu, 2010; Hedbom, 2008; Mamlöf, 2008; Stockwell, 2007; Thornton & Houser, 2005). Many of these reports show a very positive effect from involving mobile devices in language learning, but they agree on that there is a lot more to be investigated within the subject.

1.2 Purpose

The purpose of this report is to analyze in what ways an application for vocabulary learning can be used by students in high school¹. We will investigate what effects such an application can have on students' learning processes and if it is an effective complement to already existing learning methods.

The goal of this study is to find out in what context smartphones can be used as part of high school students' language education. We want to investigate if there is a way to combine the usage of mobile phones with language learning in order to increase the students' engagement and/or change their learning habits. As a guideline for this project we have formulated one main question that will be in focus throughout the process. This question is:

- *Which effects could the introduction of an application for vocabulary learning have on high school students' learning processes?*

¹ By high school we refer to the grades in the Swedish school system that lasts between ages 15-19

To be able to answer our main question we have also formulated a few sub queries to help us to a conclusion. These are:

- *What advantages/disadvantages can learning by using a mobile application have compared to traditional learning methods? Which new learning opportunities are created?*
- *Could a mobile application increase the interest for practicing?*
- *How should an application be designed in order to engage high school students?*
- *Is it possible to make conclusions about which effects are long- respectively short-lasting? Is an increase of practice only caused by the Novelty and/or Hawthorne effect?*

1.3 Target group and delimitations

The focus of this report is, as previously mentioned, on language learning for mobile devices, more specifically vocabulary learning for smartphones.

We focus on Swedish high school students as our target group. These students are of ages 15-19 and preferably studying English as a second language. As members of this group are underage we have made certain to follow the rules of the Law of Ethics. It is stated in § 18 that research which involves children who are over 15 years and realize what the research means for him or her, must be informed and consent to the research ("Codex - Rules and Guidelines for Research," 2012).

We do not focus on students learning other languages than English. We will be focusing on the students' attitudes towards applications for vocabulary learning and their possible change in learning habits rather than their results on tests etc. This is mainly because we believe that effects, like for example an increase of practice, will also affect the students' results.

Furthermore, we analyze students using applications for mobile language learning, not teachers using mobile applications in their education. However we use the teachers to manage the content and distribute our application to the students.

The platforms we concentrate on are android smartphones with connection to the Internet. This could be either by using wireless networks or by 3G-connection. The application itself is developed for the web but customized for small screens. Consequently, it is not a local application that can be run without Internet connection.

2. Background and theories

In this part we will go through and explain the background and different theories that we find relevant for our study. We will begin with explaining the terms e-learning and mobile learning. E-learning is not directly connected to the study but it is relevant when describing mobile learning. Then we will describe some learning styles and -strategies and concepts such as flashcards, spaced repetition and gamification. We will also go through theories for designing a mobile application. Shortly we describe some effects that can occur when performing a survey. Finally we present previous research in the field of vocabulary learning using mobile phones and spaced repetition.

2.1 E-learning

This report mainly focuses on mobile learning, also called m-learning. In order to understand this term one must have basic knowledge about e-learning as well since many definitions of m-learning include comparison to e-learning.

E-learning is an American term which has been used for about 20 years, the phenomena itself is much older though (Boström, 2011). E-learning comprises all forms of electronically supported interactive learning and teaching, both with and without access to the Internet. It includes all learning supported by PCs, laptops, CDROMs and so forth.

According to Traxler some of the core characteristics of e-learning are that it is: media-rich, structured, massive, intelligent and/or interactive (Traxler, 2005). This is relevant in order to compare with the main characteristics of m-learning.

2.2 Mobile learning

Even though mobile learning today is a widespread concept it still lacks an exact definition.

In John Traxler's *Learning in a mobile age* he discusses several different definitions made by himself and others in the field (Traxler, 2009). Eg. Desmond Keegan argues that m-learning should be restricted to "learning on devices which a lady can carry in her handbag or a gentleman can carry in his pocket" focusing on the device used for learning (Keegan, 2005 cited in Traxler, 2009). This differs some from the viewpoint of O'Malley who states that m-learning is "any sort of learning that happens when the learner is not at a fixed, predetermined location", accentuating the learner's mobility rather than the device's (O'Malley et al., 2003 cited in Traxler, 2009). Furthermore some argue that mobile learning might be a wholly new educational format or perhaps 'merely' a variety of e-learning (Traxler, 2009). This makes it difficult to encapsulate all the meanings of m-learning in the scope of this text. We will therefore focus on the parts that are most relevant to our survey.

It is common knowledge that technology is moving forward in a rapid pace. In the field of mobile devices, smartphones are getting more and more intelligent. The possibility to always stay connected through Wi-Fi and 3G combined with better screen resolution, higher memory capacity and faster processors makes the possibilities expand in pace with technology when it comes to applications and web tools. Even analyzing the use of mobile applications has become easier since you can track user patterns and even location (through GPS) and thereby develop the systems ever further.

The constant connection also encourages social and communicative aspects. The effects of mobile communication are frequently mentioned by Kukulska-Hulme in the publication *Mobile language learning now and in the future* (Kukulska-Hulme, 2006). She states that it is “one of the key advantages” of m-learning considering that it embraces more flexible arrangements than traditional classroom situations. On the other hand, making learning part of students’ personal life there is a risk overly enthusiasm may be seen by children as an intrusion on their personal life. “There is a need to discuss where the bounds of the school lie and where it is not legitimate for formal education to intrude on childhood” (Sharples, 2006).

Some of the main characteristics of m-learning described by Traxler in 2005 are that it is “spontaneous, private, portable, situated, informal and perhaps soon connected, personalised and interactive” (Traxler, 2005). Now, seven years later, one can conclude that m-learning really is connected, personalised and interactive. It is interesting to compare e-learning with m-learning in order to see what aspects that are most important to make good use of while making an application. Figure 1 illustrates the differences in a good and understandable way.

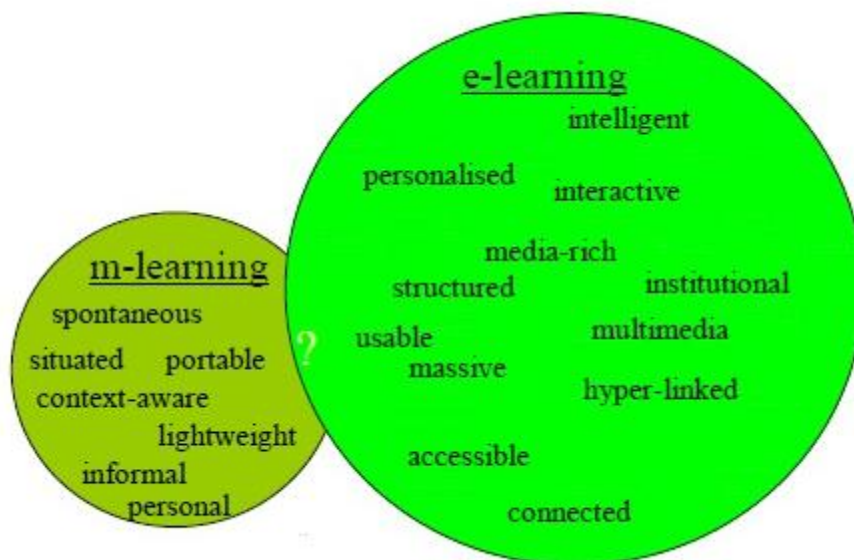


Figure 1- The differences between m-learning and e-learning (Traxler, 2005)

2.3 Learning styles and strategies

Learning styles are the general approaches that students use when learning any subject (Oxford, 2003). Learning strategies can be defined as specific actions, behaviors or techniques used by students to enhance their own learning. Well used strategies can help “making learning easier, faster, more enjoyable, more self-directed, more effective, and more transferable to new situations” (Oxford, 1990 cited in Oxford, 2003).

We will in the following sections describe the strategies and styles we find most relevant for our study.

2.3.1 Dunn and Dunn learning-style model

A very famous and well used model for describing learning styles is the Dunn and Dunn learning style model. This model divides different aspects of learning into five elements illustrated by Figure 2.

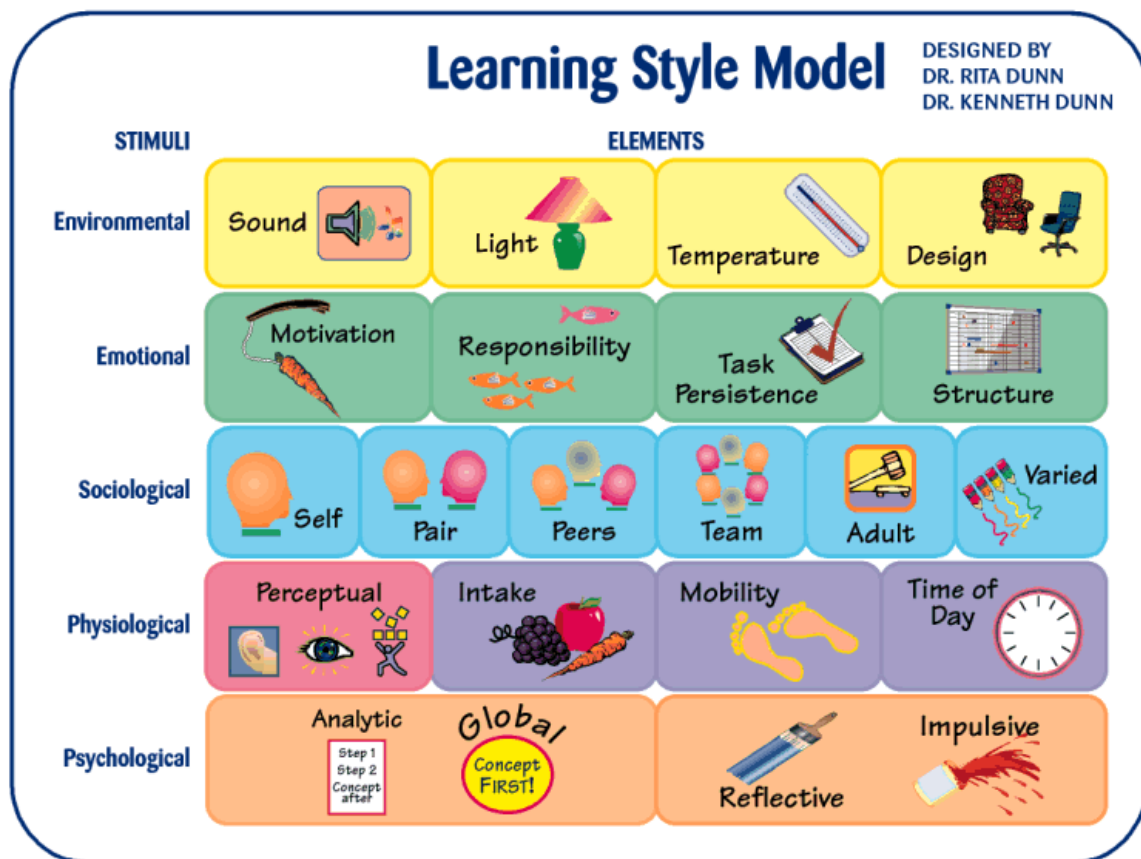


Figure 2 - The elements of the Dunn and Dunn learning-style model (Dunn et. al. 2008)

Many of the elements shown in this figure are interesting when combining learning and smartphones as the significance of each element changes when applied to mobile learning. For example the environmental element, consisting of sound, light, temperature and design, is likely to change when moving learning onto the mobile

platform.

Furthermore, the aspect “time of day” in the physiological element is also interesting since the smartphone enables learning at any time a day, with no restrictions to school hours or day and night. (Dunn et al., 2008)

2.3.2 Formal/informal learning

School systems today tend to use a specific set of the elements in the Dunn and Dunn model. Many of the aspects in the environmental and physiological elements are locked to e.g. studying at a specific time and place using more formal factors such as traditional furnishing with chairs and desks and ordinary school hours. When using mobile devices the opportunities to change these aspects increase. For example, mobile learning supports spontaneous learning and offers a possibility of learning in more informal situations and environments (Kukulska-Hulme, 2006). There is evidence that spontaneous learning often lead to deeper understanding and other positive effects (Williams, 2007).

2.3.3 Vocabulary learning

Although it might seem like vocabulary learning is easy, learning new vocabulary items has always been a challenge for the learners. Different ways of learning vocabulary are usually utilized by the students such as using flash cards, notebooks, finding synonyms and antonyms, just to name but a few. (Nemati, 2009) Some argue that the best way of learning new vocabulary is when the learner’s attention is focused on the message, not the form, for example when reading or listening for meaning. This way the learner would acquire more linguistic knowledge which is more useful in the authentic language use. More recently, however, it has been argued that this kind of learning is insufficient to acquire second-language vocabulary and needs to be supplemented by more deliberate learning. (Elgort, 2011)

To deliberately practice glossaries provides an efficient and convenient way of memorizing vocabulary. Learning from word lists and flashcards can be done outside of the classroom and vocabulary can be personalized to the needs and learning goals of individual learners. It is shown that people are able to learn between 30 and 100 new words per hour from word pairs (Nation, 1980 cited in Elgort, 2011). However, the downside is that it cannot be automatically assumed that the quality of vocabulary knowledge gained through this kind of deliberate learning is at the level that is needed for real language use. (Elgort, 2011) For long-term recall, the successful learner should not only analyze and rehearse the new word and its meanings, but also expand the word-meaning complex and establish it within a suitable network of meaning. This elaboration probably increases the chances that the word and its meaning will be available for use at a later time. (Lawson & Hogben, 1996)

2.3.4 Flashcards

A flashcard is a card with an item, concept or question on one side, and the explanation, translation or answer on the other. Flashcards is a memory-related strategy that enables learners to learn and retrieve information in a mechanical way. Memory-related strategies can help learners to link an item or concept with another but do not necessarily involve deep understanding (Oxford, 2003).

The possibilities of using e.g. sound and colors make smartphones an excellent platform for flashcards. Using this method for vocabulary learning is convenient since it enables the learner to practice “both ways”, e.g. either from Swedish to English or the other way around.

2.3.5 Spaced repetition

Spaced repetition refers to a memory advantage that occurs when people learn material on several separate occasions, instead of a single massed study episode. Many studies show that spaced repetition benefits the long term retention of verbal information, including vocabulary learning. (Sobel, Cepeda, & Kapler, 2011)

2.3.6 Gamification

Gamification is the use of game aspects in non-game contexts. It is a good approach to make non-game technology more engaging and encourage people to use services in a more enjoyable and motivating way. (Deterding & Dixon, 2011)

2.4 Designing a mobile application

People use mobile devices for different purposes. The goals of the usage can be divided into following categories:

- *Lookup/Find (urgent info, local): I need an answer to something now—frequently related to my current location in the world.*
- *Explore/Play (bored, local): I have some time to kill and just want a few idle time distractions.*
- *Check In/Status (repeat/micro-tasking): Something important to me keeps changing or updating and I want to stay on top of it.*
- *Edit/Create (urgent change/micro-tasking): I need to get something done now that can't wait.*

(Wroblewski, 2011)

If you know the reason someone pulls out their phone you can also design and structure your device based on that knowledge. Often people who use mobile applications are in a hurry and have limited screen space; therefore it's important to make the initial navigation adapted to the purpose of the application. That is, not too many navigational bars that take up all the space and the content the user is after should be accessible at first view. (Wroblewski, 2011)

We did not feel that any of the categories above reflect our potential users so we formulated a new category:

- *Last minute/Efficient use of time (urgent, bored): I haven't had time to do this until now. I can do it while waiting for the bus, before going to sleep or wherever.*

This is applicable on every task that has been postponed for a long time and suddenly needs to get done, like practicing vocabulary on the way to school before a test. Also we felt that it addresses the situations when the user wants to make efficient use of some spare time, like waiting for the bus having a lunch break etc.

Other aspects we will use for designing our mobile application are found in Wroblewski's book *Mobile First* (Wroblewski, 2011). Since design is not the main focus of this essay we will not further dwell on facts about making good applications here.

2.5 Common effects when performing a survey

When performing a survey of people there are some common effects that need to be taken into account before analyzing the result. The effects we find relevant for this study are the Novelty effect and the Hawthorne effect.

2.5.1 The Novelty effect

The Novelty effect is a common threat to the validity of a research and refers to that new treatments often are more effective than older approaches simply because they are new and different. After a while, the novelty wears off and the new treatment is no longer any better than the old treatment. In a research study, reactive effects due to the novelty can be controlled for by extending the period of the study long enough so that any Novelty effect will have worn off. (Marguerite G. Lodico, Dean T. Spaulding, 2010)

2.5.2 The Hawthorne effect

The Hawthorne effect refers to a situation in which an individual's behavior is changed because of the observation itself. The effect is characterized by a positive and temporary change in some measurable behavior in a situation where the observer had no intention to truly affect the other individual's behavior. (Leonard & Masatu, 2006)

2.6 Previous Research

There has been a lot of previous research within language learning in combination with mobile learning. Many of the studies concern how mobile phones can be used for vocabulary learning and others more closely study the effect of spaced repetition combined with m-learning.

2.6.1 Vocabulary learning using mobile phones

The studies and surveys performed on students learning foreign languages has been many and the results are generally positive towards using mobile phones in educational purposes.

For example a Turkish study compared digital flashcards on a mobile phone with traditional flashcards on paper. 60 undergraduate students were participating and the results showed that the ones who had used the mobile application had reached better results than the ones who used traditional methods (Başoğlu, 2010). Furthermore a survey in Japan from 2007 showed that students were more prone to use computers than mobile phones for vocabulary learning, but argues that this might be due to the expenses of mobile Internet. The writer however concludes that the potential of the mobile application was great (Stockwell, 2007).

In another more extensive survey, over 300 Japanese university students were studied regarding their use of mobile devices in a language learning context. The results showed that the students evaluated educational materials designed for mobile phones very positively and that they were able to learn via this medium. The researchers also found mobile phones are a very effective platform for vocabulary learning as they are able to catch the students interests and create new study opportunities (Thornton & Houser, 2005).

2.6.2 Spaced repetition

Using spaced repetition as a tool for vocabulary learning is beneficial and helps the long-term retention (Cepeda, Pashler, Vul, Wixted, & Rohrer, 2006 cited in Sobel et al., 2011). For example a study from 2010 shows that children rehearsing vocabulary with spaced repetition reached superior results compared to children using massed learning (Sobel et al., 2011).

Furthermore a few master theses have been written at KTH concerning the combination of spaced repetition and mobile learning. Two reports from 2008 were used as inspiration while composing this survey. The first investigates how spaced repetition serves as a method for learning new facts. The researcher concludes that it is a very efficient method given that the facts can be divided into smaller parts. It also best suited for persons with a certain learning style, making them able to learn in shorter sessions. This thesis was tested on University students only. (Malmlöf, 2008)

The second report aims to examine how spaced repetition works as a method for mobile vocabulary learning, and also how mobile phones are perceived and used as learning aids. These results showed that the attitude towards mobile vocabulary learning and spaced repetition was positive, especially among high school students, but the actual usage of such applications was low. This thesis was tested on both high school and university students. (Hedbom, 2008)

3. Methods

When choosing methods for this report we wanted to gain theoretical knowledge as well as empirical. Therefore we chose to do both a literature study in the relevant field as well as perform focus groups and distribute a questionnaire. To gain more practical knowledge about how a mobile application can be used by students we chose to develop a prototype so that we could test and gather actual data of the usage.

3.1 Chronology and performance

To collect information concerning relevant theories and former studies within the field of our investigation, a literature study was started at an early stage and then continued throughout the entire process. At an early stage we also got in contact with teachers at Thorildsplans Gymnasium who could help us to gather students for questionnaires, focus groups and prototype testing.

The questionnaire was handed out very soon after we had formulated the purpose and research questions. It was handed out to two classes at Thorildsplans gymnasium. At the same occasion, a focus group was also performed with a smaller group of students. Based on the results from this questionnaire and focus group we then continued our process with developing a mobile application prototype for vocabulary learning. This prototype was then tested on a new group of students from Thorildsplans gymnasium for a period of four days in relation to a vocabulary test. After this vocabulary test we performed a focus group with the students that had tested the prototype.

The chronology of the survey was as following:

February 16th (morning) - Questionnaire

February 16th (afternoon) - Focus group 1

February 17th - April 16th - Development of prototype (FlashWords)

April 17th - April 20th - Testing of FlashWords

April 20th - Focus group 2

3.2 Literature studies

The literature used in this study was mainly found on the Internet and at the KTH library. We also received relevant material from our supervisor Björn Hedin. On the Internet we have searched Google scholar and IADIS Digital Library, the latter is a digital library which offers a great range of journal publications and articles from unique world conferences within mobile learning. The search terms used were: “m-learning”, “mobile learning”, “e-learning”, “language learning”, “vocabulary learning”, “learning styles”, “learning strategies”, “flashcards” and “spontaneous learning”. At the library KTH Primo was used to search through relevant literature available within the areas “mobile learning” and “language learning”.

3.3 Questionnaires

A questionnaire was used in the beginning of our research in order to receive relevant information from a larger part of our target group. We choose to use a questionnaire because it is a good method to collect quantitative data from a large group of people without being time and/or money consuming.

When creating a questionnaire there are many important aspects to keep in mind. First of all, you need to consider the intentions of the research. (Robson, 2002) We had two main purposes with our questionnaire. To get a better understanding of the usage of mobile phones among high school students, and to investigate their study habits for vocabulary learning. With these purposes in mind we then formulated a set of provisional questions. We then tested these questions on four persons from our own course to see if the questions were understood the way we intended. The feedback received from these tests was then used to design a final version of the questionnaire.

It is very important to make a good understanding of who will respond before designing the questionnaire. Responders must be able to understand the questions in the way that the researcher intends, have accessible the information needed to answer them, be willing to answer them and actually answer in the form called for by the question. (Robson, 2002) Since our target group is quite young, between 15-19 years old, we focused on making the questionnaire easy to understand and quick to fill in. This resulted in a one page (back and front sides) questionnaire consisting of mostly simple questions where the student is asked to answer through choosing one or more of the alternative answers. At a few places the students was also asked to fill out the answer themselves.

The questionnaire was handed out to 45 students from first and second grade at Thorildsplans Gymnasium. All the students were currently studying English as their second language. Out of the 45 students participating, 100% responded.

3.4 Prototype and data gathering

To help us analyze the effects of a mobile tool for vocabulary learning we developed an application prototype. This was to gain practical knowledge about how a mobile application can be used by students. Having the prototype tested and then evaluated in a focus group we could gather information that helped us answer our research questions.

The reason to why we chose to use our own application instead of an already existing one was the possibility to log numerical data about the usage. Our prototype helped us log the amount of exercises performed, i.e. how much a certain student practiced before the vocabulary test. By comparing this numerical result with the result from the first questionnaire where we asked the students how much they practiced before a test we could approach the answer to the question "Could a mobile application increase the

interest for practicing?”.

We used a database to log data about the usage of the application. This was done through saving a row with the username and time in the database every time a user began a new practice.

The application was tested on eight high school students for four days when practicing for a vocabulary test prepared by their teacher. They were given usernames and an introduction to the application the same day as they received their glossaries, which already had been inserted to the database. Out of these eight students, seven were able to log in and use the application and could be logged using it in our database. Six of these students turned up for the vocabulary test.

To solve development-related problems along the way we used many web pages, forums and tutorials such as www.w3schools.com, www.php.net and www.stackoverflow.com. To get insight in designing for mobile devices the book *Mobile First* (Wroblewski, 2011) was consulted along with looking at other examples of already existing software.

3.5 Focus groups

Two focus groups were carried out during the study. We chose to use this method for our study because they provide qualitative data, they are quick and flexible to set up, the group dynamic helps to give more natural data and it also helps the participants to focus on the subject (Robson, 2002).

When planning a focus group there are a few important things to consider. To collect data from the group recording in combination with note taking is generally recommended. The number of questions discussed in the group should be quite low, typically fewer than 10 can be asked in an hour. (Robson, 2002) At both of our focus groups we were both present when running the group, and we used a mobile phone to record what was said. We also kept the number of questions down to only a few main questions.

3.5.1 Focus group 1

The first focus group was carried out in order to receive more qualitative data concerning the same main questions as in our first questionnaire. We wanted to get a feel for the general interest for a mobile application as part of studying. In the initial state we also felt we needed to know what aspects the students felt were important for them to actually use an application similar to the one we wanted to test. These aspects could help us to design an application prototype with high usability and relevance for these students.

The group consisted of six first year students at Thorildsplans gymnasium, five boys and

one girl. The group lasted for about half an hour where the students were asked to freely discuss a few questions that we had prepared beforehand.

3.5.2 Focus group 2

The second focus group was held with the students who tested our prototype. This was to evaluate what effects the application had on the students, focusing on the aspects that could not be logged in the prototype database. For example we needed to ask the students about the location since our application could not log it. We also wanted to know what aspects of the application they appreciated and which ones could be developed further.

This group consisted of six second year students, three boys and three girls. These students, with the rest of their class, were given glossaries to study on a Tuesday and then tested on these the following Friday. The focus group was then carried out after the test to investigate how the students had used and experienced the application when studying for the test. Out of the eight students that were introduced to the application, six showed up for the test and were also present in the focus group. The group lasted for about twenty minutes where the students were asked to freely discuss a few questions that we had prepared beforehand.

4. The application prototype

To be able to further analyze what effects a mobile application for vocabulary learning have on students, we developed a prototype, FlashWords, which we tested on a number of high school students. The main reason why we chose to develop this tool ourselves, instead of using an already existing application with similar functionality was that it allowed us to log data about specific users.

4.1 Existing applications

To develop a prototype we needed to examine the market of already existing applications for vocabulary learning based on the flashcard method. Many of the available applications had limits in platform support and could not be run on both Android and iPhone and/or were not free to download.

We choose to take a closer look at three applications in particular: Anki, AnyMemo and Glosappen. These are all free to download and available for both android and iPhone platforms. What we found was that they all had a nice interface for practicing, but they were all a bit too complicated and they were all designed for the user to insert the glossaries themselves. From our own early focus group we could conclude that the students found inserting the words themselves too difficult and time consuming, therefore none of these applications was preferable for our study. Also the possibilities to log data from the users are strictly limited while using an existing program. The aspects we found good with these applications, e.g. the design of the practice interface, we used as inspiration for our own prototype.

4.2 FlashWords

The development of the prototype was in collaboration with the course DD2390 Web programming which we read during the first part of this project. The development languages have mainly been PHP, HTML/CSS and SQL.

The prototype is a web-based application, called FlashWords, best suited for android phones. Consequently Internet connection via Wi-Fi or 3G is essential. Also, to be able to control and log the usage of the prototype a login is required (see Figure 3).

The application is built on the principles of flashcards. The basic functionality is to be able to repeat words from a certain list that your teacher manages. In the main menu the student can choose to go straight to practice or to settings (see Figure 5).



Figure 3 - The log in screen

In the settings menu you can choose whether to show the English or the Swedish word first (see Figure 6).

If choosing practice, you will be sent to a page where you can choose which list you want to practice (see Figure 4). Every time a user chooses a list to practice the usage is logged in a database. Since each user is unique we can track the amount of exercises and at what time they were started.

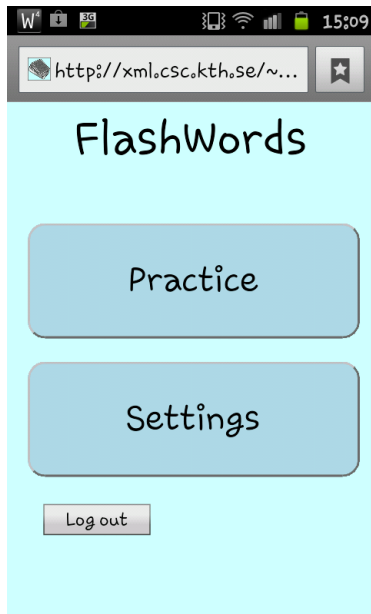


Figure 5 - The main menu

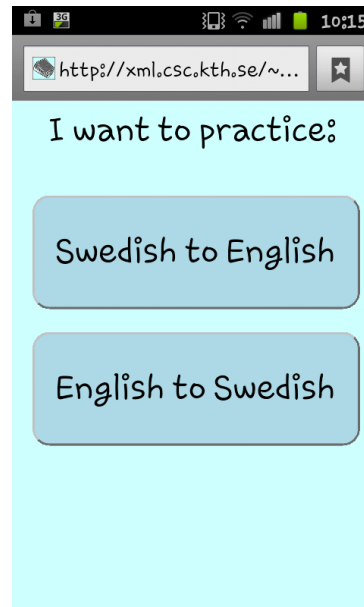


Figure 6 - The settings menu

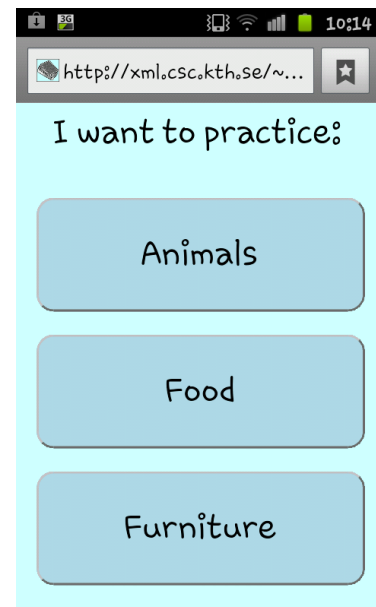


Figure 4 - The list menu

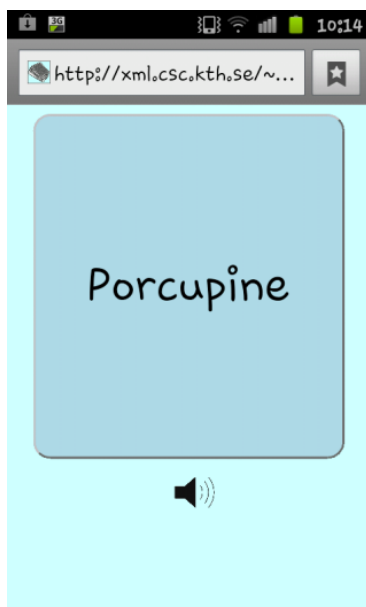


Figure 8- Pressing the speaker plays an audio file with the pronunciation of the word



Figure 7 - The user can choose whether they knew the word or not

When a list has been chosen the student will be shown a word. The translation is shown when pressing the card. Whenever an English word is shown a small speaker symbol appears and you can press it to hear a computer generated pronunciation of the current word (see Figure 7). After turning a card you choose "Correct" or "Wrong" depending if you considered yourself to know the word or not (see Figure 8).

If you press “Wrong” the word will be shuffled back into the list and shown again later. If you press “Correct” the word will disappear from the list. You will at the end of each exercise know how many words the exercise contained and how many tries you used (see Figure 10). You can also choose to show a list of the words that you did not get right on the first try (see Figure 9).

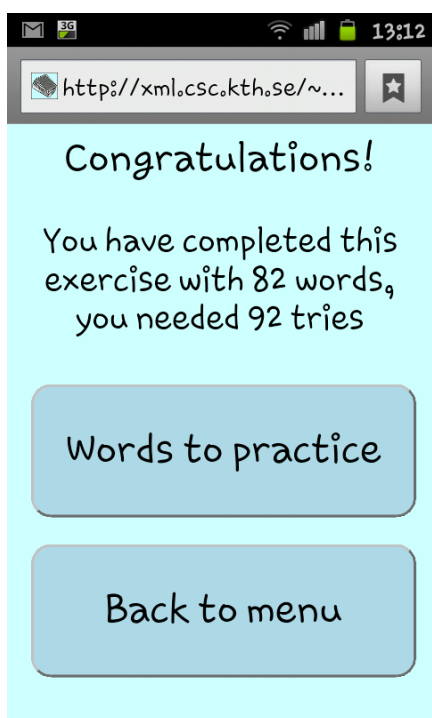


Figure 10 - The end of an exercise



Figure 9 - A list with words the user did not get right on the first try

4.3 Design and functionality

We used the result of our questionnaire, first focus group, literature study and impressions from already existing applications to choose the design and functionality for FlashWords.

We chose to build FlashWords on the characteristics of flashcards because it is a well-known and effective way of memory training (Oxford, 2003), but also because it was relatively easy to implement.

From the first focus group we could conclude that it was important to the students that the application was easy to use and they did not want to have to insert the glossaries themselves. Therefore we created an admin function in FlashWords where only the admin, i.e. the teacher, can insert new glossary and glossary lists. The glossaries will

then already be there for the student to practice when they log in.

When designing the application we wanted to consider the user's goal that we earlier formulated as "Last minute/Efficient use of time". When logged in, the student will therefore be met by a very simple menu, this to make it easy to get straight to practicing and decrease the risk of getting "lost". Too many functions and a confusing menu was one of the biggest disadvantages we found with the already existing applications we found.

We wanted to take advantage of the unique possibilities that the mobile device offers compared to traditional vocabulary learning. One of the aspects that is frequently mentioned in mobile learning contexts, is the possibility to use audio. Therefore we implemented a function that makes it possible for the students to also listen to the words they practice.

During the first focus group we asked the students what would motivate them to practice on their phone, and they all agreed that visible progress and/or competition would be a big motivator. Hence, we implemented the function where the student, when turning a card, can choose if one's answer was right or wrong. When the practice is over the student will be shown how many tries it took to complete it. This way the students can view their own progress.

Our original idea was to use spaced repetition and make the application alarm the student when it was time to practice. Both the questionnaire and the first focus group gave the result that very few students would actually use that function. Therefore we chose to not use it.

4.4 Delimitations and weaknesses

When designing FlashWords we had some limitations regarding time and knowledge. Therefore the design and functionality are not optimal in some aspects. These drawbacks are mentioned and discussed here.

In our first focus group the students agreed that it would be more convenient with a local application than a web-based one. That was because their Internet connection was slow and sometimes expensive. This we did not consider when developing FlashWords since the amount of time and effort of developing a web-application clearly falls below developing a local application. Another reason to why we built a web-based application was the possibility to access both android and iPhone platforms. The result though, turned out to only work well for android anyway, which clearly is a disadvantage.

There is no possibility to pause and later retrieve a practice session in FlashWords as the web based session times out when the user leaves the page. We could not find a way to do this without saving cookies on the students' phones, this we preferred not to do as the user need to approve the use of cookies. With the students being underage we did

not feel this was a good option. This means that the student will have to practice with a full list of words every time without the ability to save a specific state of a session.

Furthermore, the interface for managing glossary lists and words is not particularly developed as it is not actually showed to the users. In a future version this might be available to the teacher but at the time of the testing this was for our eyes only.

Many functions that we and the students in the first focus group figured would be desirable had to be dismissed due to the time and knowledge limitations. Examples are possibilities to share and keep high scores, test spelling and/or pronunciation and gather extra points before an upcoming vocabulary test.

The possibility to log data is not fully exploited since we only log the amount of exercises each user begins and at which time they were performed. Desirable would have been to log the geographical place where the application was used, this to easier be able to answer the research question “Which new learning opportunities are created?”. The geographical aspect was discussed in our second focus group instead.

5. Results

In the process of this report we performed a number of surveys, one questionnaire, two focus groups and the development and testing of a prototype. This helped us come to a conclusion and to answer our main research-question. The results from these surveys are presented in this section.

5.1 Questionnaire

As previously mentioned, a questionnaire was handed out to 45 high school students at an early stage of our investigation. Out of these 45 students 100% participated in the survey.

The purpose of the questionnaire was to form an understanding about a few fundamental aspects before proceeding with our research. These aspects were divided into three main areas: usage of smartphones, habits for vocabulary learning and mobile learning.

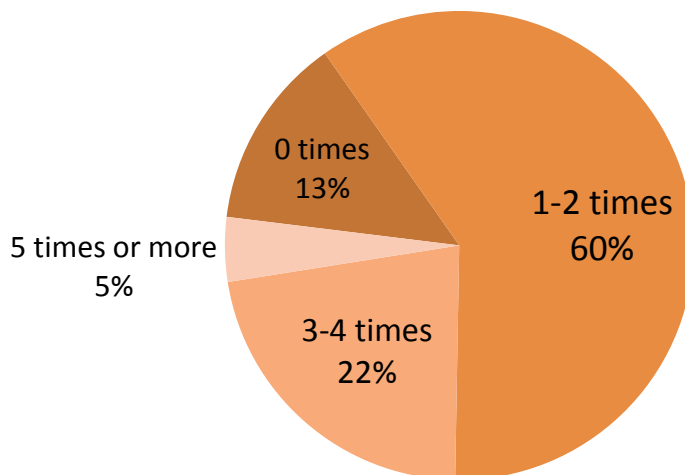
5.1.1 Usage of smartphones

The results received from questions concerning the usage of smartphones showed that 67% of the students owned a smartphone. Out of these students, 89% daily accessed the Internet via their smartphone and 86% daily used mobile applications.

5.1.2 Habits for vocabulary learning

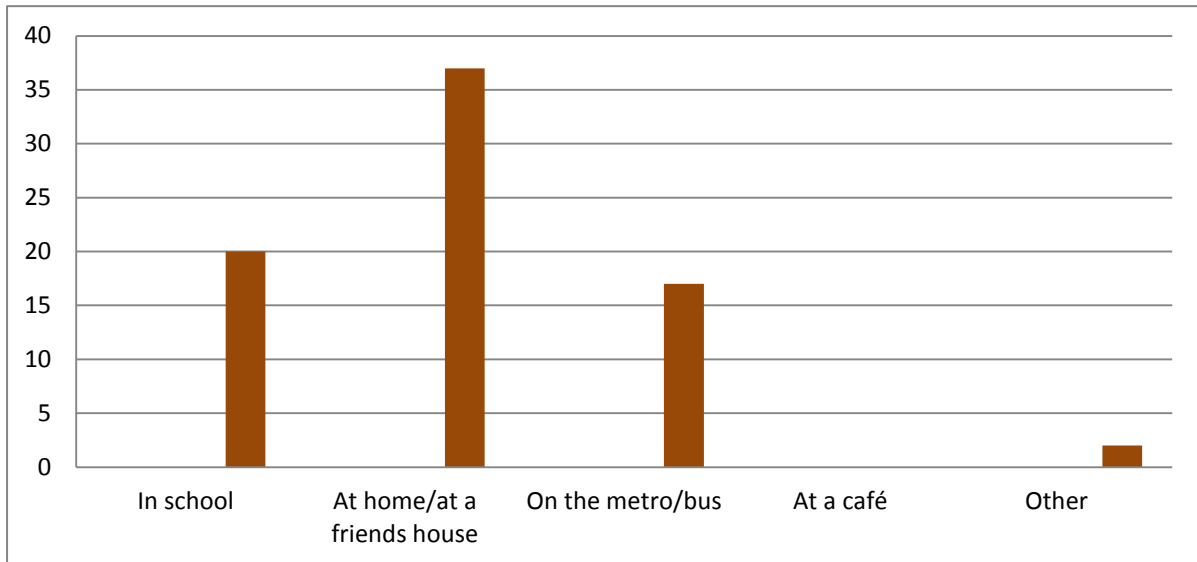
The results from questions about glossaries and repetition habits showed that 60% of the students only repeated glossaries 1-2 times before a vocabulary test (Diagram 1).

Diagram 1 - How many times do you practice glossaries before a test?



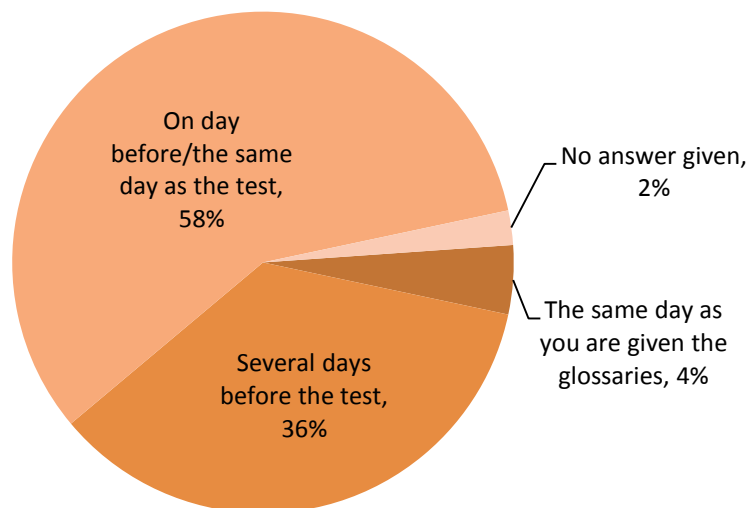
It also showed that most of the students usually practiced glossaries at home or at a friend's house, the second most common place was in school followed by on the train and/or bus (Diagram 2).

Diagram 2 - Where do you practice glossaries?



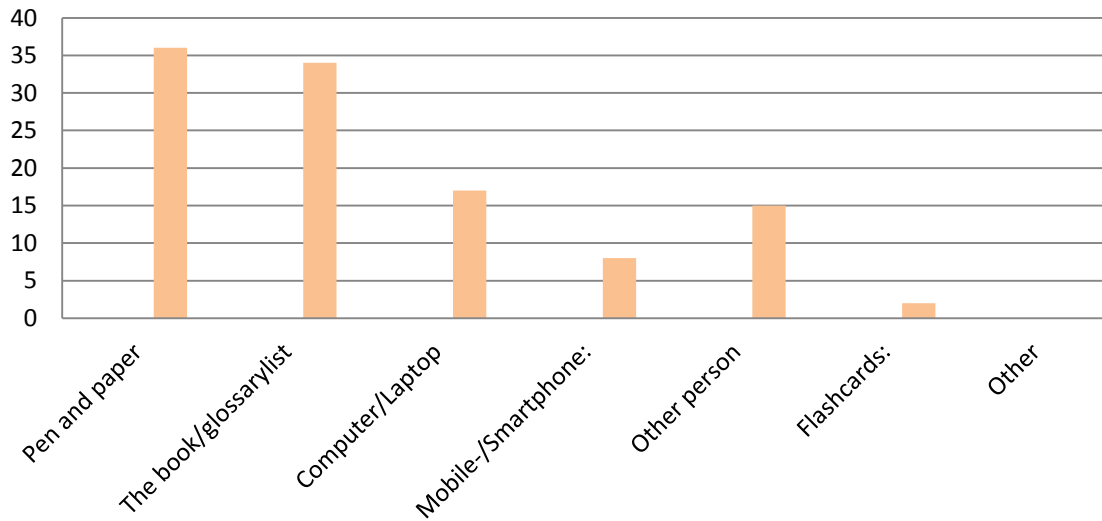
58% of the students started to repeat the glossaries the same day, or the day before the test, whereas only 4% started to practice the same day as they were given the glossaries (Diagram 3).

Diagram 3 - When do you start practicing?



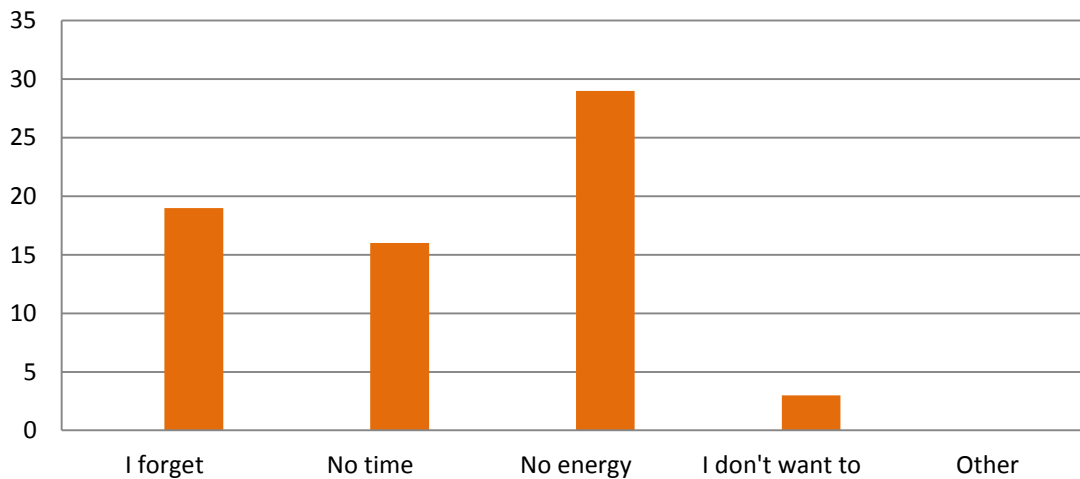
The most popular equipment used for vocabulary learning was pen and paper, closely followed by the glossary list or book (Diagram 4).

Diagram 4 - What equipment do you use when practicing?



The most common reason to not practice enough for a test was because they did not have the energy and/or could be bothered, followed by forgetting and not having time (Diagram 5).

Diagram 5 - If you did not practice enough, what factors do you think caused it?

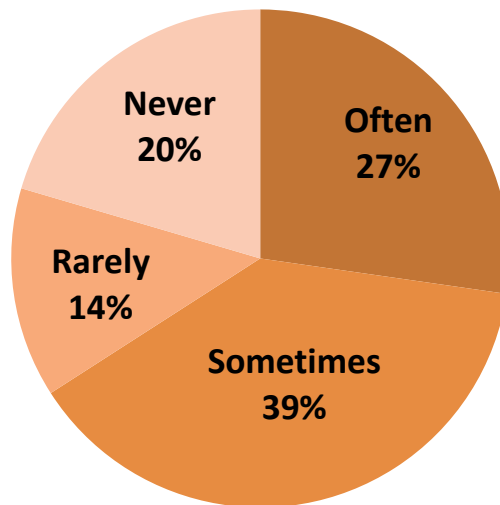


On the question if they would repeat more often if they got reminded via their mobile phone or computer, 69% said yes. 84% said they would practice more if it somehow could give extra points for the test.

5.1.3 Mobile learning

The results concerning mobile learning showed that 66% of the students, “sometimes” or “often”, used their mobile phone as a supporting tool in school ().

Diagram 6 - How often do you use your phone as a supporting tool in school?



The phones were used in a big variety of subjects, and within everything from taking notes to calculating and searching for information. 51% believed that learning vocabulary would be more fun if they could do it on their mobile phone. 67% of the students believed that they would use an application for vocabulary learning if it was recommended by their teacher, whereas 60% believed they would use it if they just came across it themselves.

5.2 Focus groups

Two focus groups were carried out during the research. The first one was held at an early stage in order to explore the students' attitude towards a mobile application for vocabulary learning, and also how such an application could be designed. The second focus group was performed to evaluate the prototype of our mobile application, FlashWords.

5.2.1 Focus group 1

The first focus group was held with six students and lasted for about 30 minutes. For this we prepared four main questions that we wanted to discuss, these were:

- Had the students used any applications for vocabulary learning before?
- Would the students have any interest in using such an application?
- Where would the students be likely to use such an application?
- What design and/or functionality would the students prefer?

Had the students used any applications for vocabulary learning before?

The results from discussing the first of these questions showed that none of the six students had used a mobile application for vocabulary learning. One girl had however used a computer based application for language learning, which she found very useful.

Would the students have any interest in using such an application?

On the second question, if the students had any interest in using a mobile application for vocabulary learning, the first reaction from the students was that they would probably download it, but possibly not really use it. Under certain conditions, e.g. the teacher would manage the glossaries so that it would be made very simple and convenient for the student, they were more positive to use it. The whole group agreed that if using the application would generate extra points before a test, they would definitely use it.

Where would the students be likely to use such an application?

Discussing where the students would be likely to use an application for vocabulary learning showed that all the students in the group often studied when traveling to and from school. They all had a commuting time of between 20 and 60 minutes by metro and thought a mobile application could be very useful in these situations. One of the students explained that he was able to concentrate better on the train than at home, partly because he found it more difficult to focus where it was too quiet. Someone also mentioned that he used to practice while laying in bed.

What design and/or functionality would the students prefer?

The majority of the time was used to discuss a hypothetical application's functions and design. One of the aspects discussed was the possibility of using some kind of gamification in the application. The students all thought that it sounded fun with an application for vocabulary learning that used some of the aspects and functions related to games, but they also expressed a worry that they might miss out on actually learning something when using it. If there was a possibility to compete against other students they said that they would all use the application.

Web based or local application?

When asking the students whether they would like the application to be web-based or local they agreed that a local application would be better. One student argued that the typing of web-addresses together with zooming around a web page was troublesome while others just thought the speed of the 3G-connection was the problem. Using a web-application while on a Wi-Fi connection did not seem like a problem, other than the geographical limitations.

Spaced repetition and reminders?

One idea that we proposed was to use the application as a reminder for spaced repetition, something that the students did not find overly useful. "I would erase it" was one student's response to the idea of the application sending a text message or alarm when it was time to practice. He later figured that if the phone locked itself he would be forced to do the exercises and thereby use the reminder function. Some of the others said that they wouldn't mind a reminder, but if they did not feel like practicing at the time, they still would not.

Audio?

One girl said that she learned words better if she heard them. Another student also expressed that it would be useful if the application could pronounce the words as well, especially when learning more difficult languages, like Spanish.

5.2.2 Focus group 2

The second focus group consisted of six high school students and lasted for about 20 minutes. This focus group was carried out in order to evaluate our application prototype, FlashWords, and the main questions discussed in the group were:

- How, where and when had the students used FlashWords?
- How did they experience FlashWords compared to traditional methods?
- What was good/bad about the design? How could it be improved?
- Could they consider using a mobile application for vocabulary learning in the future?

How, where and when had the students used FlashWords?

On the first question, all the students agreed that they had primarily used FlashWords when commuting or being bored. The places where they used the application was therefore on the train/bus or in school between classes. This was the same for all the students except one who did not have 3G on her phone which restricted her to only being able to use the application at home. One of the students also mentioned a problem with using the application on the bus due to slow Internet connection. The all agreed that they had practiced more when having FlashWords than what they normally would have. Many of the students said that they usually would not begin to practice glossaries until the night before or the same morning as the test. One boy said that he normally would not have practiced at all. With FlashWords, they had all started to practice the same day or the day after they received the glossaries.

How did they experience FlashWords compared to traditional methods?

Comparing FlashWords to traditional methods, the students all said that the mobility was very positive. They thought it was easier to practice on the phone than with a list or book when e.g. commuting. One of the boys also thought it was positive in the sense that he could not cheat as easily with the application, meaning that if he used a printed list he could see the translation of a word without really trying to translate it himself first. All the students also saw a benefit with having the glossaries on the phone considering they always carried their phone with them. This made it possible to practice at various unplanned occasions, e.g. on the bus to meet a friend or between classes in school. These are occasions when they probably not would have access to the list or book and therefore not a chance to practice if they did not have the mobile application. A disadvantage with using FlashWords instead of pen and paper was that they could not write down the words. All the students believed writing down the glossaries was an important part of practicing, especially when practicing spelling.

Most of the students in the group had used both FlashWords and traditional methods when they practiced for the test. One girl said that she had only used FlashWords, until

the evening before the test when she sat down and practiced the words with pen and paper. She figured she learned better, especially the spelling, if she was able to write the word. Another student said he only used FlashWords until the same morning as the test; he then used the list because it was easier to find the words he needed to practice more. The students said the reason to why they used traditional methods as well was because they wanted to be able to write down the words, and because it was too time consuming to go through the whole list of words on the application.

What was good/bad about the design? How could it be improved?

When discussing the design of FlashWords the students all thought that many improvements could be made. They all said that there should be a way to divide the words into shorter lists, since practicing a list of, in this case, over 80 words was inconvenient and very time consuming. Especially they wanted to be able to put the words they needed to practice more into a separate list, so that they did not have to go through all the words they already knew every time they practiced. One boy even said the list was so long he never managed to actually go through it.

It appeared only a few students had been able to use the audio function in FlashWords. The major part of the students did not get it to work properly and did therefore not use the function. They all thought they might have used it if it worked better, but they believed it was more important to be able to write the word than to hear it. One girl said she thought the audio function would be a good idea for shorter lists, when having more time to listen to them.

One of the boys said it would have been better if the application was not web based. He thought it would be a better idea to have it as a downloaded application that you only had to connect when downloading a new list. This was agreed with by the other students, especially the ones who had problems with their 3G connection.

The design in general was found clean and simple but a bit boring. One of the boys said he wanted a more fun design, which one girl replied to with "but studying is not funny!". Other possible improvements of the design that was mentioned in the group was a possibility to see both the word and its translation at the same time and to randomly practice both Swedish to English, and English to Swedish at the same time. None of the students seemed interested in a function that could remind them to practice.

Could they consider using a mobile application for vocabulary learning in the future?

On the question if the students thought they would continue to use the application in the future, they all thought they would, if it was improved. The reason to why they would use it would primarily be because of the mobility, offering them to practice anywhere and at any time since they are always carrying their smartphone. They also said that they would only use it if they did not have to insert all the words themselves, although one of the students said it would be good if they had the possibility to insert

words if they wanted to. They all agreed that the best solution would be if the teacher managed the insertion of new glossaries.

5.3 Prototype and observations

From the prototype’s database we gathered information about when and how many times the students practiced during the four day-period that the prototype was tested.

Diagram 7 shows the result, based on the 7 students that used the application (the 8th could not get the application to work on his phone):

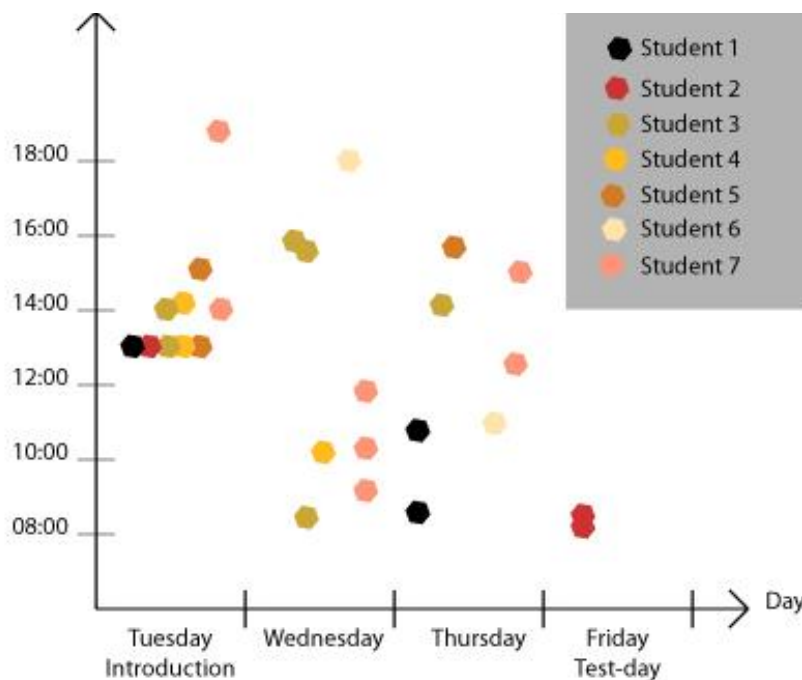
Diagram 7 - The results from the database

Student no	Practice sessions
1	3
2	3
3	6
4	3
5	3
6	2
7	7

The average amount of practices was 3.86 times (note that in most of the cases the first practice session was the introduction given by us and therefore it might be sufficient to subtract one session from the average).

Diagram 8 shows how the practice sessions were distributed throughout the day:

Diagram 8 - Distribution of practice sessions



6. Discussion

In this section we will analyze the results of our survey and try to answer our sub queries. This is to later make a conclusion and thereby answer the main research question. These sub queries were:

- What advantages/disadvantages can learning by using a mobile application have compared to traditional learning methods? Which new learning opportunities are created?
- Could a mobile application increase the interest for practicing?
- How should an application be designed in order to engage high school students?
- Is it possible to make conclusions about which effects are long- respectively short-lasting? Is an increase of practice only caused by the Novelty and/or Hawthorne effect?

6.1 Advantages and disadvantages

As mentioned in the theory section, many advantages and disadvantages with mobile learning has been examined in earlier surveys of the subject. Some of the characteristics of m-learning that have been described are that it is spontaneous, private, portable, situated, informal, personalised and interactive. The results from the surveys carried out in this investigation indicate advantages and disadvantages directly connected to these aspects.

6.1.1 Portability and new learning opportunities

The most significant advantages of using a mobile application found in this investigation were the possibility of portability and spontaneous learning. The results from our second focus group showed that the students had mainly used FlashWords when commuting, which is made possible by the portability of the application. Other occasions when the students had used the application were times when they had been waiting for something or had been bored. These are occasions when the students had not planned to study but done it spontaneously. Comparing to traditional methods, a mobile application seemed to provide these students with more possibility to engage in this kind of spontaneous learning due to the fact that most of these students always had their smartphone available. A traditional list or book with glossaries, on the other hand, demands more planning and thought to be carried around and used in these situations.

The possibility of portability and spontaneous learning might not always be an advantage in learning situations though. In our investigation we only received positive effects by these aspects, but it is possible that further investigation would give different result. There is a risk that the portability and possibility of spontaneous learning makes the students lazy and unused to plan their studies. It might therefore be important that this kind of learning becomes a complement to traditional learning, and not a substitute

for it. We would need more time to investigate before we draw any conclusions about this in combination with vocabulary learning.

6.1.2 Audio

Another advantage with using a mobile application for vocabulary learning compared to most traditional methods is the possibility of using audio. This aspect was mentioned frequently in the literature that was studied in the beginning of this investigation, and also a function used in FlashWords.

The results from the first focus group, before testing the application, showed that there was an interest from the students to be able to hear the pronunciation of the glossaries. The second focus group, with students that had tested the applications showed a different result. Important to mention here, is that the audio function did not work as planned. Many of the students had difficulties using the function on their phones and it was therefore sparingly used. The fact that the list given to these students was very long also resulted in that the students found it too time consuming to listen to all the words. There was still a positive attitude towards the idea of an audio function among the students and they said they would probably use it for shorter lists of more difficult words, or for glossaries in other languages than English, given that the function would work properly.

The conclusion we make of this is that the possibility of using audio is not a very important advantage brought by the mobile platform when practicing glossaries. High school students find it too time consuming and superfluous when practicing, especially since pronunciation rarely is tested in school. There might still be occasions when an audio function could be an advantage though, for example when learning a language where the pronunciation is found more difficult.

6.1.3 Informal learning and learning styles

One advantage found with FlashWords was that an application is an easy and cheap way to support students with learning styles that differs from the ones usually encouraged by schools and more formal learning environments.

As previously mentioned, most of the students were using FlashWords when commuting and/or when bored. This choice of occasions changes the aspects of the environmental element in the Dunn and Dunn's learning model. This element involves sound, light, temperature and design of the surrounding environment when studying. In contrast to traditional formal learning where the environmental element is strictly locked to a quiet classroom with chairs and tables, practicing vocabulary could now easily be done while lying in bed or on the train where the sound level is higher than normal. In our second focus group we found that students really made use of the possibilities to change these aspects, they suddenly used environments that are not commonly found in formal learning contexts.

One aspect that we thought would change more was the aspect that Dunn and Dunn refer to as Physiological - Time of day. According to our database no student used FlashWords any later than 18:30 or any earlier than 8:00. This suggests that the mobility did not encourage the students to study at any particularly different hours than normally, something that we did not expect. We still believe that this possibility is an advantage for students with different learning styles, who might prefer studying at different hours than the traditional.

6.2 Increase of practice

One of the sub queries concerned whether student's interest for practicing could increase with a mobile application as a tool. According to our survey the amount of practicing performed with FlashWords were greater or equal to the amount performed without. This is based on results from our first questionnaire, the logging in our database and the second focus group. The questionnaire showed that 73% practiced vocabulary two times or less. When testing FlashWords we could log that 100% of the participants had practiced at least two times. When asking the students in the second focus group if they had practiced more than they usually would have, they all said yes.

6.2.1 Main reasons

There are many possible reasons to these positive results. The most important reason is probably the portability, which was mentioned earlier. Since the students always carried their phone with them, and thereby also the glossaries, new opportunities for practicing were created. Another important reason is that the glossaries were easily accessed with FlashWords as all the words had been inserted by us beforehand. There was no need for the students to insert words by themselves, something that was well appreciated according to all our focus groups. These reasons connect to some of the core characteristics of mobile learning such as being portable, spontaneous and personalised.

Another reason for the increased practice might be that the students found practicing more fun and modern when doing it on their smartphone. One of the students in the second focus group literally said: "Everything that's mobile is good".

6.2.2 Students and their level of ambition

The students we met for our first focus group seemed less ambitious in their studies than the ones in that tried FlashWords. This could have been a reason to our positive results regarding the increase of practice. On the other had all the students in the second focus group agreed that they had practiced more using FlashWords than they would have normally.

The questionnaire was handed out to a wide range of students and it is therefore difficult for us to make any conclusions about their level of ambition. It would thus be desirable to survey the same set of students before and after the prototype test, preferably students with different levels of ambition.

6.2.3 Novelty and Hawthorne effect

The positive results might have been affected by the Novelty and/or Hawthorne effect. It did seem like the students were extra excited about using FlashWords due to the fact that they would be part of an investigation. It is also possible that the high activity resulted from the excitement in using a new method. The risk is therefore, that when the students get used to the new method, or no longer are part of an investigation, could fall back into their old learning patterns. However, the students we talked to all said that they would be using the application for vocabulary learning even after the investigation was over, if the application was improved. If this is true in practice is impossible to conclude without further investigation.

6.3 Design

Through testing and evaluating FlashWords we found both advantages and flaws with the application. We will more generally discuss these aspects and investigate how a more optimal application for vocabulary learning should be designed in order to engage high school students.

6.3.1 User goal

In the Theory section we defined the goal that our potential users would have when using our applications as:

“ Last minute/Efficient use of time (urgent, bored): I haven’t had time to do this until now. I can do it while waiting for the bus, before going to sleep or wherever.”

The results from testing the application showed that this goal was accurate, since the students had mainly used FlashWords in situations when being bored or waiting, or last minute right before the vocabulary test.

6.3.2 Structure

The goal of making the application easy to use for someone with a spare moment was not fully reached. It was the length of the vocabulary list that was the weak spot, with about 80 words the practice session was not really a quick and easy time distraction. Simply going through the whole list took a great amount of time and patience, which the users did not always have. Consequently it would be desirable to be able to easily find the words that one needed to practice more. The students agreed it would have be a great advantage to have a function for practicing only these words. Ideas of how to solve this could be to either make it possible for the student to divide the words into shorter lists, or a function to easier overlook and manage all the words.

6.3.3 Writing and spelling

It was not possible to practice spelling as FlashWords did not support writing words. This we had chosen not to implement based on the first focus group where the students had thought it felt troublesome to write using the touchscreen. It later appeared that this only applied when inserting lists of words rather than when just practicing. Many of the students in our second focus group wanted to be able to write down the word as

they practiced in order to improve their spelling. This functionality would also widen the possibilities for scorekeeping and progress bars, something that we, based on the first focus group, believe would be an additional improvement.

6.3.4 Managing glossaries

One really appreciated feature was the fact that there was no need for the students to insert the words themselves. Not having to spend time adding words before being able to practice was one of the biggest reasons the students thought they would keep using an application similar to FlashWords. This assumes that the teacher would spend the time and energy to add the words to a database, something that is relatively easy to do with a web interface. The teacher's engagement plays an important part in the role of mobile learning and can no doubt be investigated further.

Another very interesting aspect is the possibility for companies to offer application services along with language course literature. This way the glossaries relevant to the literature would be ready to practice without the students or the teacher having to insert them.

6.3.5 Gamification

Some aspects of gamification, like score counting and competing against other students, was very positively viewed by the students. In the first focus group all the participating students agreed that they thought they would practice more with an application that used these aspects.

Something that surprised us was the reluctance towards other forms of gamification as part of the application. "To make vocabulary learning a game would make me feel like it is not important " one student argued. Another student argued against a more fun design of the application since she thought that "Studying is not funny!". Apparently some level of formality is important in order for the studies to be taken seriously.

6.3.6 Reminders and spaced repetition

In the beginning of this survey we considered making our application based on spaced repetition. The master theses mentioned in the background section were both based on this function, and it was found to be efficient. To make the most of our survey we agreed to investigate the attitude towards spaced repetition among high school students to make sure they would use the application before deciding whether to use the concept of spaced repetition or not. Our early questionnaire showed that it would be desirable to get reminders from the application. The first focus group on the other hand, gave the opposite result. The students in the focus group argued that they only would turn such a function of, and that they would not use it. We therefore decided to trust the result from our focus group, since their answers seemed more sincere and well-motivated than the ones from the questionnaire.

It later showed that the students in the second focus group weren't interested in a

reminder function either. This directly contradicts both results from our own questionnaire and also the results found by Hedbom and Malmlöf in their investigations. This could be a coincidence depending on the students attending the focus groups or it could be because of a change of attitudes due to the evolution of mobile ubiquity. Today we are used to always being notified and updated on our mobile phones; therefore a practice reminder might be filtered out and simply ignored.

6.3.7 Web and Internet connection

The fact that FlashWords was web based, and not a local application, directly contradicted the result of our first focus group. Nevertheless the complaints about this after the testing were fewer than we expected. The students who used an unlimited 3G connection and/or Wi-Fi really had no problems with the application being web based, it was the ones who had a limited transfer speed or no access to 3G whatsoever that commented on this. Some thought it was slow to use, and others were limited to using FlashWords only in their home or in school. This is possible to improve by making the application local, but that would limit the publication possibilities as it is more difficult for developers to publish applications on Android market or App Store than on the web.

6.3.8 The future potential of FlashWords

The evaluation of FlashWords showed that it was flawed in some ways but considering the limited amount of time spent on developing and testing the application the results were still good. Fixing some minor bugs and changing some of the overall functionality might be enough to make the students keep on using it. By improving the interface for managing vocabulary lists and users it is fully possible that a teacher can use FlashWords as part of the education. The overall concept might also attract companies selling language course literature.

One big issue is nevertheless the question about equity and availability, currently FlashWords only works on Android phones, students with iPhones or non-smartphones would be neglected the opportunity to use it.

6.5 Evaluation of methods

In this section we will analyze and evaluate the methods used in the investigation.

6.5.1 Questionnaire

The questionnaire was handed out at a very early stage of the investigation, which brings a risk of not having enough knowledge and information to found a good questionnaire on. Looking back at the questionnaire, we understand that some of the questions we used have not been of any use for the rest of the survey and therefore were superfluous. Despite this, most of the questions were very accurate and helped us gather a lot of valuable data that gave us a good understanding on how to proceed with the rest of the survey.

The reason to why the majority of data gathered from the early questionnaire turned

out to be very useful for the rest of the study was probably because we were very careful with basing it on our research questions. Since these questions has basically stayed the same during the rest of the investigation, the data from the questionnaire stayed relevant as well.

6.5.2 Focus groups

During this project two focus groups were carried out in order to gain qualitative data about the relevant area of research. These were both held with six students in empty classrooms within the high school. A significant part of our results are from these focus groups and it is consequently of particular importance to analyze in what ways the results of the focus groups might have been affected by the performance.

Lack of time and focus

To begin with, the length of our focus groups was strictly limited because of the facts that we were taking the students out of class and that students in the age of 15-17 sometimes find it hard to focus for a longer amount of time. After about 15 minutes we felt that they had got tired of the discussion and reached the limit of new things to add to the discussion, despite our encouraging questions.

Uneven distribution of speakers

A common problem when performing focus groups is to keep the opportunity to speak even among the participants. This was not really a problem in the first focus group but in the second there was one student who spoke more than others and one who spoke clearly less. This was unfortunate since the one who spoke less was one of the few who had gotten the audio function to work properly. She did not seem comfortable telling us about her experience in front of the others, this might have been different in a private interview situation. We did although manage to get the most important information from her regarding her experience.

Selection of students

The first and the second focus group did not consist of the same set of students. The first was held with first year students and the second with second year students. The first group affected the way which we chose to develop the prototype and the way it was received by the second set of students was most likely not the same as if we had presented the prototype to the same group. Eligible would have been to have more time and more resources and thereby be able to speak with many different groups before and during the development. In this survey we have been limited to a quite homogenous group of students which makes the result less reliable seen to a wider perspective.

6.5.3 FlashWords

There were a few particular flaws with the application, FlashWords, which affected the survey in several ways.

Logging data

The data logging function could have been improved in many ways. Most importantly the function only logged when a student started a practice session. Therefore we could not make any conclusions about if the student actually finished the practice. A practice session where a student only turned over a few words was logged in the same way as a session where the student practiced the entire list, which gives misleading data. This was on the other hand a good thing seeing to the fact that the specific list of words we used for the test was very long, which lead to that the students rarely managed to go through the entire list when practicing. Logging only the finished sessions would therefore have led to very misleading results.

Another minor flaw was the lack of a function to log location. Since time and place has been very interesting aspects for our study, logging the location of the practicing student would have been very beneficial. We made up for this by asking the students in the second focus group about their location while using the application.

Time and improvements

As discussed previously in this report, the application could have done with a few improvements to increase the reliability of this study. If we had time to make these improvements and further test FlashWords on students, we believe we could gather more qualitative and reliable results. In general the application would need to be tested over a longer amount of time to decrease the risk of the students being affected by Novelty and/or Hawthorne effects.

7. Conclusion

In this section we will draw our conclusions in an aim to answer the main research question:

- *Which effects could the introduction of an application for vocabulary learning have on high school students' learning processes?*

7.1 Effects of FlashWords

Our study shows that the introduction of an application for vocabulary learning can have several effects on high school students' learning processes. The most significant effect is that it provides them with new learning opportunities and enables more spontaneous learning. This is probably due to the portability of a smartphone and the fact that students normally carry this kind of device with them. At occasions of being bored or waiting, students seemed keen on practicing glossaries on their smartphone spontaneously, something they had not been with traditional methods.

The study also shows that the students started to practice glossaries earlier when using an application. Instead of starting the same morning or night before the test, the students started to practice almost immediately after given the glossaries. Also it could be seen that the students practiced more in total with FlashWords than without, something that will eventually lead to better results.

7.2 Future research

To further investigate how mobile applications can be used as a tool for vocabulary learning one needs to take into account several things. This study has been very time restricted, and can therefore be improved in several aspects. Most importantly the time limitation only enabled us to draw conclusions about short term effects.

To be able to draw better conclusions about the long term effects of the application, and also decrease misleading results and coincidences one would need to improve FlashWords and study the effects on a larger group of students and over a longer set of time.

Another aspect that is worth considering is context. This set of tests and surveys only focused on the students, to be able to draw conclusions about applications in a larger context, for example in a whole class or school, it would be interesting to investigate the teacher's role of managing and/or encouraging the usage of the application. It would also be interesting to investigate the possibilities for publishers of language learning literature to integrate vocabulary learning applications in their material. This is particularly interesting since it is a commercial market which could benefit the publishers as well as the schools and students.

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Appendix 1 - Questionnaire

Frågor om smartphones

1. Har du en smartphone?
 Ja
 Nej
(om du svarat nej, gå till fråga 4)
2. Hur ofta surfar du på din smartphone?
 Dagligen
 Några gånger i veckan
 Några gånger i månaden
 Aldrig
3. Hur ofta använder du appar?
 Dagligen
 Några gånger i veckan
 Några gånger i månaden
 Aldrig

Frågor om glosor och repetition

4. Vid hur många tillfällen repeterar du inför ett glosförhör? (kan vara flera tillfällen på en dag)
 0 tillfällen
 1-2 tillfällen
 3-4 tillfällen
 5 tillfällen eller fler
5. Vid vilket/vilka tillfällen repeterar du? När du är: (välj ett eller fler alternativ)
 I skolan
 Hemma/hemma hos en kompis
 På bussen/tunnelbanan
 På café/fik
 Annat (I så fall när: _____)
6. Hur långt innan glosförhöret börjar du repetera?
 Samma dag som du fått glosorna
 Flera dagar innan förhöret
 En dag innan/samma dag som förhöret
7. Vilket/vilka hjälpmedel använder du för att lära dig glosor? (välj ett eller fler alternativ)
 Penna och papper
 Boken/gloslistan
 Dator
 Mobiltelefon/Smartphone
 Annan person (som kan förhöra etc.)
 Flashcards (övningskort med svenska ordet på ena sidan och översättningen på andra)
 Annat (I så fall vad: _____)

8. Om du inte repeterat tillräckligt, vilken/vilka faktorer tror du att det beror på?
(välj ett eller fler alternativ)
- Glömmer bort
 - Hinner inte
 - Orkar inte
 - Vill inte
 - Annat (I så fall vad: _____)
9. Skulle du repetera oftare om:
- a. Du fick påminnelser via mobilen/datorn
 - Ja
 - Nej
 - b. Det gav extra poäng till provet
 - Ja
 - Nej

Frågor om mobil inläring

10. Hur ofta använder du dig av mobilen som hjälpmedel i skolan?
- Ofta
 - Ibland
 - Sällan
 - Aldrig
- Om du använt mobilen som hjälpmedel, i så fall:
- a. I vilket/vilka ämnen?

 - b. Till vad?

11. Tror du att glosrepetition skulle bli roligare om du kunde använda mobilen?
- Ja
 - Nej
 - Vet inte
12. Tror du att du skulle använda en app för glosrepetition om:
- a. Din lärare rekommenderar den
 - Ja
 - Nej
 - Vet inte
 - b. Du själv hittade en
 - Ja
 - Nej
 - Vet inte

Tack för att du svarat!

Appendix 2 - Questions to Focus group 1

We aim to find out:

- Is there any interest for an application for vocabulary learning?
- What is required in order to make the students use the application?
- How can such an application be used?
- How should the application be designed?

Main questions:

- Do you think that an application for vocabulary learning sounds like an good idea?
 - Have you already heard about/tried a similar application?
- What is required in order to make you use an application for vocabulary practice?
 - Recommendation from your teacher?
 - If it gave extra points for the test
 - On your own initiative?
- How/where would you consider using it?
 - As a reminder, easy to forget?
 - Pros and cons compared to traditional methods?
 - commuting form/to school?
 - Instead of traditional methods or as a complement?

How should the application be designed and what functionality should it have?

- Complex or simple?
- Game aspects?
- Spaced repetition functionalities?
- Local or web based?

Appendix 3 – Questions to Focus group 2

Evaluating FlashWords

How has it been used

Where and when have you used it?

Why/why not?

Compare to traditional methods

How did you experience the app compared to your usual way of practicing?

Have you practiced more than you usually would have?

Did you experience the audio function as helpful?

Was the mobility an important factor?

Novelty effect

Do you think this is something you would keep using or was it just good because it was new?

What would make you keep using it?

Design and improvement

What was good/not good

Which functions did you like/unlike/miss?

