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# Mobile Application Usability Research

Case Study of a Video Recording and Annotation Application

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<p>The purpose of the final year project was to evaluate the usability of AchSo!, an Android application, developed as a tool for informal learning. The goal of the study was to identify usability issues within the application and to determine if the application supports the goals set for its use.</p> <p>The usability study of AchSo! was conducted as a part of larger user research, the goal of which was to study the suitability of the application for the field of healthcare.</p> <p>Both qualitative and quantitative data was gathered. The qualitative and quantitative usability research was conducted in two separate field studies, which involved 45 users, who were nursing students studying at Metropolia University of Applied Sciences. The classrooms of the Tukholmankatu campus of Metropolia worked as an environment for the study. During the field studies the students participated in a practical examination. The users were observed while they used AchSo!, and data was also collected using interviews and questionnaires.</p> <p>The data collected through the questionnaire was analyzed using quantitative methods, and it was used to identify usability issues, whereas the observations and interviews were used to get a better understanding of the users' experiences with application.</p> <p>Analyzing the data showed that some parts and functions of the application need to be fixed or revised. One of the discovered issues was a major usability error, which resulted in the loss of a recorded video. According to the users, the categories for the videos were not clear and were not relevant for their field of work. After the first field study the design of the user interface of AchSo! was updated according to the new guidelines of Google.</p> <p>Despite the individual usability issues, the overall usability of AchSo! is good, and the users felt that the application could be used as a tool to support learning.</p>	
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<p>Insinööriyön tarkoituksena oli tutkia mobiililaitteilla käytettävän videokuvaus- ja annotointisovelluksen käytettävyyttä. Tutkimuksen tavoitteena oli kartoittaa sovelluksen käytettävyysongelmia ja selvittää, tukeeko sovellus sen käytölle asetettuja tavoitteita.</p> <p>Käytettävyystutkimus tehtiin osana laajempaa käyttäjätutkimusta, jonka tarkoituksena oli selvittää sovelluksen sopivuutta ja käyttömahdollisuuksia terveydenhuollossa työskenteleville henkilöille.</p> <p>Kvalitatiivinen ja kvantitatiivinen käytettävyysutkimus tehtiin kahtena erillisenä kenttätutkimuksena, joihin osallistui yhteensä 45 ammattikorkeakoulun sairaanhoitajaopiskelijaa. Testausympäristönä toimivat ammattikorkeakoulun kampuksen luokatilat, joissa opiskelijat osallistuivat elvytyskokeeseen. Testikäyttäjien sovelluksen käyttöä tarkkailtiin ja tietoa kerättiin haastatteluin sekä sovelluksen tutkimusta varten suunnitellun käytettävyyskyselyn avulla.</p> <p>Kyselyiden avulla kerättyä tietoa käytettiin käytettävyysongelmien paikallistamiseen, ja haastatteluja ja havaintoja käytettiin täydentämään tietoa käyttäjien kokemuksista.</p> <p>Kun tulokset analysoitiin, kävi ilmi, että joitain sovelluksen toimintoja ja ominaisuuksia tulee korjata tai uudelleenarvioida. Yksi vakava käytettävyysongelma havaittiin, kun käyttäjä ei valinnut kuvaamalleen videolle kategoriaa, jolloin video ei tallentunut. Videoiden kategoriavaihtoehdot eivät käyttäjien kokemuksen mukaan olleet aivan selkeitä, tai ne eivät kuvastaneet käyttäjien työlle ominaisia tilanteita. Ensimmäisen kenttätutkimuksen jälkeen myös sovelluksen ulkoasu muutettiin vastaamaan uusimpia ohjeita.</p> <p>Yksittäisistä käytettävyyspuutteista huolimatta tutkitun videokuvaus- ja annotointisovelluksen käytettävyys on pääosin hyvä, ja käyttäjät kokivat sen sopivan oppimista tukevaksi työkaluksi.</p>	
Asiasanat	käytettävyys, mobiilisovellus, kenttätutkimus

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## 1 Introduction

Over the past years the smartphone market has more than doubled its size. The same applies to the smartphone application market. This growth has applied pressure to the application developers, because when there are more users, there are also more applications to choose from. A recent study shows that the top reasons why users stop using applications include “I found a better app” and “technical problems”. These suggest that the users are increasingly demanding and prefer applications that fulfill their needs and expectations. [1.]

Based on this development, it is apparent that neglecting usability may result in losing the users’ interest, and the users will choose another application which serves its purpose better. Therefore usability needs to be considered when developing smartphone applications.

The purpose of the final year project that is described in this thesis was to evaluate the usability of AchSo!, a video recording and annotation application which is designed to be a tool for informal learning at a workplace. The application runs on Android devices and has been developed by the Learning Environments Research Group (LeGroup) at the Media Lab of the Aalto University School of Arts, Design and Architecture. [2.]

This thesis covers research on the theory of usability, which was used in selecting the evaluation and analysis methods of the AchSo! usability study. The study was planned and implemented as a part of larger user research, conducted by LeGroup research group and the results were used for the development of AchSo!. The selected methods were chosen to benefit both studies.

## 2 Usability

Usability is a multidimensional characteristic of a product. Put simply, it describes how usable a product is. According to the definition of the ISO standard 9241-11 usability is the *“extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use”* [3,7]. The ISO definition talks about a product, which in this study is referred to as an application or an app. Although this ISO definition might seem comprehensible, understanding usability and its dimensions becomes more complex when things are broken down into smaller entities. [3,7;4,26.]

### 2.1 Usability Variables and Measures

The three variables, which derive from the ISO standard’s definition, need to be specified for an app. These variables are the **users**, and the **goals** and the **context of use**. These variables are linked. The users of the application need to be predefined in order to be able to specify the goals and the context of use. When starting to design the application, three questions need to be asked:

- Who will be using the app?
- What do the users want to achieve with the app?
- Where and how will the app be used?

By getting answers to these questions, vital information can be gathered. An application should be designed considering the context of use and to support the user and their goals. ISO 9241-11 standard’s definition of usability provides three measures for it: effectiveness, efficiency and satisfaction. Some literature refers to these as attributes. Even though as attributes these characterize the product, they are the measures which describe the usability of the product. [3,9;5,11–13.]

**Effectiveness** measures how accurately the users manage to perform actions with the app to complete a task, that is, to achieve a goal. **Efficiency** relates effectiveness to use of resources, where resources can refer to time, effort or costs. In a case of a smartphone application the expended resources are usually time, and physical and mental effort. Thus efficiency describes how easily the users are able to complete tasks on the application with completely and accurately. [3,9;5,11–13.]

**Satisfaction**, being a subjective concept, is the most complex of the measures since it can be affected by the most of things. To at least some extent the user's own perception of satisfaction is essential, and his/her satisfaction with the application is affected by the effectiveness and efficiency of it. All aspects of the application affect the user's satisfaction with it. Put simply, as a usability measure, **satisfaction** describes how pleasant the application is to use, and how comfortable the users are with different parts of it and the interface in general. [3,9;6,117-120;4,33.]

The ISO definition of usability leaves room for interpretation. By applying and combining usability theories and definitions of some usability professionals, the concept of usability gets clearer and more concrete. The Danish usability guru Jakob Nielsen's definition of usability has preceded and clearly inspired the one of ISO, being an entity in a larger whole called system acceptability presented in figure 1. [4,25.]

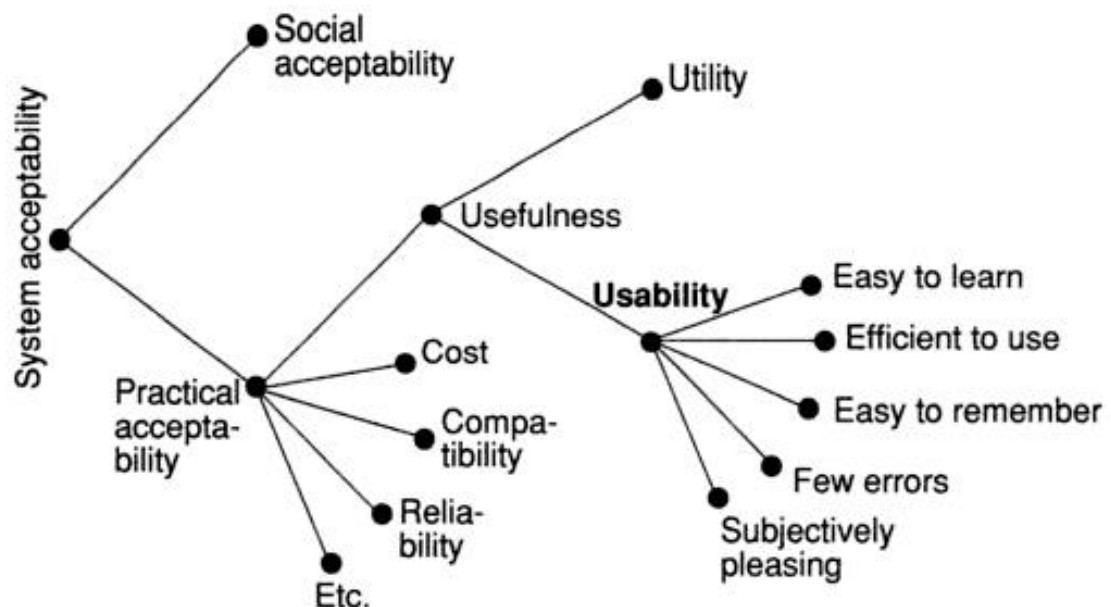


Figure 1. Usability as a part of the system acceptability model. Copied from Nielsen (1993) [4,25].

As figure 1 presents, according to Nielsen, usability consists of five measures to which Nielsen refers to as attributes: learnability, efficiency, memorability, error rate and satisfaction. As attributes, they characterize an ideal user interface. [4,25–37.]

The user interface should be as **easy to learn** as possible. After learning how to use the interface, **the use of it should be efficient**, meaning that by using the application tasks should be completed quickly and accurately. An ideal user interface is **easy to**



**remember** so that when the user returns to the application after not using it for some time he/she should be able to complete tasks without having to learn how to use the interface all over again. [4,25–37.]

Ideally the user interface should have a **low rate of errors**, but also the impact of errors should be minimal, meaning that when errors occur, it should be made easy for the user to recover from them. The use of the application and its user interface should be **pleasing or satisfying**. Even though the users' attitudes towards the use of hand-held devices in general might affect their satisfaction with the application, these two should be separated. The user's attitude towards hand-held devices is considered as a part of the devices' social acceptability property, and only the attitude specifically towards the application should be considered when evaluating its usability. [4,25–37.]

Ben Shneiderman's definition of usability from 2005 has been influenced by the ones of ISO and Nielsen, complementing and combining them, and suggesting that usability of a product can be evaluated by measuring the following:

- Time to learn
- Speed of performance
- Rate of errors by users
- Retention over time
- Subjective satisfaction

The **first two of the measures** can be considered as parts of the ISO definition's measure '**efficiency**' since the sense of time is applied. The same applies to **retention over time**, which is also related to the **time to learn**. These measures refer to how fast the users learn to use the product and how fast they can carry out tasks, but also how fast they get familiar with the application and start using it intuitively. **Rate of errors** by users refers to the number and severity of errors occurred. Obviously the rate of errors directly affects the "efficiency attributes" of the product, but because of their impact on other usability measure, error handling needs to be considered as an entity of its own. The last measure is also in this case **satisfaction**. Whereas ISO's definition talks about the user being free from discomfort, Shneiderman describes the user's satisfaction simply as "liking various aspects of the interface". [7,16–17.]

In conclusion, an application should be easy and intuitive to learn. The application should support effective and efficient use with a low error rate. The user should be satisfied with the application and the use of it. [3,9;4,25–37,7,16–17.]

## 2.2 Usability Heuristics

Usability heuristics are sets of principles which can be used to evaluate the usability of a user interface, and also as guidelines when designing a user interface. This section summarizes some of the principles of Nielsen's "Ten usability heuristics" and Shneiderman's "Eight golden rules of interface design". [4,115;7,74.]

**Consistency** is one of the key principles, which is mentioned in both heuristics. The wording and the structure of the user interface should be consistent throughout the application, meaning that actions should always be referred to with same name and that the positioning of buttons and other controls should stay the same. Consistency also includes following platform conventions. The major smartphone platforms, Android and iOS, both have their own guidelines for appearance and positioning standard UI elements. [8,4,132–134;7,74.]

**Feedback** is an important feature of an application the purpose of which is to help the user keep track of what is done, both by the application and the user. For instance when the user presses a button, they should get some sort of feedback, whether it is visual, auditory, or haptic. Also, whenever the application is performing an action, such as loading or refreshing, the user should be given some sort of a cue. When performing irreversible actions such as deleting or resetting, the user should always be prompted with a confirmation dialog of some sort. [4,134–138;7,74.]

**Minimizing the users' memory load** can maximize the users' satisfaction and performance with the application. Instead of having the user to remember where to access a specific action, the action should be positioned and located intuitively. When moving from one view of the application to another, the user should not have to remember information from the previous view to complete a task, but the vital information should be available also in that view. [4,129–132;7,75.]

**Allowing the users to undo actions** grants the user power and the possibility to explore the application without the fear of performing irreversible actions by accident. As mentioned, the user should be prompted about irreversible actions. [7,75.]

**Error handling** includes preventing errors, informing about them and recovering from them. Majority of users do nothing with the error codes, so the error message should include a comprehensible description of the error and the cause of it, and instructions on how to prevent this error from occurring in the future and how to recover from it. [4,142–148;7,74–75.]

**Supporting both novice and expert users.** One way to do this is to provide the users different ways to perform tasks, shortcuts of sort. Novice users usually choose the one that is easier to learn whereas experienced users pick the more efficient one. The benefit of these shortcuts, or accelerators, comes from Nielsen's theory of how to maximize the learnability and efficiency of a user interface. Figure 2 presents a diagram which shows the learning curves for both an interface focusing on novice users, and one focusing on expert users. [4,139–142;7,74.]

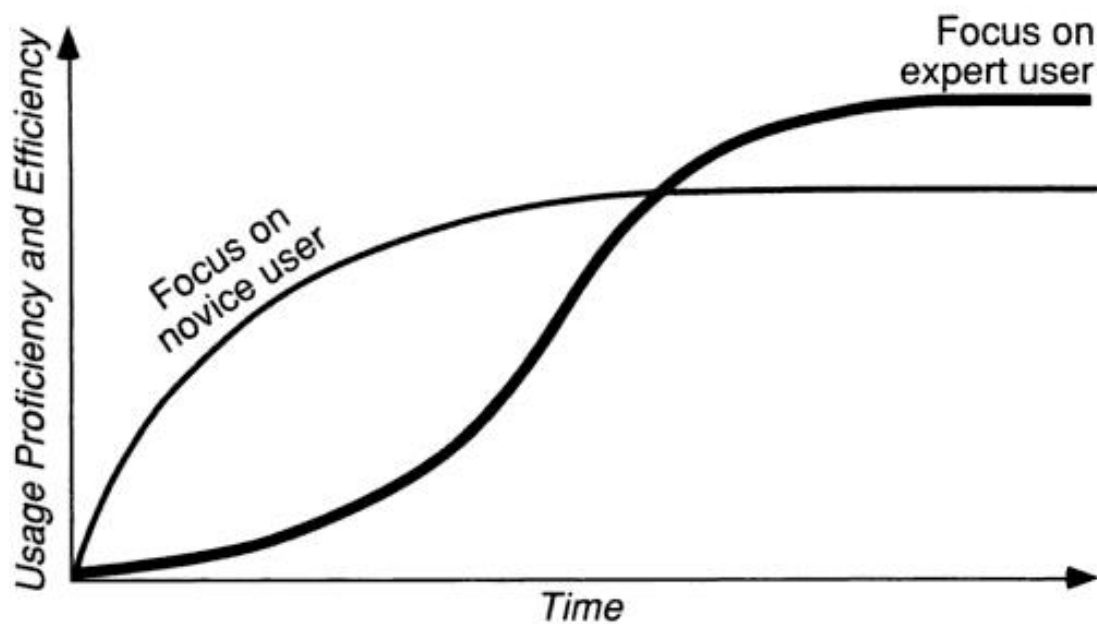


Figure 2. Learning curves for novice and expert focused interfaces. Copied from Nielsen (1993) [4;28].

As figure 2 shows, when focusing only on novice users, serving only solutions which are easy to learn, maximal efficiency of the product will not be achieved. On the other hand, when focusing only on efficient ways to perform tasks, the learning is slower.

When the user interface provides solutions for both types of users, learnability and efficiency can be maximized, when the users shift from easy-to-learn solutions to the most efficient ones. [4,41.]

### 2.3 Mobile Usability

When talking specifically about mobile usability, there are some things that need to be considered. For instance, screen sizes on mobile devices are smaller than on computers. Nielsen's heuristics describes simple and natural dialog, which refers to simplified design of the user interface, among other things. Because of the varying, but rather small screen sizes on mobile devices, keeping the user interface simple is vital for usability. [4,115–123.]

Optimizing the content to fit different screen sizes is not only user friendly, but a study conducted by a Finnish digital marketing company called Avaus Marketing Innovations shows that it also activates users. In the study they analyzed over 100 million newsletter and campaign emails comparing the click-to-open ratios (CTOR) and click-through rates (CTR) of the mobile optimized and the un-optimized emails, finding that on the mobile optimized emails the CTOR was 13% higher than that of the un-optimized. The CTR was 8% higher on optimized emails. [4,115–123;9.]

Another thing to consider is that the user interfaces are different from the perspective of interaction. Whereas the last heuristic presented in chapter 2.2 describes providing shortcuts for experienced users, on mobile devices this can be implemented also by providing alternative touch gestures, such as swiping or dragging, to perform actions in addition to items that are interacted with by tapping. [10.]

As mentioned, the size of the device's screen affects the layout and the amount of content displayed in the application. The size of the device also affects the user's ability to easily access all areas of the screen, to interact with the device. According to a study conducted from late 2012 to early 2013 49% of smartphone users employ only one hand while interacting with their device. Figure 3 presents how the way one is holding a device affects their ability to reach different areas of the screen. [11.]

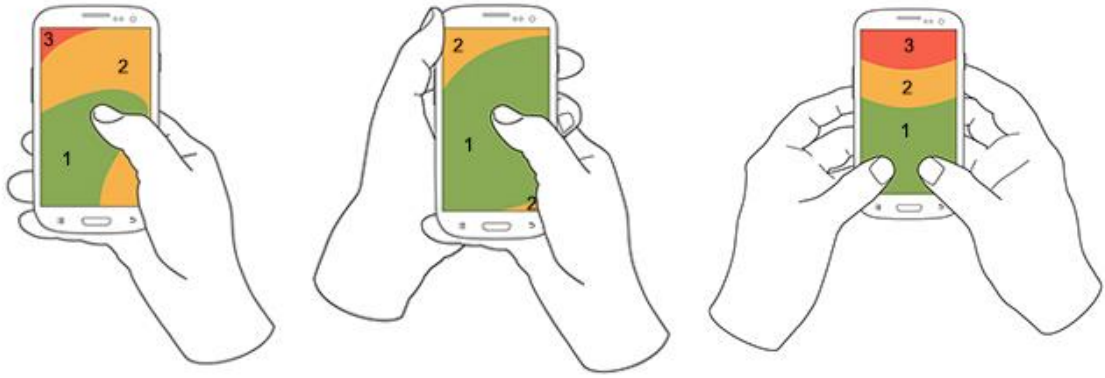


Figure 3. Illustrations of three ways users hold their devices. Modified from Hooper (2013) [11].

Figure 3 presents illustrations of three basic ways of holding a smartphone while interacting with it as observed in a study by Hooper and his colleagues. The green color, marked with number 1, indicates an area of the screen which can be reached without straining. The areas with yellow color, marked with number 2, indicate that the area can be reached with additional straining. The areas with red color, marked with number 3, can be reached only by changing the position of the device in hand. These areas are estimates and depend on the size of the device and the user's hand, and also the position and orientation of the device. [11.]

As said, the study found that while interacting with their devices, 49% of users employ only one hand, which means that they cannot easily reach all areas of the screen, as can be seen from the image on the left in figure 3. 36% of users use one hand to only hold the device and the other to interact with it, allowing them to reach most areas of the screen without additional straining. Despite the relatively small easily reached area seen on the right in figure 3, 15% of users employ both hands to interact with the device, which allows the users to provide input most effectively, whether it is typing on the on-screen keyboard, or swiping through content and tapping on interactive elements. [11.]

### 3 Usability Evaluation Methods

The usability of a product can be evaluated using numerous variations of methods, the purpose of which is to explore the aspects of the product that either increase or decrease its usability and how the product could be improved. These evaluation methods can be roughly divided into two main categories, inspection and testing methods. The choice between these methods can be made based on for instance the development phase of the product. The most widely used inspection method is heuristic evaluation. [12,168;13,14–15;14.]

#### 3.1 Heuristic Evaluation

Heuristic evaluation is a method of reviewing a user interface, using a set of principles, heuristics, such as the ones presented in chapter 2.2, as guidelines to evaluate the usability of a product. This inspection method is still widely used (74%) according to a survey conducted by User Experience Professionals Association in 2009, and can be used to detect usability issues already in the early stages of development. Probably the most used set of principles is the “Ten usability heuristics” by Nielsen. The original nine heuristics were first introduced in 1990 by Nielsen and Molich but were revised by Nielsen in 1994 to include ten principles. [4,155–163;5,61-62;14;15;16;17.]

The process of heuristic evaluation involves a number of professional evaluators inspecting the user interface, comparing the elements and aspects of it to the given heuristics. The length of the evaluation session is typically from one to two hours and the number of evaluators should be selected considering the average proportion of usability problems found and using a cost-benefit analysis. [4,155–163;5,61;15.]

In the average of six experiments a single evaluator could detect 35% of all usability issues, but when using multiple evaluators, there is an overlapping in the findings which increases with the number of evaluators, decreasing the number of unique findings per evaluator. The benefit-cost ratio for this example was calculated using more or less average costs, including a fixed cost of 4000 USD (F) for the heuristic evaluation and a variable cost of 600 USD (V) per evaluator (n). Thus, the formula is  $F+n \cdot V$ . The worth of a single usability problem found was set to 15000. Figure 3 demonstrates how the number of evaluators can be selected considering both the benefit-cost and problem detecting ratios. [4,156;15.]

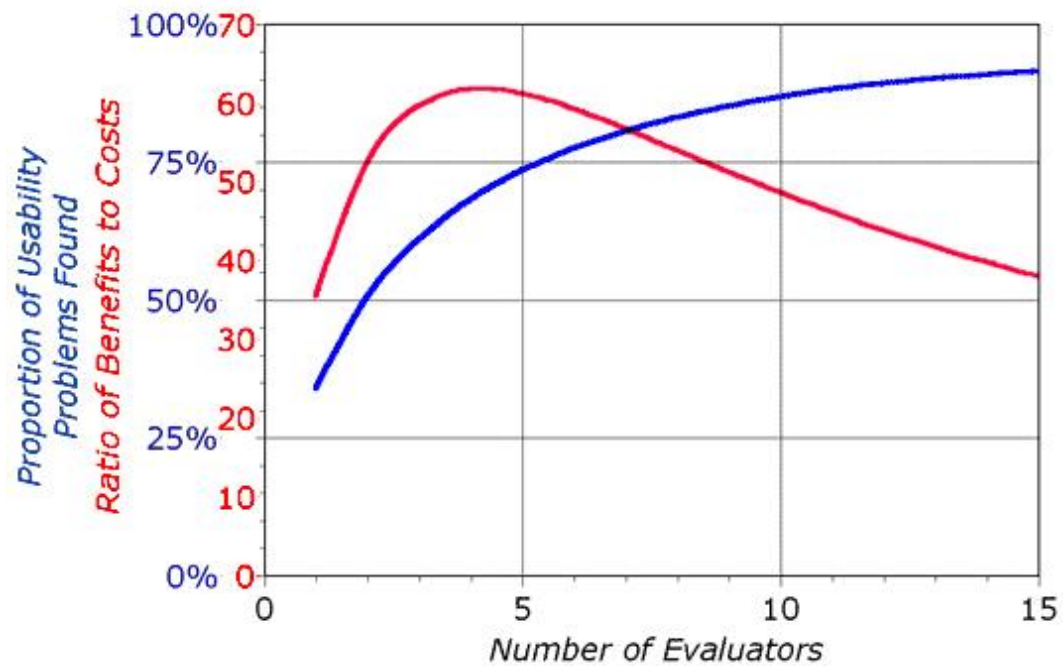


Figure 4. Benefit-cost ratio and rate of usability issues found in relation to number of evaluators. Modified from Nielsen (1995) [15].

As can be seen in figure 3, in this example the maximum benefits are achieved by using 4 evaluators, with the benefits of the findings being 62 times the costs. Even though four evaluators may seem small, Nielsen recommends using a minimum of three and maximum of five evaluators, which is supported by the problem detection and benefit-cost ratios. [15.]

### 3.2 Usability Testing

Usability testing is a common name for various usability evaluation methods which involve users completing tasks with the tested product or its prototype. The users' performance and satisfaction are evaluated using various methods such as performance measures, observations, interviews and questionnaires. These tests can be conducted in a lab, in the field or even remotely, depending on the goals, requirements and resources of the study, as well as the nature and the development phase of the product. [5,26;18.]

Christian Rohrer, a user experience specialist, has classified user research methods, including different types of usability studies, in a three-dimensional space, where the axes and their “scales” are:

1. Attitudinal – Behavioral
2. Qualitative – Quantitative
3. Context of use (natural use of product – product not used)

The first axis, **Attitudinal – Behavioral**, can be rephrased as “**what people say**” versus “**what people do**”. Attitudinal methods rely strongly on users’ statements, which represent their beliefs and opinions whereas behavioral research methods focus on the users’ actions with the product. On this axis usability studies are categorized more into the behavioral end of the continuum, apart from field studies, which are placed in the middle, having more the ability to utilize attitudinal data as well. [18.]

On the second axis the method’s approach is classified either as qualitative or quantitative. The methods on the qualitative end of the second axis answer questions of “**Why and how to fix**”, and the quantitative methods provide answers to questions of “**How much or how many**”. In qualitative methods the data is gathered directly through observations and interviews whereas in quantitative studies the data is gathered indirectly through different measurements. Depending on how the usability study is conducted, the study can utilize both qualitative and quantitative data. [18.]

Another aspect that distinguishes field studies from remote and usability lab studies is the **context of use**. In the case of field studies the **use of product** is **natural or near-natural**, whereas in the cases of remote and usability lab studies, the use of product is scripted. Natural or near-natural use of product describes the type of use of the product in which the user’s actions are not affected by the person/people conducting the study. Scripted use of the product describes the type of use where the study is more or less interfering with the user’s actions. Scripted use of products is heavily favored in quantitative usability studies in order to produce reliable usability measures. [18.]

Different types of methods often serve different purposes, which usually vary depending on the development phase of the product. Table 1 presents user research methods for different goals depending on the development phase of the product. [18.]



Table 1. User research methods for different development phases of a product. Data gathered from Rohrer (2014) [18].

	Product development phase		
	Strategize	Execute	Assess
<b>Goal:</b>	Inspire, explore and choose new directions and opportunities	Inform and optimize designs in order to reduce risks and <b>improve usability</b>	Measure product performance against itself or its competition
<b>Approach:</b>	Qualitative and quantitative	Mainly qualitative (formative)	Mainly qualitative (formative)
<b>Typical methods:</b>	<b>Field studies</b> , diary studies, <b>surveys</b> , data mining, or analytics	Card sorting, <b>field studies</b> , participatory design, paper prototype, and <b>usability studies</b> , desirability studies, customer emails	<b>Usability benchmarking</b> , online assessments, <b>surveys</b> , A/B testing

The three development phases seen in table 1 can be considered as steps in a continuous loop of agile software development, where the usability of the application is considered throughout the loop. **In the strategizing phase**, field studies, such as the one conducted by Hooper and his colleagues, can provide useful data concerning the context of use, such as the general use of the targeted devices whereas surveys can help consider the possible use cases for the application, and thus serve the (future) users better. [18.]

**In the execution phase**, testing on a (paper) prototype with a small user group can help identify the major usability flaws in the application. If the application is already released and on an iteration round, field and usability studies can be used to provide extended and more detailed information regarding the state of the usability of the application. [18.]

**In the assessment phase**, once the product is released, its performance can be compared against its previous versions and/or competing products. This point is crucial to determine, whether the changes made in the application have increased or decreased the users' performance and satisfaction with it. [18.]

## 4 AchSo! Application

AchSo! is a free open source Android application that allows its users to record video clips, categorize them, add annotations on them and share them into a cloud. The application is developed by the Learning Environments Research Group (LeGroup) at Media Lab of the Aalto University School of Arts, Design and Architecture. The group studies informal learning at work in a related project called Learning Layers Project within the 7th Framework Programme of the European Commission. The initial target group of the application was people working in construction, but the target group has now been expanded to include also people working in healthcare. [2.]

### 4.1 Library

The infrastructure of AchSo! can be divided into three main views: Library, camera and video player. Figure 5 presents a screenshot of the library view of AchSo!, which is the opening view of the application.

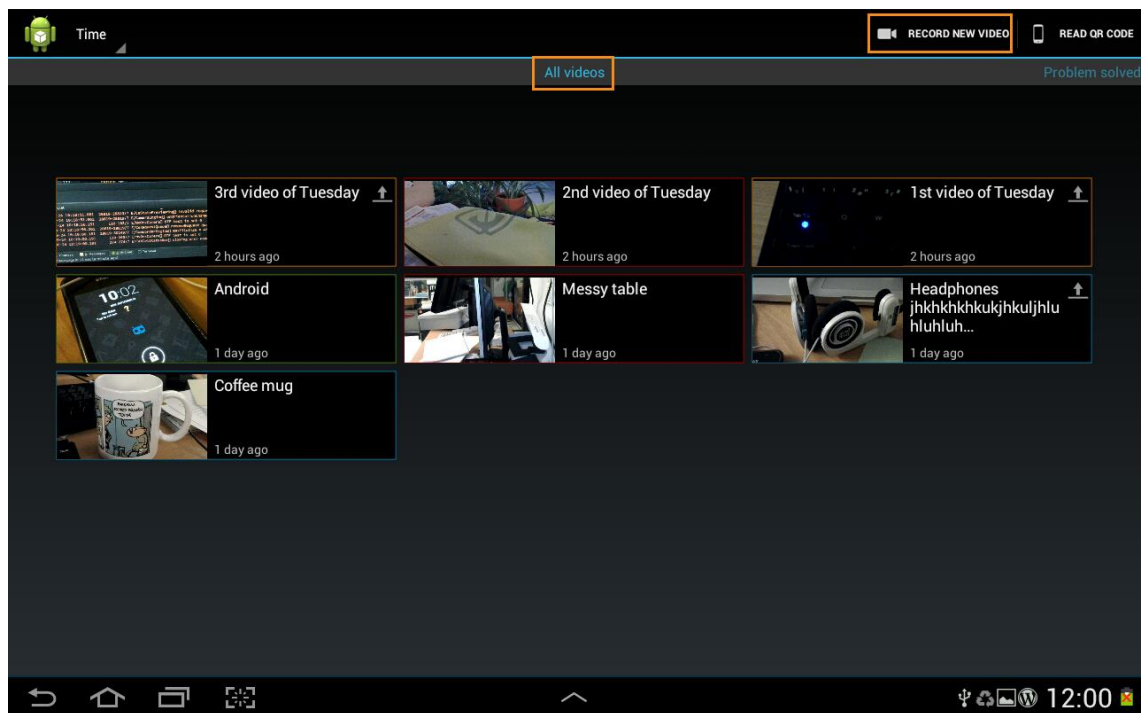


Figure 5. Screenshot of the library view of AchSo! application, showing videos in all categories. Screenshot [19].

Figure 5 presents the library view of AchSo!, displaying videos from all categories. The four default categories for the videos are good work, problem, site overview and trick of trade. The library view contains all the videos that have been recorded using AchSo! on

that specific device and when the application is launched, the library view is set to show videos from all categories. By using a sideways swipe gesture or tapping on the categories in the top navigation, the user can switch between the different categories and all videos. The categories are named considering possible use cases in construction sites.

## 4.2 Camera

The second main view of AchSo! is the camera view, which can be launched by tapping on the camera icon on the top right corner of the library view. The icon can be seen in figure 5. AchSo! employs the device's own camera application for recording videos. This means that the camera view of AchSo! looks different depending on the vendor of the device and the version of the camera application. Figure 6 presents a screenshot of an example of a camera view in AchSo!.

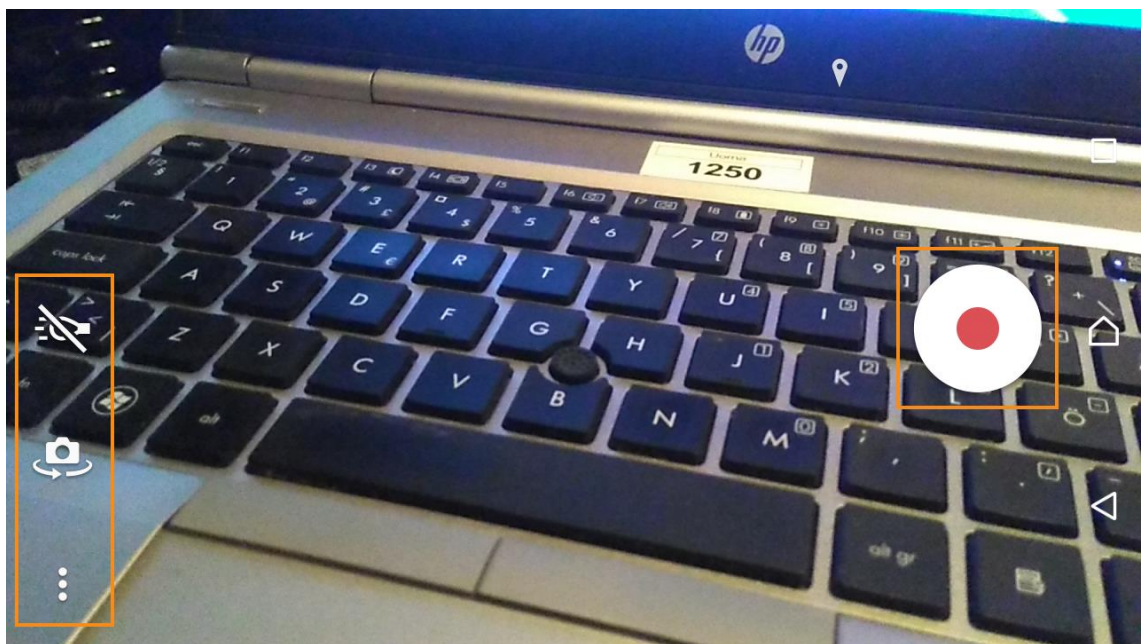


Figure 6. Screenshot of AchSo! application employing the device's default camera application on a Sony Xperia M4 Aqua device. Screenshot [20].

Figure 6 shows a screenshot of AchSo! employing Sony Xperia M4 Aqua's default camera application. The user can use the settings of the camera application for filming. Similar to the camera view displayed in figure 6, the camera application usually includes a recording button to start and stop recording video. After finishing recording, the users will be prompted to choose a category for the clip, after which the application will return back to the library view.

### 4.3 Video Player

The third main view is the player view, which can be opened by tapping on any of the video thumbnails in the library view. In the player view the user can watch a video clip and add, modify and remove annotations on it. Figure 7 presents the video player view of AchSo!.

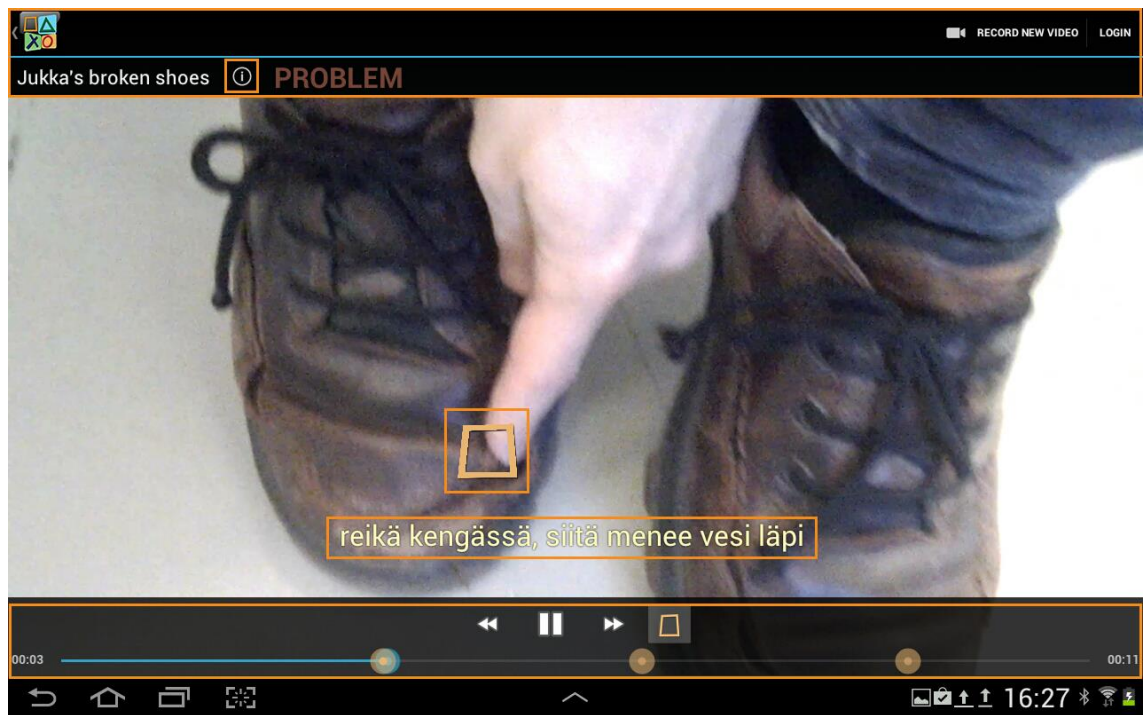


Figure 7. Screenshot of the AchSo! video player view. Screenshot [19].

Figure 7 presents the video player view of AchSo!. The player consists of “a tool bar”, the video and video controls, including a timeline and play/pause, skip back, skip forward and annotation buttons. In the tool bar on the top of the screen the user can see the video’s name and category, and can for instance edit these details or view the location where the video was shot, by tapping on the button with an info icon. The markers on the timeline on the bottom of the screen indicate annotations on those points of the video. The player will automatically pause the video on each annotation to display it for three seconds, after which continuing to play the video. Figure 8 presents the annotating interface of AchSo!.

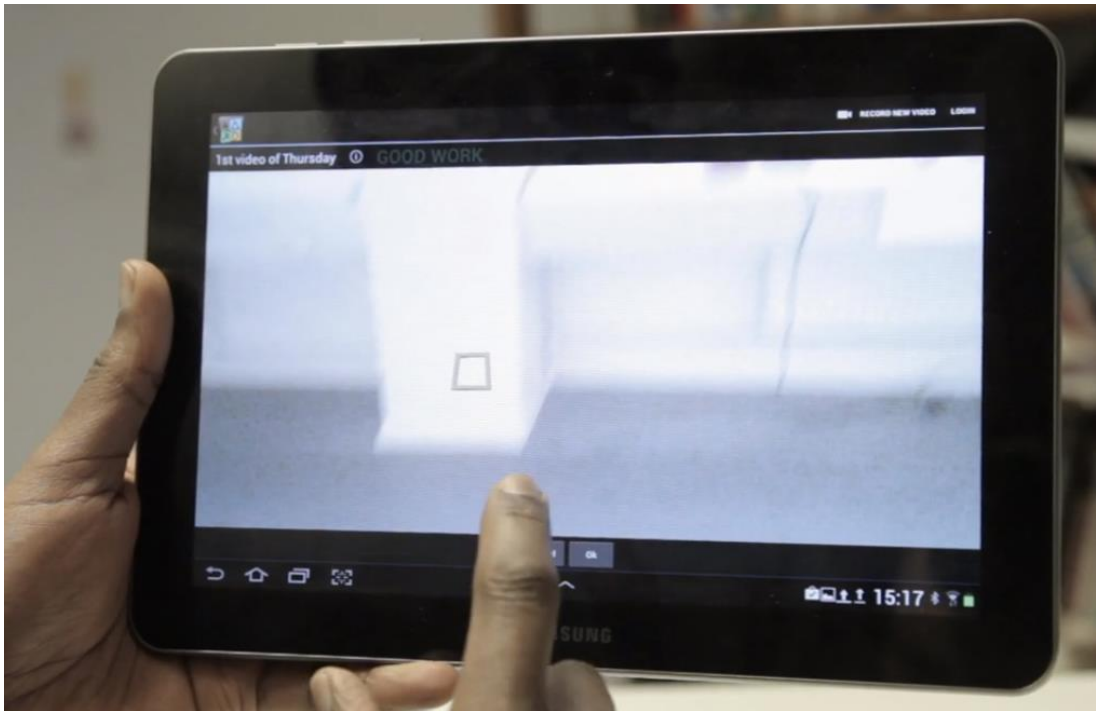


Figure 8. Screenshot of adding an annotation. Modified from Learning Environments Research Group (LeGroup), Media Lab, Aalto University School of Arts, Design and Architecture (2014) [21].

Figure 8 presents the annotating interface elements of AchSo!. To add an annotation the user will need to pause the video and long press the specific area where they want to add the annotation, after which an annotation marker will appear on the screen. Another option for adding an annotation is tapping on the annotation button in the video controls and repositioning the marker by pressing and dragging on it. After confirming the marker's position, a description box will appear. The description box is also used to edit an annotation, which happens by tapping on an annotation marker on the screen, and selecting Edit from the context menu. The user can edit the annotation description by tapping on the text area in the description box. Figure 9 presents a screenshot of adding or editing an annotation description.



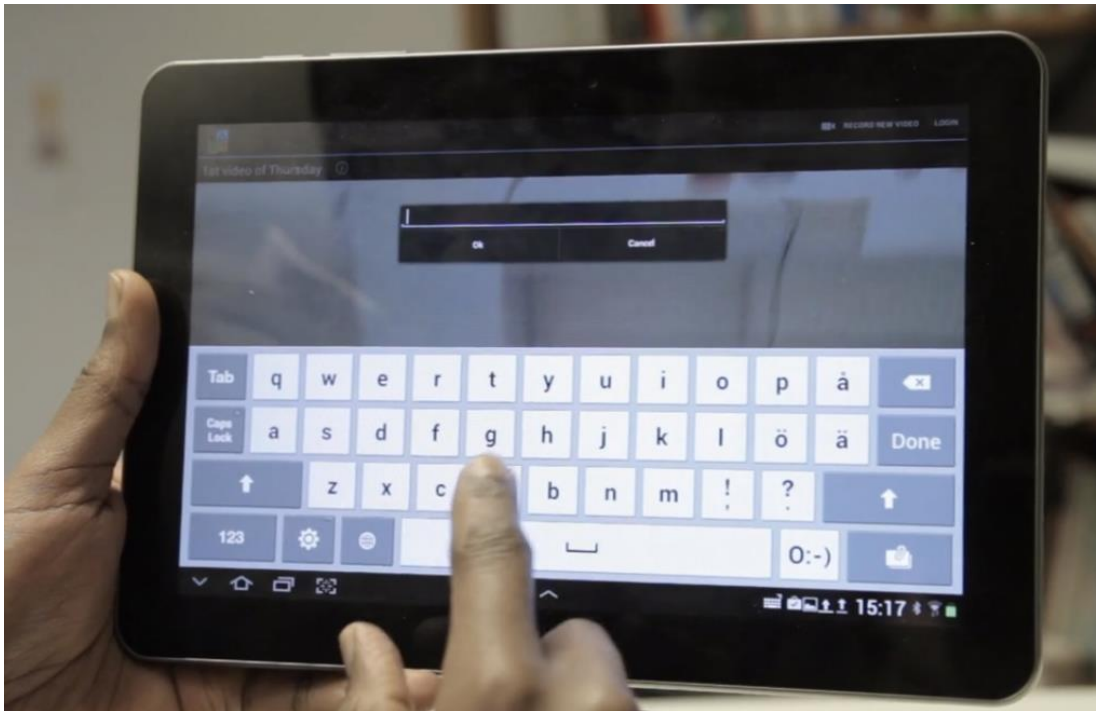


Figure 9. Screenshot of editing an annotation description. Modified from Learning Environments Research Group (LeGroup), Media Lab, Aalto University School of Arts, Design and Architecture (2014) [21].

When the user taps on the text area in the annotation description box, the device's on-screen keyboard will appear on the screen, as seen in figure 9. This keyboard is used to type in the annotation description. After typing in the desired description, the on-screen keyboard can be closed by tapping on either the back button of the device or the "Done" button on the keyboard. The position and style of the "Done" button varies depending on the device's vendor. After closing the keyboard the Keep button must be tapped in order for the changes to be saved. Otherwise the description will be reverted back to the last saved one, or to empty in the case of a new annotation. The annotation can be deleted by tapping on the delete button.

## 5 Selected Evaluation and Analysis Methods

Alongside with the usability study, larger user research was conducted concerning the utility of the application as a tool for learning in the field of healthcare. To support both studies, the method of field study combined with inquiry methods, such as observations, questionnaires and interviews, was selected for the evaluation of the usability of AchSo!. The study can be considered both **formative** and **summative** with the goals of identifying usability issues, as well as determining whether the application supports the goals set for its use or not. The field study was chosen to support both of these goals. The field study also supports the intended use of AchSo!, which is very much tied to the environment it is used in. The study was planned together with the LeGroup research group. [5,14.]

### 5.1 Scope, Users and Context of Use

The usability evaluation of AchSo! concentrated mainly on the user interface of the application, its navigation, transitions between views and the user experience of the application. The field study method benefitted both goals, providing the opportunity to observe the users in their “natural” environment and to collect data to help steer the development of the application to a direction that would serve the users in the best possible way.

**Users** chosen for the field study were students studying in the degree program in nursing at Metropolia University of Applied Sciences. The users were chosen to represent the new target group of the application – people working in the healthcare section. The selected users had no prior experience with the application and included people of different age and gender.

The AchSo! usability study consisted of two field study sessions: the first one in October 2014 and the second in February 2015. The users involved in the first session were studying in English in an international study program and the ones participating in the second session were studying in Finnish. The testing sessions were conducted on the premises of the Metropolia University of Applied Sciences’ Tukholmankatu campus of health care in Helsinki. The test sample size consisted in total of 45 nursing students above the age of 18.

The **device** chosen for the study was a Google Nexus 7: a tablet device with a 7" screen, using Android version 4.4 (KitKat®). The device's full size is 114 mm by 200 mm by 8.65 mm (width by height by depth), and being a tablet, the device is larger than an average smartphone. [22.]

The **environment** in which the users used AchSo! was a class room, or an operation room, where in groups of 4–5 they participated in an Objective Structured Clinical Examination (OSCE). A view of the class room is presented in figure 10.



Figure 10. View of a classroom reserved for the students' examination.

As figure 10 presents, the room reserved for the examination included a rescue manikin, stools, a hospital bed and medical equipment.

## 5.2 Tasks and Goals

The tasks for the field study were chosen to represent general user actions typical to the use of AchSo!. The tasks included

- recording video
- selecting a category for a recorded video
- browsing the video library
- viewing a recorded (and annotated) video and
- adding, editing and deleting annotations on it.



The intention was to integrate the tasks into the students' study exercises by having them record each other's resuscitation and intubation exercises and commenting them with annotations. Each individual task had a self-explanatory goal. Accomplishing the goal was meant to support and/or enhance the students' learning. The exam and exercises were considered good study cases because they involved evaluation and feedback, which can be reflected and projected using annotations on AchSo!.

### 5.3 Inquiry Methods and Data Analysis

The users were observed while they performed the tasks on AchSo!, and handwritten notes were taken by the researchers. The observations provide qualitative information about the users and the context of use, with the main purpose of determining if the users' behavior is consistent with their attitudes, which will be reflected in their answers to the questionnaire and interview.

To collect data for the study in a form that could be comparable and easy to analyze, as well as to **quantify**, an AchSo! specific questionnaire was designed in two languages: English and Finnish. The questionnaires are presented in appendix 1 and appendix 2. The questionnaires consist of two parts: user background information (demographics) and usability statements and an open question specific to the features and user interface of AchSo!.

The first questions in the questionnaire concern the user's background, including the following questions:

1. Age
2. Do you use (or have you previously used) a smartphone frequently?
3. Do you use (or have you used) any of the following applications frequently on a smartphone?

The questions are answered by choosing one or more of the given options by ticking a box. The options for the first question include "<25", "25–29", "30–34" and ">34". The user can tick only one of the boxes. The second question can be answered by choosing one of the following: "Yes", "Yes, in the past" or "No". The third question can be answered by choosing one or more from the following options: "Camera", "Facebook",

“Instagram” or “Twitter”. The option “Video” is the second option in the Finnish version of the questionnaire, which was produced after the English one. (See appendix 2.)

The purpose of the demographics is to find out if the users’ age and/or prior experience with applications including somewhat similar features (camera, video player, tagging) affect their ability to perform tasks on AchSo!, and thus affect the usability and/or user experience of the application. Demographics also enable recognizing different segments within the user group and a comparison between their results.

The AchSo! specific statements are answered on the Likert scale, with the options “Strongly disagree”, “Disagree”, “Neither agree nor disagree”, “Agree” and “Strongly agree”, from which the respondent can choose one according to whether they agree or disagree with each given statement. The statements chosen for the questionnaire include general statements such as “Overall in general the application is easy to use”, “I quickly learned how to use the application” and “Moving from different areas of the application to another is clear and not disorienting”. The questionnaire included also more specific feature related statements, such as “After I finish recording a video, it makes sense to me to choose a category for it right away” and “When adding text to an annotation, the keyboard appears when I need it to”.

The last question in the questionnaire is an open question, which asks the users to speak their mind and give suggestions for improvements, as well as to elaborate on their answers to previous questions or raise matters the questionnaire did not cover.

Since users often tend not to answer optional open questions as eagerly, another inquiry method that was chosen was an interview to complement and extend the data gathered through the questionnaire. The users were interviewed in small groups after performing tasks with AchSo! to get more data concerning the overall usability and user experience of the application as well as whether the application serves its purpose, meaning that it supports learning. The interviews were recorded digitally and users’ comments relevant to the usability study were collected and transcribed.

The data from the questionnaires was combined and analyzed using appropriate statistical analytical methods to identify user segments and peaks on the negative side of the rating scale, which could indicate possible usability issues. Background information for

the recognized issues was searched from the users' answers in the interviews and the questionnaire's open questions.

## 6 AchSo! Usability Evaluation

### 6.1 Field Study on October 10, 2014

During the first testing session the research group consisted of four people including myself. The session started in the morning with an information session, during which the students' teacher announced the schedule and gave instructions concerning the procedures of the day. The students were to participate in an Objective Structured Clinical Examination (OSCE), during which they would work in groups of 4–5 to perform first aid on a rescue manikin in simulated hospital conditions. After the examination specific information one of researchers shortly introduced our team and what we were studying, after which we introduced AchSo!, its interface and its main functions (recording and viewing video, and annotating), and intended use case: a video recording and annotation application to support learning. Since the students involved in the study were not all Finnish, but studying in English in an international study program, the main language that was used in the user research was, apart from some individual exceptions, English. Figure 11 presents a view of a room where some the examination took place.



Figure 11. Students resuscitating a rescue manikin in the examination.

Two examinations took place simultaneously in two different rooms, one of which is presented in figure 11. During the examinations other students were not allowed in the rooms. This forced us to change our original plan in which one group would record another group's activity. During the 5–10 minute long examinations we instead filmed the

students' actions from the other side of the room, while the teacher evaluated the students' performance. In figure 11, the teacher is standing on the right hand side and only her hand can be seen in the image. "Good work" category was selected for all examination videos. The teacher stopped the exam after the students had completed all necessary treatments or failed too many of them. After the practical exam the students had an oral examination, during which they answered questions concerning the treatment given in the practical exam, after which the teacher announced whether the group had passed or failed the examination.

After each group was done with their examination, they moved to another class room. The students were asked to sign a consent form, allowing us to interview and observe their interactions with the application and to use the collected data in research concerning the application. Apart from one, all students signed the consent form and took part in the study. The next task included two students at a time performing intubation exercises, while other two from their group were recording their activity using AchSo!. Figure 12 presents a picture of the exercise situation.



Figure 12. Two students performing intubation with two students filming the exercise.

Figure 12 presents two students performing intubation, while other two students are filming them using AchSo!. After each pair was ready with the intubation exercise, they switched places with the students who were filming them.

After each group had performed the intubation exercise and filmed another pair, they were asked to use AchSo! to view and annotate the recorded video of their own examination and exercises to recognize mistakes or accomplishments, or other things they found relevant. The users were observed during the use of AchSo! and the observations were written down on paper. After performing the tasks with AchSo! the users were asked to reflect on their performance with the application and to individually fill out the printed questionnaire presented in appendix 1.

After the users had filled out the questionnaires, we sat down with them to interview them and to discuss with them in the groups in which they had performed the tasks. They were asked questions concerning the user experience, usability and general use of the application, such as what was their first impression of the application, or if they felt that the application could be used as a tool to support learning. The interviews were recorded digitally.

This procedure was repeated for all six groups, from which 28 students in total participated in the user research and usability study.

## 6.2 Field Study on February 11, 2015

On the day of the second field study, our research group consisted of only two people, including myself. The schedule and procedures of the day resembled the ones of the previous field study.

As before, the day started with the teacher informing the students about the schedule and procedures of the day: In the same way as during the previous field study, in groups of 4–5 the students would perform first aid on a rescue manikin in simulated hospital conditions. After the information related to the examination, we shortly introduced ourselves and AchSo! and its main functions, including recording, viewing and annotating video. The students involved in this particular session were studying in Finnish, thus the language that was used was Finnish.

As before, two groups at a time in two different class rooms participated in the examination, during which other students were not allowed in the rooms. The examination consisted of two parts: practical examination and oral examination. The students were given background information about their “patient”, after which they started resuscitat-

ing them, while their teacher observed their performance. Figure 13 present students participating in the examination.



Figure 13. Students resuscitating a rescue manikin.

Figure 13 presents a scene from the examination. The 5–10 minute long practical examination was filmed by us from the other side of the class room using AchSo!. The examination videos were categorized as “Good work”.

After we finished filming the practical examination and the students were done with both parts, the students moved to another classroom with us to fill out the questionnaire and to be interviewed. As before, the users were asked to sign a consent form, allowing us to use the collected data (observations, questionnaire and interviews) in the studies related to AchSo!.

The users were asked to open AchSo! to locate, view and annotate the video which was recorded during their examination. They were asked to reflect on the teacher’s feedback and their own experience of the examination, and to annotate mistakes and accomplishments, or things they found relevant. The users were observed while they used the application and notes were taken by the researchers. After performing the tasks on the application, the users were asked to individually fill out the printed questionnaire in appendix 2, keeping in mind their experience with AchSo!.

After the users had filled out the questionnaire, we began interviewing them in the groups they had performed the examination and used AchSo! to annotate the videos. They were asked questions about the user experience and the use of the application in general. The interviews were recorded digitally.

Due to the shortage in our research staff, the same procedure was repeated with only four groups out of six, from which 17 users in total participated in the usability study.

### 6.3 Collected Data and Analysis in Short

The data collected from both field studies included in total nearly two hours of recorded interviews, 45 filled out questionnaires and observations and two and a half hours of video material.

The data from the questionnaires of both field studies were collected into separate spreadsheets to analyze if answers to any of the questions contained a high rate of dispersion or a peak on the negative side of the Likert scale. This enabled recognizing some usability issues and their frequency, with a higher percentage meaning a more frequent issue.

The interviews and observations were used to collect a more general idea of the usability and user experience of AchSo!, as well as to try to find background information for usability issues arising from the data collected through the questionnaire. The interviews were partially transcribed, collecting users' comments relevant to the usability study, for instance concerning the use of AchSo! as a tool for learning and the users' first and main impression of the application. The transcribed interviews are presented in appendix 6.

The users involved in the second field study did not use the camera view of AchSo! at all; thus no data related to that could be gathered.



## 7 Results and Improvements

The overall responses from the users in the interviews suggest that the users felt that the application could be used to support learning, although this is only based on the users' subjective perception and should be proven conclusively by conducting a study over a period of time. In the interviews some users described their memories of the exam as "foggy" due to the stressfulness of the situation, and stated that seeing their own performance from another perspective, using AchSo!, allowed them to reflect on the teacher's feedback, recognize mistakes and learn from them.

The results of the usability study indicate that the overall user experience and usability of AchSo! are good, with the large majority of over **70 %** of the answers agreeing or strongly agreeing with the application specific usability statements. **93 %** of the responses to statement 14 suggest that overall the application is easy to use, and **89 %** of the users stated that they learned to use the application quickly. With the goal of AchSo! being a tool to support learning, the effectiveness and efficiency should be measured considering the impact of the application on the users' learning.

Despite that the total rate of disagreeing answers after the first field study was only 6.6 %, reviewing the variations on individual statements revealed some issues.

The responses on statement 6 ("I understood what the different categories for the videos mean and it was easy to choose the right one for my video") had a considerably high rate of disagreement of 21.4 %, as can be seen in appendix 3. This data is supported by some of the users' statements from the interviews which can be seen in appendix 6 and indicate that the four default categories (good work, problem, site overview and trick of trade) might not be suitable for use in healthcare and need to be revised. Some users suggested the option of creating custom categories. This idea is supported by both Nielsen's heuristic called "Speak the User's Language" and Shneiderman's heuristic called "Support Internal Locus of Control". According to Nielsen, the language and wording used in the user interface should feel natural to the users, and according to Shneiderman, the users should be able to modify the user interface to suit their needs. [4,123;7,75.]

**One major usability error**, which can be related to the categories, occurred once during the sessions, when a user tapped the back button of the device instead of choosing

a category for their video after recording it. As a result, the application returned to the library view without saving the recorded video. Considering the severity of the error, fixing this issue was a **high priority**. The error was discovered during the interviews, and was also noted by the user on statement 5 in the questionnaire (“After I finish recording a video, it makes sense to me to choose a category for it right away”).

Another statement that drew my attention with a **negative peak of 17.9 %** was statement 17 (“It was easy to use the app with a single hand. I did not struggle to reach any buttons”). This issue is not as straightforward as the one concerning statement 6. In addition to the position of different functions within the application, the size of the device and the user’s hand affect the user’s ability to use the application with only one hand. Thus it can be concluded that using AchSo! on a Nexus 7 device with only one hand might not be possible for a person with a small hand.

Despite that 85.7 % of the users of the first study found the user interface aesthetically pleasing, with only 3.6 % disagreeing, the design of the interface of the application was updated to follow the Material Design Guidelines by Google. Figure 14 presents a screenshot of the library view of AchSo! with an updated design. [23.]

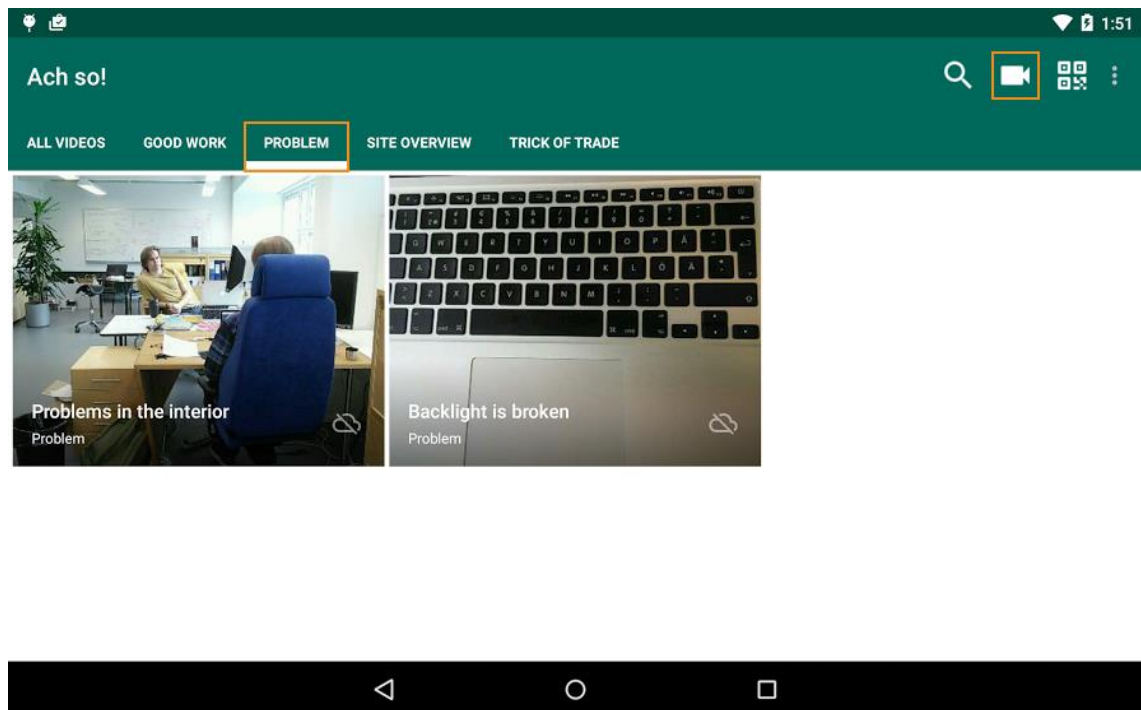


Figure 14. A screenshot of the library view of AchSo! with an update design. Screenshot [20].

As the screenshot in figure 14 presents, the user interface contains the same main elements, for instance the recording icon, the categories and the videos.

Although the results of the second session in appendix 4 show that 5.9 % of the users did not find the interface's visuals pleasing after the update, in both cases the number of disagreeing users was 1, and the difference in sample sizes causes the "peak". Considering Nielsen's heuristic of consistency, following platform conventions is considered to support users. [4,132-133; 21.]

Both before and after the interface's design update, users' statements indicated some issues with the video timeline, with some users suggesting adding "fast forward" and "rewind" buttons or enhancing the dragging of the timeline slider. Some users also wished that the time (three seconds) which the annotation is visible on the video could be selected separately for each annotation. Both of these cases and the suggested improvements can be related to recognizing the needs and preferences of different users. According to Shneiderman, providing different options/functionalities that feel natural to the users can improve the usability and the user experience of the product. [7,75.]

Taking a look at the users' demographics revealed that 84 % of users were less than 30 years old. Despite my presumption that users with a higher age would not perform as well with the tests, their age did not seem to have any effect on their performance or satisfaction with the application. All the users in the study (had) used a camera on a smartphone, with 82 % being familiar with Facebook's smartphone application.

Despite the increased dissatisfaction concerning the functionality of the timeline slider (from 3.6 % to 29.4 %), the overall rate of disagreeing answers dropped from 6.6 % to 3.1 % after the user interface update, indicating that the overall usability and user experience of AchSo! was increased as a result of the study.

## 8 Conclusions

The purpose of the final year project was to do research on the theory of usability and apply it to evaluate the usability of AchSo!, a video recording and annotation application. The goal of the study was to identify usability issues related to the application, as well as to study whether the application supports the goals set for its use.

A lot of usability theory dates back to the era before smartphones and tablets, and therefore needed to be examined to find the essentials which adapt the theory to the context of these new devices. Selecting the evaluation methods was relatively easy, basing the selection on the goals of the studies, as well as the nature of the product.

Choosing the method of field studies was definitely a good choice and considering the method's qualitative approach and nature, by utilizing the questionnaire, the study was able to produce surprisingly good quantitative data on the usability of AchSo!.

The main results of the study indicate that the users felt that AchSo! can be used as a tool for learning, and that the overall usability and user experience of the application were good. Although the overall usability of the application was considered good, both quantitative and qualitative data revealed some usability issues and already the results of the first field study were used to improve the application, and the user interface was updated.

As a result of this study, the usability of AchSo! was improved, and the application is still under constant development by the LeGroup research group. AchSo! is available on Google Play for free.

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## Appendices

### Appendix 1. AchSo! Usability Questionnaire in English

1

#### Ach So! usability questionnaire

Thank you for participating in this survey. This questionnaire regards the usability of Ach So! Android application. Your responses will be used to improve the application's user interface and make it more efficient and user friendly. Filling in this questionnaire will take approximately 15 minutes. Ask us for help if you're having trouble understanding or answering any of the statements.

1. Age

☐ under 25      ☐ 25-29      ☐ 30-34      ☐ over 34

2. Do you use (or have you previously used) a smartphone frequently?

☐ Yes      ☐ Yes, in the past      ☐ No

3. Do you use (or have you used) any of the following applications frequently on a smartphone?

☐ Camera      ☐ Facebook      ☐ Instagram      ☐ Twitter

Think about your experience with the Ach So! application and evaluate the following statements. There is a space at the end of the questionnaire for you to elaborate and specify your answers and give feedback for further improvements.

#### Shooting video


	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
4. Recording function reacts fast enough	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. After I finish recording a video, it makes sense to me to choose a category for it right away	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. I understood what the different categories for the videos mean and it was easy to choose the right one for my video	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. After I have chosen a category for the video, it's logical that the application goes back to My videos	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

#### Viewing videos and annotating

8. The timeline slider reacts well to my dragging	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. When annotating a video, the marker appears fast enough when I press the screen	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. When adding text to an annotation, the keyboard appears when I need it to	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. When dragging an annotation marker, it moves fast enough and according to my touch	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. When watching an annotated video I can pause the video when an annotation is on the screen	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. Editing and deleting an annotation is easy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



2

General user experience	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
14. Overall in general the application is easy to use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. In general the functions are placed in the right places	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. Controls like buttons and text fields are appropriately sized	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. It was easy to use the app with a single hand. I did not struggle to reach any buttons	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. It's easy to understand what the different icons mean. 	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19. Usually I could predict what would happen if I pressed a button or did something else	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20. The app behaved like I expected	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21. Moving from different areas of the application to another is clear and not disorienting	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22. The workflow is clear: I always knew what to do next to perform a specific task	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
23. I quickly learned how to use the application	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24. The interface is aesthetically pleasing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Improvements and comments**

25. What can be improved in Ach So!? How would you change the functions/structure/appearance of the application to make it better? You can specify your answers to the previous statements or bring up any new matters this questionnaire did not mention.

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## Appendix 2. AchSo! Usability Questionnaire in Finnish

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### Ach So! käytettävyysskysely

Kiitos että osallistut tähän kyselyyn. Tämän kyselyn kysymykset liittyvät Ach So! – sovelluksen käytettävyyteen. Vastauksia käytetään sovelluksen käytettävyyden ja käyttäjäystävällisyyden parantamiseen. Kyselyyn huolellinen vastaaminen vie arviolta 10–15 minuuttia. Pyydä apua, jos kysymykset tai niihin vastaaminen tuottaa ongelmia.

1. Ikä

☐ alle 25      ☐ 25–29      ☐ 30–34      ☐ yli 34

2. Käytätkö (tai oletko aiemmin käyttänyt) älypuhelimta säännöllisesti?

☐ Kyllä      ☐ Kyllä, aiemmin      ☐ En

3. Käytätkö (tai oletko aiemmin käyttänyt) jotain seuraavista sovelluksista säännöllisesti älypuhelimella?

☐ Kamera      ☐ Video      ☐ Facebook      ☐ Instagram  
☐ Twitter

Vastaa seuraaviin väittämiin pitäen mielessä Ach So! – sovelluksen käyttökokemuksesi. Kyselyn lopussa on tilaa vapaamuotoisille kommenteille, parannusehdotuksille ja mahdollisesti vastaustesi tarkennuksille.

#### Videon kuvaaminen



	Vahvasti eri mieltä	Eri mieltä	Ei samaa eikä eri mieltä	Samaa mieltä	Vahvasti samaa mieltä
4. Tallennustoiminto reagoi riittävän nopeasti	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Kuvaamisen lopettamisen jälkeen on mielestäni loogista valita heti videolle kategoria	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Ymmärsin mitä videoiden eri kategoriat tarkoittivat ja minun oli helppo valita niistä videolleni sopiva	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Kategorian valitsemisen jälkeen on mielestäni loogista että sovellus siirtyy takaisin tallennettuihin videoihin	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

#### Videon katsominen ja annotointi

8. Videon liikusäädin reagoi hyvin kosketuksen liikkeisiin	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Videota annotoidessa, annotaatiomerkki ilmestyy riittävän nopeasti kun painan näyttöä	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Kun haluan lisätä tekstiä annotaatioon, näppäimistö tulee esiin kun tarvitsen sitä	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Annotaatiomerkkiä liikuttaessa, se liikkuu riittävän nopeasti ja kosketuksen liikkeiden mukaisesti	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. Annotoitua videota katsoessa, pystyn pysäyttämään videon annotaation ollessa näytöllä.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. Annotaatioita on helppo muokata ja poistaa	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2

**Yleinen käyttökokemus**

	Vahvasti eri mieltä	Eri mieltä	Ei samaa eikä eri mieltä	Samaa mieltä	Vahvasti samaa mieltä
14. Yleisesti ottaen sovellus on helppokäyttöinen	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. Toiminnot on sijoitettu sopiviin paikkoihin	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. Säätimet, kuten painikkeet ja tekstikentät ovat sopivan kokoisia	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. Sovellusta oli helppo käyttää yhdellä kädellä. Painikkeisiin yltäminen ei tuottanut ongelmia	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. Sovelluksen kuvakkeet ovat helposti ymmärrettäviä  	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19. Yleisesti osasin ennakoida mitä kustakin toiminnosta (painikkeen painallus tmv.) seuraisi	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20. Sovellus käyttäytyi kuten oletin	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21. Siirtyminen sovelluksen osasta toiseen on selkeää, eikä häiritsevää tai eksyttävää	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22. ”Työnkulku” sovelluksessa on selkeä: tiesin aina mitä tehdä suorittaakseni toiminnon	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
23. Sovelluksen käyttö oli nopea oppia	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24. Käyttöliittymä on esteettisesti miellyttävä	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Kommentit ja parannusehdotukset**

25. Mitä parannettavaa Ach So! – sovelluksessa on? Kuinka muuttaisit sovelluksen toimintoja, rakennetta tai ulkoasua tehdäksesi siitä paremman? Voit myös esimerkiksi tarkentaa aiempia vastauksiasi tai nostaa esiin ongelmakohtia tai muita ajatuksiasi, joita kyselyssä ei mainittu. Sana on vapaa.

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### Appendix 3. AchSo! Usability Questionnaire Results, October 10, 2014

[illegible]

#### Appendix 4. AchSo! Usability Questionnaire Results, February 11, 2015

[illegible]

## Appendix 5. AchSo! Usability Questionnaire Results, Total

Total number of participants													
	45												
	< 25	25 - 29	30 - 34	> 34									
1. Age	27	11		4									
2. Do you use (or have you previously used) a smartphone frequently?	Yes	Yes, in the past	No										
3. Do you use (or have you used) any of the following applications frequently on a smartphone?	Camera	Video	Facebook	Instagram	Twitter	Camera %	Video %	Facebook %	Instagram %	Twitter %			
	41	15	37	20	100%	33%	82%	44%	22%				
Shooting video	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Total answers	Total answers %	Disagree %	Neither %	Agree %			
4. Recording function reacts fast enough	0	1	1	15	10	27	60%	2%	2%	56%			
5. After I finish recording a video, it makes sense to me to choose a category for it right away	2	1	9	12	2	26	58%	7%	20%	31%			
6. I understood what the different categories for the videos mean and it was easy to choose the right one for my video	2	4	7	12	1	26	58%	13%	16%	29%			
7. After I have chosen a category for the video, it's logical that the application goes back to My videos	1	1	3	15	6	26	58%	4%	7%	47%			
Viewing videos and annotating	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Total answers	Total answers %	Disagree %	Neither %	Agree %			
8. The timeline slider reacts well to my dragging	0	6	4	19	14	43	96%	13%	9%	73%			
9. When annotating a video, the marker appears fast enough when I press the screen	0	1	5	21	17	44	98%	2%	11%	84%			
10. When adding text to an annotation, the keyboard appears when I need it to	0	0	3	20	20	43	96%	0%	7%	89%			
11. When dragging an annotation marker, it moves fast enough and according to my touch	0	2	5	24	12	43	96%	4%	11%	80%			
12. When watching an annotated video I can pause the video when an annotation is on the screen	0	0	9	23	12	44	98%	0%	20%	78%			
13. Editing and deleting an annotation is easy	0	2	11	22	9	44	98%	4%	24%	69%			
General user experience	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Total answers	Total answers %	Disagree %	Neither %	Agree %			
14. Overall in general the application is easy to use	0	1	2	28	14	45	100%	2%	4%	93%			
15. In general the functions are placed in the right places	0	1	6	27	11	45	100%	2%	13%	84%			
16. Controls like buttons and text fields are appropriately sized	0	2	3	26	14	45	100%	4%	7%	89%			
17. It was easy to use the app with a single hand. I did not struggle to reach any buttons	0	6	15	17	6	44	98%	13%	33%	51%			
18. It's easy to understand what the different icons mean	0	2	3	24	16	45	100%	4%	7%	89%			
19. Usually I could predict what would happen if I pressed a button or did something else	1	3	8	25	8	45	100%	9%	18%	73%			
20. The app behaved like I expected	1	0	5	30	9	45	100%	2%	11%	87%			
21. Moving from different areas of the application to another is clear and not disorienting	0	2	19	17	7	45	100%	4%	42%	53%			
22. The workflow is clear: I always knew what to do next to perform a specific task	0	2	12	26	5	45	100%	4%	27%	69%			
23. I quickly learned how to use the application	1	1	3	26	14	45	100%	4%	7%	89%			
24. The interface is aesthetically pleasing	0	2	4	30	8	44	98%	4%	9%	84%			
						90.90%		5%	14%	71%			

**Appendix 6. Users' comments in Interviews and on the Open Question****October 10, 2014 Group 2:**

Junnu: So what was your first impression of the application? What was the first thing you thought when you opened it?

Person 1: It looks easy to use

Person 2: Yeah and there isn't much like buttons or anything

Person 1: Like, the basics

Person 2: Yeah and it's quite clear

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Junnu: What do you think you could use this application for?

Person 3: Well anything basically, like, with the practical skills

Person 2: Yeah, and like demonstration videos and like helping yourself to learn because you can see all the mistakes you are doing

Junnu: Could you use it for education?

Person 3: Yeah, and just like...

Person 2: Education or just for fun

Person 3: Yeah

Person 2: You can make a like a cooking video or some demonstration

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Junnu: Do you have anything else? Anything that comes to your mind?

Person 1: I sort of didn't understand in the beginning, like, there were four options we could choose from, we all checked "good work", but I didn't really understand what's the purpose of that

Junnu: Originally the application is designed for construction sites. So they can go to the construction site and take short video clips of something they see. Like, you know, they can take a clip of a well done little bit, and they can categorize it

Person 1: Yea, 'cause those categories don't really fit. Or then if you... Can you rename your videos? Then if you have a lot of videos and they're all just named "blahblah123" it would be really confusing eventually if you have

Person 3: I guess you could make those categories by yourself

Person 1: Oh yeah, but we didn't understand the category thing as well, how did that work? Because you said that if we tag it with some words, someone else can find it... I didn't understand how that works.

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### **October 10, 2014 Group 3:**

Leo: Would this work for, like, self-evaluation?

Person 1: Yeah, of course



Person 2: Yeah

Person 3: Yeah, of course

Person 1: That's the main thing. That would be really good

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**October 10, 2014 Group 4:**

Junnu: What do you think was your first impression when you opened the application?

Laughter

User 1: I guess it's quite clear, there's like a giant button that says "record video"...

Laughter

User 2: Yeah, there's not too many options

User 3: Yeah it's pretty straightforward

User 4: I don't use a tablet ever really, so that's why I was asking.. I didn't really know what to do, I know it said record, but yeah...

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Junnu: What do you think you could use this app for?

User 3: I think it was good for learning

User 2: Yeah I think it was good

User 3: I don't think I would use it at home really...

Laughter

Junnu: So would you say for education?

User 1: I thought it was beneficial like looking on the OSCEA, I think that was really good

User 2: Yeah you forget a lot of thing

User 1: Yea there's like a lot happening, you just forget what's happened, so that was really good. I think we learnt what we did and the mistakes. Maybe if we did it (OSCEA exam) again, we would do it better, 'cause we've seen the video

Junnu: Do you think you could use this application for feedback? So that the teacher could mark the

Multiple: Yeah, definitely

User 1: In a way it's good 'cause the annotation is there when it happens, but maybe the annotation could be there for a little longer, because it's for like a flash and then it goes away, so you would have time to like relate to what's happening and what the annotation said.

Junnu: So the annotation time should be longer?

User 4: Jos siin vois ite säätää miten kauan se pysyy siinä..

Junnu: Joo

User 2: Yeah maybe like counting by the word count

User 1: Yea or you could do like a selection like the... like you can pull back and forth, you could do like a selection on there and then.. Because something will happen over a period of time, it's not just a moment, so you could select that period of time you want it to be on there.

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**October 10, 2014 Group 5:**

Junnu: So what would you say was your first impression or feeling when you first started using the application?

Person 1: Frustration in this situation

Person 2: Yeah because the situation was so stressful

Person 3: But if this would have only been and exercise with no stakes, then people would have been kind of like "oh this is just going to be fun" but now everybody had like expectations, so obviously people didn't want to see their own doing in the situation.

Person 4: Do you mean the situation when we went around the phone and watched the video?

Jana: Just the first impression, what's the first impression of this application?

Person 2: Well the first impression when we heard was that you are going to come here and film us was like "oh fuck"

Laughter

Person 1: I told that in the ER room that I'm not going to give a shit about that machine or the videos or whatever

Person 2: I think we forgot about it, I didn't even remember that you were filming us

Person 5: But I think that it was really good that we had it in because then you can watch what you did and learn from it

Person 6: First impression was that I thought "YouTube already has this, why do they do this?"

Person 7: ...old-fashioned, I'm not like the first person to adopt things, so if I'm completely honest, my first reaction was like "it's a nice idea but I don't really see how it's going to help like concretely "

Junnu: So, would you say that this application has any potential in education purposes?

Person 2: Yes

Person 5: Yes

Person 7: Yeah

Person 3: Definitely

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Jana: How did you feel about the categories? Were they well explained or would you put something else or something more?

Person 5: I didn't even see the categories, I deleted the video accidentally

Laughter

Person 5: I didn't realize that I finished the video and I was like "what, what am I supposed to press" so I just pressed the x, because usually the x means that you close something, I thought it automatically saves it, but it didn't so...

Jana: Should we make those signals better? Like the "save"

Person 5: Yes, because I just pressed the x and I thought it automatically saves it somewhere but it didn't

Jana: But the categories are "good work", "problem", "trick of trade", and "site overview"

Person 7: So when we have that app they're already there? Why can't you just make your own?

Merja: They were made for construction workers, so we don't know how global we can go with construction workers' categories

Laughter

Jana: So what would be for you useful?

Person 7: It would be nice to have an option there to create your own markers. As soon as you make your first video there isn't any markers, so you then have to make the markers

Jana: Yeah

Person: Like a folder system

Person 5: Or I think you should, that I agree that you should be able to create your own, but also there is this documentation. That there's this official documentation system in Finland for nurses so you should look at that.

Merja: So there would be pre categories from the documentation and you could select from there or you could make your own

Person 5: Yeah

Merja: And if you would start to write something it would suggest automatically from there?

Person 5: Yeah, something like that

Person 7: But what's the purpose of the categories? Do they help search videos easier later?

Person 5: Yeah maybe, like for example "hengitys" and you look if there's videos with "hengitys". The thing with your own tags is that if it's a system within an organization it's going to be 10000 tags where the same resuscitation is misspelled in 5 different ways.

Laughter

Person 7: So the organization would create guidelines, but I don't think the program should worry about that

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### **Users' open question comments October 10, 2014**

"I was pleased with it :)"

"If you push a wrong button it's easy to get stuck. Maybe more clear"

"Edit text button could be bigger (?). I had slight problems like going back to the main phone screen but that was because I hadn't used a Nexus before. The app was very clear, simple and easy to use. Is there a link to send video via WhatsApp easily? Personally I would prefer to choose a folder to put the video rather than a marker e.g. good work. The options could include 'create new folder', then the application could go back to that folder, not My videos."

"<3"

"Accidentally deleted the video"

"I did not agree with the categories given, they didn't feel appropriate to how I would use the app. It would be good for the app to ask to name it [video] as soon as you stop recording. It may be good to add tags to the videos that you could use to search for videos in addition to the video's title. Editing the annotations was a little difficult before it was explained but then it was easy. Using the app on a smartphone was a bit difficult because it felt very small, but it is good because the app is more portable."

"I think the design could be improved. Also the responsiveness was somehow questionable, took a while and I had to rewind quite frequently. The categories were really not making sense in terms of our field or even for an everyday regular user. I thought it was easier to use on tablet than on a phone."

"AchSo! seems to be easy to use but I personally don't have any experience on Android devices."

"As I don't use a tablet usually it was clearly a bit harder for me to learn the system than for people who use a table on a daily basis / often. The time we had was a bit too short for me to understand the app properly."

"I didn't really understand the purpose of the app. How it is different from other video editing/making tools."

"Location of text / font size."

"- uploading

- writing a description for the video

- editing the video"

"I think it would be easier if the controls had rewind and fast forward buttons to control << or >>. I did not understand how to rewind when first using it."

"Depending on the size of the pad or phone you can't really do it with one hand, if you want the footage to be clear and not move."

"The categories were a bit strange and I didn't really pay attention to them, just pressed the first one. Otherwise the app is easy to use."

"App looks good! Easy to use and logical."

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**February 11, 2015 Group 1:**

Marjo: Vielä tuosta itse sovelluksesta: löytykö siitä kaikki toiminnot helposti mitä te tarvitsitte?

User 1: Löyty

User 2: Joo

User 3: Joo ne pari mitä me käytettiin ni joo

Marjo: Eli te teitte niitä merkintöjä?

User 1: Joo

Marjo: Oliko mitään virheitä tai jotain että se ei toiminu kunnolla tai..?

Person 2: Ei...

Multiple: Jotenki vähän hitaasti otti sitä että siirtyy sillä aikajanalla. Sitä se otti aika hitaasti.

Marjo: Ahaa...

User 2: Piti olla tarkka et teki sen tietyllä tapaa, se oli ainut

Marjo: Mihin liittyen se oli? Oliko se siis se aikajana mikä siin alhaalla näkyy?



User 1: Joo

User 2: Ilmeisesti se oli vaan et siit pitää painaa tai tökätä yhtä kohtaa tavallaan et se siirtyy sinne mut mä aina niinku pari kertaa yritin lähtee sitä palloa siirtää, niinku hilaamaan et pari kertaa joutu tökkää siitä

Marjo: Katoitteks te sitten useempaan kertaan jotain siitä eli kelasitte?

Multiple: Joo

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Marjo: Millasta teistä oli kattoo nyt uudestaan sitä omaa toimintaa?

User 1: Oli varmaan ihan hyvä et hetihän me huomattiin ne kaikki mitä ois voinu tehdä erilailla ja sillai noi on ihan käteviä tapoja myös oppia

User 2: Nii ja kirjottamalla oppii, mut kirjottaa sen ylös ja yhdistää vielä siihen kuvaan ni sillä tavalla hyvä

Marjo: Eli sen videon kautta te näitte uudestaan mitä...

User 3: Nii näki eri tavalla ne virheet ja sitten ihan ne hyvätki jutut

Marjo: Miten se video on sitten erilainen?

User 4: Tietysti se on toi hetki ku sä meet tonne, oot jännittäny vähän koko päivän, ja se on aina vähän semmonen, vaik toi oliko nukke , niinku, ei siin ehdi ajattelee kaikkee mitä sä teet

User 2: Ja tietysti ku sä katot sitä siin tilanteessa omin silmin, mut tossahan sä katot sitä tietysti jonkun toisen näkökulmasta tai seuraat sitä koko toimintaa ja omaa toimintaa

User 3: Nii ja ylipäättään et muistaa, ei sitä muista sitä kaikkee mitä tuolla teki mut nyt ku ne näkee uudelleen ni sit silleen niinku taas muistaa kaiken mitä on tehny ja

Marjo: Huomaaks siitä videosta sit eri asioita tai eri tavalla?

User 3: Ei ehkä eri tavalla mut erilaisia asioita kyllä, mä huomasin siin samanlaisia mitä mietti siinä ku käveli tuolt huoneesta ulos, ni mitkä vaivas, ni näki tossa videolla mut ehkä viel enemmän ehti pohtii

User 2: Omat virheet siin huomaa aina, niinku tos videolla huomas nytte mitä muutki teki

User 1: Et niinku kokonaisuutena koko ryhmätyö

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### February 11, 2015 Group 2:

Junnu: Mikä teil oli päällimmäinen kokemus mikä jäi tästä sovelluksesta?

User 1: No ihan kiva nähdä miten se oma toiminta siel ja ne huomiot, et vois jolleki toiselleki näyttää ja ne huomais sieltä ne virheet

Junnu: Oliko teil muilla eriäviä mielipiteitä?

User 2: No ei eriäviä, aika semmonen simppeli ja niinku yksinkertainen, ei ollu hirveen monimutkanen

Junnu: Koitteks te et tää ois niinku hyödyllinen esimerkiks vaikka tällasis koetilanteissa työkaluna

User 1: Joo

User 3: Joo

Junnu: Palautteen antamisessa?

User 2: Tos näytössä oli ainaki hyvä nähdä oma suorituksensa. Mut tietysti jos siinä samalla opettaja antais palautetta

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Junnu: Huomasitteks te tossa sovelluksen käytössä et siit puuttu joku toiminto mitä te olisitte halunnu käyttää?

User 1: Mä en tiedä, pystyks sitä vaan täppää siihen? Eiks se pitäny aina eka pysäyttää.. Huomas et ois halunnu jo painaa sen et se pysähtyis samantien, ku ne asiat menee niin nopeesti, niin siinä tuli viive

User 2: Jos se niinku pysähtyis ku painaa sitä kuvaa eikä sitä stoppii siinä

Junnu: Uskotteks te et käyttäsitte tätä toisteki? Tai haluisitteks te et tätä sovellusta käytettäis esim

User 2: Kyllä opetuksessa, juu

User 1: Just joku elvytysharjoitus osastollaki et se kuvattais ja käytäis yhdessä kaikki asiat läpi siinä, koska monesti ihmisillä on tosi eriäviä mielipiteitä jälkeenpäin et "kyllähän mä nyt siinä tein" vaik ei tehnykään, et toi on niinku dokumentti siitä et mitä siin oikeesti tapahtu

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**February 11, 2015 Group 3:**

- Junnu: Ihan tota ensimmäisenä et mikä jäi päällimmäisenä fiilikseks tästä sovelluksesta?
- User 1: Ihan hyvä et siinä pysty laittaa niitä täppejä, tavallaan niit huomioita
- User 2: Semmonen ihan opettavainen
- User 3: Ihan kiva
- Junnu: Löysitteks te siitä kaikki tarvittavat toiminnot?
- User 3: Joo
- User 4: En mä kyl tienny mitä mä tarviin, ehkä ei ollu ton kokeen jälkeen ollu enää keskittymistä
- User 2: Se ois voinu olla rhkä vähän mielenkiintoisempi se ulkoasu
- Junnu: Se sovelluksen ulkoasu?
- User 2: Nii, ne kaikki pause-painikkeet ja ne oli vähän tylsät, ja se merkintä, ois ollu kiva et se ois saanu valita jossain alussa ehkä, sen ulkonäön...
- Junnu: Huomasitteks te tossa sovelluksessa mitään mitä te parantaisitte? Ulkoasu oli yks.
- User 1: No se oli vähän sellanen nykivä se kuva, se oli vähän jäljessä
- Junnu: Okei, toi voi periaatteesa johtuu laitteesta, mut pitää tarkistaa esimerkiks toisen ryhmä videosta et olisk siin
- User 1: Siin elvytykses, koska kyl mielestäni se rytmis tein mut siin tuli sellasii ihmeellisii katkoksii

Junnu: Mä itseasiassa kokoajan kuvates ku katoisin sitä, kuuntelin ku osa laski ääneen niin se ei todellakaan menny samassa tahdissa sen kuvan kanssa et

User 2: Se oli vähän häiritsevä

Junnu: Oliko muita parannusehdotuksia

User 1: Ei ainakaan nyt tuu mieleen

Junnu: Haluisitteks te käyttää tätä esimerkiksi koulussa jonkinlaisena työkaluna, oli se sit palautte tai dokumentaatio

User 1: Kyl meil on tääl muutenki kuvattu simulaatioita et kyl ne edesauttaa

User 2: Ja sit niinku omaan käyttöön et itte näkee

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Junnu: Teil on täällä ilmeisesti joku simulaationlabra?

User 2: Joo

User 1: Joo

Junnu: Koetteks te et tätä sovellusta vois ehkä käyttää sen labran sijasta?

User 2: Mieluummin

Junnu: Mieluummin tää ku labra?

User 2: Mieluummin tämä. Silleen et ku tässä näin ku joku kuvaa sitä ni sit tietää et se yks on siinä et siel ei oo koko luokka kattomassa siellä mikä on tavallaan tosi häiritsevää

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**February 11, 2015 Group 4:**

Marjo: Mikä jäi päällimmäisenä vaikutelmana mieleen?

User 1: Sitä ois helppo kattoo myöhemmin uudelleen ja palata niihin kohtiin

Marjo: Joo, oliko tota.. Miltä se käyttö tuntu, oliko helppoo, hankalaa?

User 1: Kyl se aika..

User 2: Helppo

User 1: Nii kyl se sit ku ymmärs sen niinku perus

User 2: Näytti helpolta

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**Users' open question comments February 11, 2015**

"Ääkköset näppäimistöön"

"Ulkoasu mielenkiintoisemmaksi. Alussa voisi olla muutama valittava ominaisuus (ennen sovelluksen käyttöä) esim. merkinnän väri / fontti. En tiedä onko ks. ominaisuuksia"

"Enemmän aikaa tustua sovellukseen."

"Mielestäni sovellus oli helppokäyttöinen ja näppärä."

"Nyt oli liian vähän aikaa perehtyä."

"Hieman hidas -> kuva tökki"