

CHALMERS



OnCourse at Ericsson Academy **Using Android tablets to enrich classroom training**

Master of Science Thesis in Applied Information Technology

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OnCourse at Ericsson Academy

Using Android tablets to enrich classroom training

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Cover:
A Samsung Galaxy Note 10.1 running OnCourse, the app that was developed in this thesis project.

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Abstract

Tablets have recently become popular as tools in elementary schools in Sweden and many other parts of the world. To be able to really utilize them in educational activities more research is needed though. At the same time tablets can most likely be used equally well in professional training, but such education differs quite a bit from school education and even less research has been carried out in that specific area. This thesis project has investigated how tablets can be incorporated in classroom training at Ericsson AB in Mölndal. We have done this by both gathering and evaluating data and creating a hands-on prototype app called *OnCourse* for Android. The prototype allows Ericsson to without much effort test using tablets in their training to create a rigorous base for whether they should introduce tablets in full-scale in their training organization or not.

Our conclusion is that tablets really have the possibility to enrich professional training as a technical and informative as well as a pedagogical aid. However, more research is needed into the pedagogical possibilities in order for an app and tablets to be worth full commitment at Ericsson. Using it only as a way to present information and to access the Internet is not enough to justify their introduction considering the extra cognitive effort required by both instructor and learner during the course.

Keywords: training, tablets, active learning, Ericsson, collaborative learning, classroom, prototype, Android, education, learning, collaboration

Sammanfattning

Surfplattor har på senare tid blivit väldigt populära som hjälpmedel i grundskolan i Sverige och andra delar av världen. För att verkligen kunna utnyttja dem ordentligt även pedagogiskt krävs dock mer forskning i ämnet. Troligtvis går det även lika bra att använda surfplattor i yrkesutbildning på företag, men sådan utbildning skiljer sig trots allt en del från skolutbildning. Dessutom finns det ännu mindre forskning när det gäller yrkesutbildning med surfplattor. Det här examensarbetet har undersökt hur surfplattor kan användas i klassrumsundervisningen som Ericsson bedriver i Mölndal. Undersökningen har dels samlat och värderat data, dels skapat en fungerande prototypapp för Android, vilken vi valt att kalla *OnCourse*. Med prototypen kan Ericsson ordentligt och utan mycket mer resurser testa att använda surfplattor i deras undervisning för att skaffa ett rigoröst underlag för huruvida man ska börja använda surfplattor fullt ut eller inte.

Vår slutsats är att surfplattor faktiskt har potential att utveckla undervisningen en hel del, både som ett tekniskt-, informativt-, och pedagogiskt hjälpmedel. Dock krävs mer forskning kring de pedagogiska möjligheterna för att vår lösning med en app för surfplattor ska bli lönsam. Det räcker inte att låta surfplattan vara ett sätt att distribuera och dela kursmaterial och annan information på grund av den extra insats som krävs från både instruktör och kursdeltagare för att lyckas använda surfplattan.

Nyckelord: företagsutbildning, surfplattor, aktivt lärande, Ericsson, kollaborativt lärande, klassrum, prototyp, Android, utbildning, lärande, samarbete

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Glossary

API	<p>An <i>Application Programming Interface</i> of a software package such as a library or a platform defines the public interface (functions, structures, constants, behaviors, etc.) that an application programmer can make use of when she wants to use the functionality provided by such a software package.</p>
app	<p>A small application tailored for smartphones or tablets (although the definition is increasingly used for computer applications as well). Apps are typically distributed from a central market service on the Internet, such as Google Play, App Store or Windows Store.</p>
CPI	<p>The <i>Customer Product Information</i> is an umbrella term for all the documentation that comes shipped with the equipment that Ericsson develops and markets.</p>
DRM	<p><i>Digital Rights Management</i> systems attempt to control and restrict the manner in which content can be consumed, altered and/or redistributed by third parties.</p>
GUI	<p>A <i>Graphical User Interface</i> is the visual appearance of a program or application that is presented to the end user.</p>
ICT	<p><i>Information and Communication Technology</i> is a broad term sometimes used as a substitute for the older umbrella term Information Technology (IT). The addition of the word <i>Communication</i> emphasizes networks of interconnected devices and the role these networks have in tying into human social interaction.</p>
IDE	<p>An <i>Integrated Development Environment</i> is a program that eases the burden of a programmer by gathering useful tools in one place. It combines source code editing with compilation and debugging, and often provides immediate feedback on the correctness of the code as well as suggestions along the way.</p>
ILT	<p><i>Instructor-Led Training</i> is a term used by Ericsson Academy when talking about the type of training held in classrooms with lectures and exercises, and where the instructor and participants travel to the same physical location to attend the course.</p>

MyLearning	<i>MyLearning</i> is the learning management system in use at Ericsson globally. For our purposes, its most interesting function is its user database where the enrollments in courses of individual users are tracked.
QR code	A <i>Quick Response</i> code is a modern two-dimensional version of the classic barcode used in virtually all retail stores. QR codes come in different sizes and can hold much more information than a standard barcode.
Student coursebook	The materials that each course participant gets in a binder today at Ericsson Academy. Typically all of the Powerpoint slides presented during the course together with exercise materials constitute the Student coursebook.
VCT	<i>Virtual Classroom Training</i> works like ILT but with the difference that the participants are not necessarily in the same physical location. Therefore a tool is used to exchange information and facilitate live communication across the Internet.
WBL	In a <i>Web Based Learning</i> there is no live instructor, in contrast to ILT and VCT. Instead the course is developed completely beforehand and any amount of learners can go through the training on their own devices at any time and in their own paces.
WBS	A <i>Work Breakdown Structure</i> is a way to divide a project into manageable parts for which one can for instance estimate time consumption.
XP	<i>eXtreme Programming</i> is an agile development method that together with SCRUM has become quite popular, especially in the United States.

1 | Introduction

Since the introduction of Apple's iPad in 2010, tablets have quickly grown very popular in retail (The Daily Mail, 2012). As a consequence they have also started appearing in more and more places in the society as a whole. They are used in interactive information kiosks at museums, at fairs and trade shows, by real estate agents and in advertising to give only some examples. Yet another place where they are increasingly being utilized are in education (BBC News, 2013).

In Sweden, Information and Communication Technology (ICT) has come to take an increasingly larger part in the public school system in recent years. According to The Swedish National Agency for Education there is currently one computer for every three pupils in primary school, and out of these 10% are tablets (Skolverket, 2013). At the same time they note that more research and more teacher training is needed in order to really use the new resource that is now available. The push for an increased usage of ICT in public education has had ripples throughout society and companies are investigating how they can exploit the new technology in their setting. Though professional training at companies is in many ways similar to public education at schools there are also a few notable differences. When an employee is booked on a specific training, there is most likely a very specific and narrow learning goal (associated with a certain skill to be attained) and the employee typically has clear extrinsic motivation for taking the training, such as needing the skills to do his job or for acquiring a higher salary. In primary school on the other hand education has a much broader learning goal and pupils do not necessarily understand why they have to go to school, and therefore teachers have to put additional work into how to motivate the pupils. One can then wonder, do companies that conduct training for adults use new technologies to the same extent, or are they more conservative when it comes to introducing new learning concepts in general? Can professional training improve from using ICT and specifically tablets in its learning environment?

Large enterprises such as Ericsson AB often have dedicated training departments in-house that develop and deliver courses to their customers and within the companies themselves. The courses, at least in the case of Ericsson, resemble those given in schools in many ways. They are held in a classroom environment with a live instructor in front of the assembled class. There are lectures and exercise sessions. People raise their hands to ask questions. The instructor provides expert assistance and helps overcome learners' problems and misunderstandings. However, they still distribute printed course materials in binders and in Ericsson's case they are even in grayscale¹. Owing to Ericsson's great size it has numerous training departments spread throughout the world and these go by the name Ericsson Academy. Linus Eriksson who is manager of Ericsson Academy in Mölndal, Sweden believes that there is great potential in combining the worlds of professional training and ICT tools such as tablets. He is confident that both pedagogical, economical and user experience aspects of the training could benefit from incorporating tablets. As such, he reached out with a proposal for a thesis project into investigating the possible benefits of using tablets at Ericsson Academy, what risks were associated with using tablets

¹This is knowledge concerning the training at Ericsson Academy, provided by Linus Eriksson in October, 2012.

and what would be a suitable future course of action. We heard of this project proposal and approached Linus to find out more. A few days later, we paid a visit to Ericsson Academy in Mölndal and met up with him. It became evident that his ideas and wishes fit nicely with our academic backgrounds and so we decided we would take on the project.

1.1 Our personal aims

With our university backgrounds in computer science and engineering mathematics it is perhaps no wonder that we share interest in programming and user interfaces. Not only that, through our common master's programme *Learning and Leadership*, we have studied human sciences such as pedagogy and organizational topics which makes Linus's problem even more interesting to us since it can be approached from so many perspectives. From the very beginning our aim was to take the thesis work in a direction where we would not only give a theoretical perspective but also do some actual prototyping work, and Linus approved of this. Our task would be to evaluate how digital platforms, namely tablets, can be used to improve the customer experience at Ericsson Academy in Mölndal. This task can be broken down into partly the issue of improving course materials, partly into other aspects of training such as *the way* in which courses are delivered. By the introduction of additional ICT in the classroom (they already use desktop computers for practical exercises), opportunities are created for wholly new ways to give courses. Stakeholders in this matter are not limited to the individual learners and instructors though. The needs of the course developers would also have to be taken into account as well as the interests of the learners' parent companies.

1.2 The target audience

Our thesis project would constitute part of a solution to a perceived long standing need within the Ericsson Academy department to improve training and increase customer satisfaction. By looking specifically into what benefits ICT offers to the learning context, we aimed to improve the learning experience of the hundreds of learners who annually take courses at Ericsson Academy. Having the learners' needs in focus was very important to steer the thesis project in a direction that actually strived to add *value* to Ericsson Academy's customers. But project stakeholders were not limited to the course attendees. Others include Ericsson's course developers, instructors and other parts of the Ericsson Academy organization. We chose not to completely fix our target audience at the very beginning of the project, instead opting to make that decision further on when we would have more knowledge at hand.

1.3 Problem statement

Through this thesis it was our aim to process and ultimately give an answer to the following guiding question:

How could Ericsson incorporate tablets in their classroom training to improve course experiences?

We planned to approach this question by first reading in on literature on prototyping, app development and qualitative research methods. Then we would interview Ericsson Academy staff and course attendees, conduct surveys and observe the current state of the training given. Following that, we would develop a concept of a training app as well as a prototype of this app with key features implemented. There were three main reasons why we wanted to create a prototype in the first place: we believed many

good ideas would emerge along the way of an actual implementation, Ericsson Academy explicitly wanted a proof-of-concept to be able to continue the development based on our groundwork, and we personally find the process of programming creative and appealing. During the course of our *initial project planning*, we further concretized this problem statement into three missions (see chapter 5).

1.4 Scope and Limitations

Given the time frame we could not both investigate how to change the overall course structure from a pedagogical view, how the tablets can be used in practice and how Ericsson's existing infrastructure could accommodate these changes. Therefore our focus, in the end, lay only on how tablets can be used in practice in Ericsson's current training. To avoid tedious integration work with Ericsson's user databases real user data was not used. Furthermore, the course materials were assumed to look like they do today since we would not focus on how to pedagogically alter the structure of courses. Finally Linus did not want us to be restrained by organizational changes in the works, so we did not explicitly investigate how such changes would affect our work nor how our work would require changes in the organization. Ideally Ericsson would, when our work was done, have a clear notion of how (and if) to go about introducing tablets in their training.

1.5 Thesis outline

Chapter 2 is a suitable introduction to how Ericsson works with training and what a tablet is, but most of the report can be understood anyway. Chapter 5 covers how we initially planned our work, and together with chapters 6-9 it forms a complete description of our procedure. The reader who is just interested in our results is encouraged to check out both chapter 10 and appendix I to get the whole picture of what we achieved. Finally, chapter 12 gives the most short and concise walkthrough of what was done and what our conclusions are.

2 | Background

Any significantly large organization is bound to have a complicated organizational structure and Ericsson is no exception. We will now give an overview of how they organize the training they give today. We will also look at the details of tablets and what sets them apart from other computing devices. Our understanding of current procedures and methods at Ericsson Academy as reproduced in this chapter is based on interviews with staff, casual conversations and internal documentation.

2.1 Training at Ericsson Academy

Ericsson Academy is a department within Ericsson AB, a global actor in the telecommunications industry. They develop and deliver training, both internally within the Ericsson organization and to the operators who buy telecommunications equipment from Ericsson. Most of this training is presently carried out in the form of live classroom training, also called *Instructor-led training (ILT)*, either at Ericsson's own premises or on-site at the customer's. Some of the internal training is also given over the Internet as e-Learning or *Web-based learning (WBL)* as they call it. The development of new courses is markedly different depending on whether the course is to be given as an ILT or as a WBL, as will be covered in sections 2.1.1 and 2.1.2.

Within Ericsson there are several departments with varying roles all involved in training, and Ericsson Academy in Mölndal is but one of these. The internal organization surrounding ordering, planning, development, ownership and delivery of courses is quite complex so we will only cover it briefly. The Ericsson Academy department is a delivery organization, meaning that the department does not own the courses it develops or delivers. It merely receives requests for courses from other departments and carries out the order. If a suitable course does not already exist it may be developed, otherwise the existing course materials can be reused. Since each course along with its materials is considered an asset, course materials are not freely available to customers and there are rigid rules governing their distribution. For instance, ILT attendees get a single copy of their course materials given in a grayscale paper binder.

2.1.1 Instructor-led training

In the classroom environment courses consist of traditional lectures mixed with hands-on labs when appropriate. The presenter's slides for each lecture and each exercise are handed out in one or several paper binders called the *Student Coursebook* at the beginning of the course so that the learners can make notes in them. One day at a course can for instance consist of four lectures and two exercises, and these six parts map to one chapter each in the binder. When the course is over each learner gets to keep her binder(s). Together with the user technical manual for the product being learned, referred to as the *Customer Product Information (CPI)*, these two serve as the primary knowledge base in the technician's everyday work. The Student Coursebook is actually most often the Powerpoint slides, printed together with slide notes when available. The print is in grayscale to save printing costs. The slide notes were

originally intended for the instructor only, but since the learners get their copies the target has shifted towards providing additional notes for the learners. To prove their achievement each learner gets a printed and signed certificate at the end of the course. However, since there are no tests to pass the only requirement to get a certificate is to attend at least 75% of the course. Ericsson Academy does not want to mark grades on individual learners or in other ways unduly impact their prospects within their own companies. Its role is to provide training, not to assess learners' abilities.

2.1.2 Web-based learning and rapid e-learning

For a few years, Ericsson has been supplementing their traditionally developed ILT courses with web-based learning courses, WBLs. When new courses are ordered for in-house use only, they are often developed to be delivered online without a live instructor. The benefits of developing WBLs include reduced delivery costs and a potentially much larger audience at the expense of steeper development costs and a more rigid and static course structure. On the one hand, courses can be very polished and include various forms of interactivity to facilitate learning, but on the other hand it can be much harder to develop a one-size-fits-all course which suits different kinds of learning styles and tailors different cultures. Although generally implicit and taken for granted, the instructor can and does during ILT training adapt both content and presentation style to the target audience, whereas WBLs lack that possibility for adaptation.

The feasibility of developing a course as a WBL as opposed to a traditional instructor led course is dependant on many factors. Among these are its development budget, the kind of learning outcome that is desired (mere factual knowledge vs. hands-on proficiency, for instance) and the level of uncertainty in the prior knowledge of the learners, hence the necessity for facilitating customization at course delivery. To give an example of a successful WBL course where the format was well chosen, there was a recently developed course in Ericsson's anti-corruption policy which is a mandatory course for all Ericsson employees. One can safely bet that this course would be much more expensive to give traditionally as a live classroom course given the enormous target audience.

Ericsson Academy is at times tasked with creating *rapid e-learning*s. These are really regular WBL courses that are built from the foundation of an existing ILT course and can thus be seen as adaptation projects. Having an ILT teaching material available saves time and cost during development of the WBL as opposed to creating a wholly new course. The drawback is that while it is possible to simply reuse PowerPoint slides and other presentation materials with minor adjustments it may not be optimal from a pedagogical perspective, since such slides are meant as a teaching aid and are therefore usually not self-explanatory. Besides, the ILT course materials have been designed for live delivery and WBL materials are not. Labs and exercises may also have to be redesigned to accommodate for the asynchronous delivery of a WBL, i.e. that the learner has no direct communication with any instructor. The course developer will have to try to anticipate the most common questions and pitfalls the learner may encounter.

2.1.3 Virtual Classroom Training

The Internet allows for new ways of collaboration, especially over great distances around the world. Since Ericsson is a global company with both offices and customers all over the world and travel costs are a concern they have, as a test, started to conduct part of their internal training using *Virtual Classroom Training* (VCT). This works like an ordinary live classroom lecture, with the difference that each learner might sit in their own part of the world in front of a computer screen where they can see the instructor lecturing, chat with peers, talk to each other over voice and receive other materials and documents online. Therefore it can be regarded as a mix of traditional classroom training and e-learning. The main advantage with VCT is that expensive travelling can be avoided while still keeping the so important

live communication between instructor and learner. Still, traditional classroom training is the dominant means of giving training to outside customers since that type of training is well known and proven to work all over the world.

2.2 Tablets

Tablet computers have been available in various forms for a long time but it is only in recent years that they have really gained momentum in retail. A modern tablet computer (or simply tablet) as we define it in our work can be described as a hybrid device between a smartphone and a laptop. It has no physical keyboard and a screen size usually ranging between 7 and 12 inches covers most of the device's front. There are several software platforms on the market for tablets, the two largest being Apple's iOS and Google's Android. The former is exclusive to Apple's iPad range of devices while the latter can be found on numerous devices from a lot of different manufacturers. If the device sports a digitizer Android supports stylus input while iOS is designed solely to be used with fingers or equivalent pointing devices.

Applications on tablets are popularly known as "apps", and though many apps can be running simultaneously the philosophy has been that only one of them can be visible on screen at a time. This philosophy has begun loosening recently, with devices that can present two or several apps at once. Compared to the standard A4 paper format a tablet with a screen size of 10 inches is roughly half as large, i.e. about as large as an A5 paper sheet.

While these modern tablets use special operating systems, rely heavily on touch interfaces and are really quite different from ordinary PCs or laptops, the early tablet designs had a lot more in common with traditional computers. It was only with the release of Nokia's 770 Internet Tablet in 2005 and, perhaps more notably, with Apple's iPad in 2010 that tablets really found their own niche and started to gain traction. Presently, Android powered tablets have surpassed iPads in sales¹ while Microsoft is pushing for its own tablet platform. Tablets and smartphones are steadily becoming ubiquitous in the western world and with readily available high speed Internet connectivity through cellular networks and WiFi users are finding new uses for these mobile devices. It has been predicted that global tablet sales will surpass those of laptop computers as early as 2014².

2.3 Introducing technology in the classroom

Over years past researchers have looked into various ways of improving school education by introducing computing devices (Naismith et al., 2004). In Sweden as in many other countries, there have been numerous national initiatives to push ICT adoption in schools. In the mid nineties for instance, the push was for schools to offer computer rooms with desktop PCs for word processing and other tasks. Meanwhile research on using the mobile devices of the time such as Pocket-PCs in schools was gaining momentum. This was followed by the one-to-one programs of the early 2000:s which equipped every pupil with a personal laptop PC. In recent years many schools have shifted over to offering tablets instead of laptops. Clarke et al. (2012, p. 5) who are engaged in promoting tablets in schools summarize the key reasons for this happening in the UK in the following way:

While several trials have run in schools in the UK in the past five or six years with one-to-one devices (such as notebooks and laptops), infrastructure, cost and maintenance,

¹See for instance <http://www.businessinsider.com/android-ahead-of-ios-tablet-market-share-2013-5> (available 2013-05-22)

²See <http://www.techspot.com/news/52061-tablets-to-outship-desktops-this-year-notebooks-next-year.html> (available 2013-05-21)

and lack of teacher training have appeared to be restrictive factors in their widespread adoption. Tablets, it seems, offer a faster, easier, cost effective and more manageable route to giving every child in secondary school access to the Internet at home and at school, and to the potential of providing the best educational content through each child having their own device.

Through the British non-profit organization FutureLab, Naismith et al. (2004) have published a review of previous and ongoing scientific work in mobile technologies and learning, though at the time of the article's publication smartphones and tablets were not yet mainstream. Naismith et al. (2004) recognized that mobile technologies were still emerging, but held great potential. They accurately predicted that mobile computing would become more and more ubiquitous and that as the capabilities of the devices increased and their costs decreased we would see these devices enter the classroom in a whole new way.

3 | Theory

This chapter gives a brief introduction to theories of learning and organizational change. Though these two subjects have not explicitly been the focal point of the thesis project, our previous subject experiences have made them permeate our work. An overview of these matters will help the reader understand many of our choices during the thesis project.

3.1 Education, training and models of learning

What is learning? According to Lundgren et al. (2010, ch. 5) learning is a very broad term, both in everyday life and in science. In essence one has to know on which philosophical foundation the person who talks about learning stands. During the later 19th and early 20th century a number of different models on how learning works were developed. The earliest of these is called *behaviorism*, which dwells on the thought that our complete behavior is based on actions taken as a natural response to some stimuli. One of the most well-known experiments within behaviorism is *Pavlov's dogs* (Pavlov, 1927/1960/2003). Each time a dog would get fed a bell rang. After a while no food was presented when the bell rang, but the dog still increased salivation. This implied a successful *conditioning* of desired behavior.

Other researchers were not convinced that behaviorism could explain human behavior. Two philosophies, quite opposite in nature, are constructivism (often attributed to Jean Piaget) and Lev Vygotsky's sociocultural tradition (Lundgren et al., 2010). In short, Piaget's philosophy is based on learning coming from the individual, that she would deal with information and construct knowledge in a number of stages during cognitive development (Flavell, 1996). Vygotsky had the opposite view in that society and education builds individuals in a social and cultural context through *mediation* and the usage of *mediating tools* (Säljö, 2010). The most central of these is the *psychological tool* language. In other words, communication (and thus language) is crucial for learning. The other class of tools that Vygotsky introduced is *physical tools*, of which the modern computer can be taken as an example. However, he says, in order to be able to *appropriate* (learn) new knowledge, it needs to be within the so called *Zone of Proximal Development (ZPD)* (Phillips and Soltis, 2004). This means that the new knowledge cannot be too advanced compared to what the learner already knows, it has to be close enough to the learner's pre-existing knowledge base.

A popular philosophy in USA in the first half of the 20th century was *pragmatism*, usually associated with John Dewey and his famous phrase "learning by doing" (Dewey, 2004). Here emphasis lies on the pupil, that learning needs to be tailored for each individual, and that practical work needs to be intertwined with more theoretical education.

We are today living in a "knowledge society" in that services and work related to knowledge has come to have a much larger impact on the economy (Lundgren et al., 2010, pp. 122-123). Conveying knowledge and developing competences is very important in such a society. Today the term competence has actually in many ways replaced knowledge in education to reflect that it is hard to know which specific knowledge

is needed in a certain context. In other words, it is better to gain proficiency in various competences that in turn enables the individual to search for relevant knowledge when needed than to learn things that may not turn out to be useful in future work.

When it comes to the actual teaching situation Dyson (1997) among others describes the quite intriguing relation between learning and teaching as much more complex than simply transferring knowledge from teacher to student. Each student has their own culture, values, agenda and notion of how education works which makes them thinking subjects in the classroom rather than simple objects that absorb knowledge. Thus, it becomes important to involve students in the learning process and not treat them as if they are only passive recipients of knowledge.

3.2 Organizational change

According to Nadler and Lawler (1990), one can divide organization change into types on the scales incremental/strategic and anticipatory/reactive. Together they form a grid, as seen in table 3.1 of four types of organization change. In one end *Tuning* means that small changes are made to prepare for anticipated future outside changes that will affect the organization. In the other end *Re-creation* means that an organization has to radically change as a consequence of something that has already happened. *Adaption* and *Re-orientation* are then the two other combinations of the above categorizations. In the context of projects, Maylor (2010, pp. 53-55) also defines organizational change as one of two divisions of types of projects that organizations strategically deploy, where an organizational change type of project does not immediately earn any money but enables other projects to succeed. The other division is simply all service or product projects which are planned to earn revenue.

	Incremental	Strategic
Anticipatory	Tuning	Reorientation
Reactive	Adaption	Recreation

Table 3.1: *Two dimensions of change give rise to four types of organizational change*

The nature of a specific organizational change can also differ. Jacobsen and Thorsvik (2008, p. 414) mention four types of changes: task, technology and strategy; organizational structure; organizational culture and behavioral processes. The first type changes how current tasks are carried out, the second e.g. management positions, the third is concerned with core values, while the last one changes e.g. ways of communication and how decisions are made. On top of this one can also explore organizational change among many organizations or just one, and on changes that happen without the influence of any human being in contrast to changes created by people. The most commonly investigated organizational change though is *planned change*, i.e. changes issued by people in one single organization (Jacobsen and Thorsvik, 2008, p. 418). A planned change is in summary when the organization has seen some kind of external change that they need to take action on, analyzed this change, decided how to change their own organization and then executed that change through some change strategy.

In today's fast changing world it has become increasingly important for organizations to have a high *adaptability*. High adaptability requires the organization to be sensitive to outside changes to avoid reactive changes. In addition organizations who are well aware of mechanisms of *resistance to change* have a higher chance to succeed when doing organizational changes and can then adapt faster and more often. Jacobsen and Thorsvik (2008) address ten main reasons for resistance to change. Some of them are fear of the unknown, change in power relations, resource demand, possibility of personal loss and extra work. All ten are quite logical but nonetheless need to be taken into account if a change is to be successful. What does then characterize successful organizational changes? Jacobsen and Thorsvik

(2008) list six main factors, that are actually close to some of the types of resistances above. There needs to be clear communication as to what will be changed, what will *not* be changed, successful parts so far in the ongoing change process and also a clear vision of the goal ahead. Furthermore there needs to be a notion of crisis, that if nothing is done the organization will not survive. All in all awareness and planning are key in successful organization change.

4 | Methods

With the previous chapters' knowledge in mind it is now time to look into which methods could be used in the execution of this thesis project. The three main topics to cover are on how to acquire relevant and useful data on requirements and needs, on how to devise prototypes and on different methods of software development.

4.1 Data acquisition

An early task in just about any project is that of data acquisition. The methods used and the extent of which the acquisition needs to take place varies extensively depending on what type of project is at hand. In the context of learning and education Dimenäs (2007) mentions seven methods or tools to use in the context of learning and education: *surveys, interviews, observation, documentation and literature, theory and self reports*. The last one might be worth explaining a bit further. A self report means that a test subject is asked to write a story, draw a picture or similar, and the result is then analysed to understand some phenomenon related to the given task. The first three of the mentioned tools have the advantage that it is possible to ask follow-up questions and talk to the respondents during the data acquisition. On the other hand, the methods documentation, literature and theory have the advantage that there is (usually) more thought behind each word. It must be stressed that these two groups of methods are complementary. Searching for relevant literature and theory may take a lot of time without giving much results though, and observations can take even more time.

4.1.1 Surveys, interviews and observations

Surveys, interviews and observations are all forms of study that generate quite raw data. They can be conducted on a scale from completely quantitative to completely qualitative. A quantitative study is, simply put, concerned with numbers, i.e. with the questions *when, what, who* and *how much* (Troost, 2010, ch. 2) while qualitative studies seek to answer the questions *why* and *how*. Closely related is how structured and standardized a study is. Troost (2010, pp. 39-42) describes these as, respectively, whether there are set response options to a given question or the question is open, and whether e.g. each individual interview looks the same or if they are different depending on what unfolds as the interview progresses.

When conducting surveys, interviews or observations it is important to consider the reliability and validity of the study. The *reliability* is concerned with the degree to which the study yields consistent results. In the case of a survey, it is relevant to consider how much one has mitigated the effects of random errors in the gathered data. For instance, one must consider how likely it is that a respondent interprets a given question in the manner that was intended by the survey maker (Troost, 2001, pp. 59-62). One can increase the reliability by e.g. having multiple questions address the same underlying issue but having them formulated in slightly different ways and possibly spread throughout the survey. In this way the respondents are given several opportunities to interpret what is intended and a single misinterpretation

from a respondent will have a smaller overall impact on the results of the study. The *validity* of a study concerns to what extent it really measures what the author intended to measure. It may be that a study gives very consistent results if repeated (i.e. it has high reliability) but that the questions asked or actions observed are really not useful or relevant in answering the question(s) at hand (Trost, 2010, pp. 131-135). It is therefore wise to think carefully about the exact wording of questions.

4.1.2 Attaining informed consent

When conducting a study involving other people it is crucial from an ethical point of view to attain all participating subjects' *informed consent*. This means that the researcher needs to ensure that the subjects understand and approve of the objective of the study they take part in, that they are aware of any risks involved and that they understand that their participation is completely voluntary (to the extent that they may opt out at any time, even after first deciding to participate). While this may at first seem obvious and straightforward, oftentimes it is not. Researchers need to balance the amount and the nature of information given to the subjects beforehand in order to not put them off while still not appearing (or being) manipulative. In some instances, the researcher may justifiably fear that if prospective study participants had a completely accurate picture of the nature of the study this might either induce them into declining to participate or influence their behavior in a way that skews the end results of the study.

On a related subject, participants withdrawing their consent at a late stage of a study can impede the research because whole corpuses of data may become unusable when their parts are excluded (Wiles et al., 2004). Furthermore, loss of participants degrades the breadth of the data collected and reduces the quality of conclusions drawn therefrom. This is especially severe in studies where statistically reliable quantitative conclusions are sought. When publishing raw data acquired in interviews or surveys, it is important to protect the anonymity of the individual respondents. This is partly because a respondent should not be at risk of being held accountable for dubious or questionable statements, and partly because the target audience reading in on the data should be able to do so without being overly influenced by irrelevant information which might bias their understanding (consciously or subconsciously). For instance, in a study on how firefighters perceive compulsory physical tests in their profession, it might be justified to mask out the gender of individual respondents in addition to their names not only to protect the respondents' anonymity but also to prevent stereotypical biases in the mind of the reader. Of course, it could just as well be argued that the gender is in fact very important in this case and should be disclosed on the very ground that the responses in the study may correlate to gender. As we see, researchers are forced to balance the aspect of anonymity and individuals' interests against the scientific principle of transparency and full disclosure.

4.1.3 Documentation, literature and theory

As opposed to the studies mentioned in 4.1.1 documentation, literature and theory all present already analyzed data and information. They are primarily used to gather enough information to be able to do a relevant and informed analysis of the present situation. They are also useful when the one who possesses needed information is no longer reachable. Dimenäs (2007, ch. 7) mentions a common pitfall when it comes to literature that has become more widespread now that Internet allows for easy information seeking, namely that learners tend to just duplicate information from the source to whatever it is they have been tasked to do rather than really processing their own question. The learners will that way not learn much at all, except possibly information literacy. For all tools mentioned so far, but especially for the last three, source criticism is of uttermost importance. One has to always have in mind what the author's own interests are to evaluate data and claims.

4.2 Prototyping

In the development process when creating a new product there are various methods how to create test versions of the product, usually called prototypes, that each have their strengths and weaknesses. Depending on the desired scope of the prototype one may need to employ a more or less rigorous process. Before choosing a specific prototype method the most important decision to make is exactly what properties of the product are to be investigated and to what extent. Usually a given prototype is said to have either high or low fidelity, but in order to compare different prototyping methods effectively the granularity needs to be higher (Arnowitz et al., 2007, p. 11).

Snyder (2003, p. 260-262) chooses to divide fidelity into four dimensions that a given type of prototype has: breadth, depth, look and interaction. Depending on what the purpose of the prototype is some of these four dimensions may be more important than others. *Breadth* is about how many of the features that the finished product is supposed to have are present in the prototype, *depth* defines to what extent these features really work as they would when finished, *look* how much the prototype looks like the real deal and *interaction* whether user created events really unfold as they would in the finished product.

One method to do prototyping of graphical user interfaces (GUI:s) is called *paper prototyping*. All the parts of the user interface that will be tested are drawn on paper. When testing the test subject sits on one side of a table while one person acts as the computer by switching papers in front of the test subject according to what he or she does with it. Preferably a third person observes and makes notes about what happens. The main strengths with this method is that it is cheap and that it takes very little time to both create the prototype and to adjust and improve it as testing progresses. Both breadth and depth depend mostly on how much time and effort one puts into preparations. The main weaknesses on the other hand are that the interaction is not at all close to the real product (the interaction is in low fidelity), and the look is quite basic (Snyder, 2003, ch. 12).

There are numerous other methods for prototyping, all suitable for various stages in the development process. Just to mention a few one can use *wireframe prototyping*, *storyboard prototyping*, *wizard of Oz prototyping* and *coded prototyping*. Wireframes are usually used in the very first stage of initial design when a rough concept of a design is needed in preparation for more extensive prototyping like coded prototyping. Storyboards on the other hand is a collection of scenes that form a use case and thus prototypes interaction rather than design. Coded prototyping is simply speaking a digital version of paper prototyping with much greater opportunities to test visual design and interaction. It does however take considerably more time than paper prototyping, but can on the other hand be used as a basis for the final product. Finally, the wizard of Oz method is a way to test interaction aspects of a feature that would require too much time to implement in a coded prototype. Instead the feature is simulated by a person whereas the tester interacts with the prototype as though it was real. One example is automatic communication with a central server. The "server" is then actually a person responding as quickly as possible instead of a real computer. (Arnowitz et al., 2007, ch. 7)

4.3 Programming

Unless a programming project only consists of one person and has no restrictions on time some kind of method how to go about implementing the software is needed. The more people involved, the more explicit the used method needs to be. One way to work is the infamous *waterfall* method where everything is done in one long sequence without feedback along the way. Whether this method actually exists or is just a theoretical antagonist to other methods has been disputed for many years though (Weisert, 2003). Still, there are many software development methods, like RUP (Rational Unified Process) (Kruchten, 2004), which could be said to be based on traditional product development where

all parts of the process really need to be done in sequence. Another common concept in software development today is that of *iteration*, which all *agile methods* make use of. Agile methods have sprung from the Agile Manifesto (Maylor, 2010, p. 394) from 2001, which was written as an antithesis to current development methods at the time. While there are numerous agile development methods, the two most common ones are Scrum and Extreme Programming (XP) (Beyer, 2010, ch. 2). Shore and Warden (2003) go through the rather extensive XP method and its parts thoroughly, but stress that adoption of any method can never succeed if one just tries to implement the techniques in one go. Adoption takes time and requires a lot of effort from all parties involved, and the method always needs to be tailored for the specific setting. Furthermore ways of thinking and people behavior are just as important as the actual techniques used. One of the techniques in XP is *Pair programming* (Shore and Warden, 2003, pp. 74-82) where one person writes code (the driver) and the other sits right next to her and thinks ahead. This is a way of sharing knowledge within the team while reducing errors and generally improving quality of code. An alternative is formal code inspections where programmers inspect each other's code in retrospect. Another technique used is called *Incremental design*, which means that each new part of the program is done just enough to handle what is needed at the time. It is then extended later on as more functionality is needed. By doing so the program as a whole is runnable almost at any time.

5 | Initial planning

It is now time to move on to what was done during the thesis project. Before actually starting to work on the thesis project for real, though, we had to come up with a plan how to go about looking at the problem at hand - and to help us understand the problem itself. The document that was produced as a result of the work outlined in this chapter can be found in appendix A. After two initial discussions with Linus Eriksson at Ericsson Academy our understanding of the problem at that time led to the following problem definition:

How can Ericsson streamline course design and add value for their course participants by replacing course materials distributed on paper with a digital platform for tablets?

This question is in essence the *original version* of what ultimately came to be our thesis project's problem statement, as defined in section 1.3. As one can see it was a bit more specific at this point, emphasizing the replacement of printed course materials. As the thesis project evolved and we got a deeper understanding of Ericsson's needs focus shifted slightly though, which also changed the wording of our problem statement. To go about answering this question we laid out three overall missions that together would shed light on the problem.

- Identify how Ericsson Academy works with training both internally and externally today.
- Investigate how other companies and "learning institutions" use digital platforms today.
- Create a basis for determining how Ericsson should introduce a digital platform in their classroom training that could replace course materials on paper.

Using the breakdown into these three overall missions, we started to propose even smaller tasks that would make up the thesis project and tried to estimate their individual time scopes. With these tasks in mind, it was necessary to consider what relevant knowledge and tools we had available from previous studies and what new knowledge we would need to acquire.

5.1 Our competence areas

We recognized that we have solid knowledge in programming in general and the Java programming language in particular. We are also proficient in pedagogy, education, organizations and organizational change, which again was why this particular thesis project seemed like a perfect fit for us. At the same time we knew that we would need to read up and gather a lot more knowledge when it comes to the Android and iOS platforms, web programming, interview methodologies, surveys and interaction design. These were the key areas we identified as crucial for the project but where we lacked necessary knowledge.

5.2 Method

We planned to fulfill the first two missions by interviewing employees at Ericsson Academy as well as their customers and by conducting surveys with current and past customers and other companies in the same business area. In order to plan and do this we would need to learn more about interview and survey methods. Based on our studies' findings we would then develop a software prototype aimed for tablets, either as a native app or as a web app. The actual coding would take place in two sprints, and the resulting prototype would be *one* answer to the third mission. Before deciding on the exact methods for both evaluation of gathered data and development we would need to study these competence areas though.

5.3 Time estimates

Table 5.1 shows a weekly breakdown of the thesis project. In total, we planned to work for an equivalent of roughly 16 "Chalmers weeks" which corresponds to 20 "ordinary" university weeks, i.e. the time frame of a Master's Thesis.

Get to know Ericsson's organization and plan the thesis project, read literature	two weeks
Plan and conduct interviews with employees and course participants	two weeks
Understand and get to know Ericsson's backend systems, databases etc	one week
Create a prototype sketch	half a week
Sprint 1 - code a first prototype	two weeks
Evaluate first sprint	half a week
Sprint 2 - further develop the prototype based on feedback	two weeks
Evaluate second sprint	one week
Finish prototype, Report to Ericsson	two weeks
Finish thesis, oral presentation, opposition	four weeks

Table 5.1: *The project plan, dated October, 2012*

The first few weeks would be used for project planning and to get to know Ericsson Academy, their processes, ways of working and how they distribute information today. We would also conduct interviews with staff in the department. As a result of all information we had gathered we would decide on what kind of solution to develop in order to answer the initial problem statement. This could be, for instance, an app for tablets. At this point we had not yet fully decided on this matter. We planned to focus on investigating how the solution could be integrated with already existing databases and Ericsson's organization as a whole. That work would enable our recommendation to precisely tell Ericsson which changes would need to be made to implement our solution. We planned to wrap up the thesis project with a dedicated period of writing the thesis itself.

6 | Pre-study

Since the thesis project would span seven calendar months we figured that rigorous planning was called for and that our initial planning in chapter 5 would not suffice. This chapter details how we carried out planning and literature studies during the first seven weeks and what decisions were made during that period of time. This planning should be seen as an extension of the initial planning described in the preceding chapter. As a complement to reading this chapter the reader is encouraged to read Appendix B (in Swedish), which contains the resulting project plan that we used as a base for continued replanning throughout the thesis project.

6.1 Planning large projects

Project management literature is abundant with extensive project models and methods for managing large projects (Maylor, 2010, pp. 12-16). In these models, careful planning is oftentimes emphasized as a key success factor. Having good planning is important in order to anticipate and ideally avert issues, but one has to be careful not to overdo it. Any project management model is only useful if adapted to the local conditions that govern the project in question. After all, a key characteristic of a project is that it is unique, that there has never before been one quite like it (Maylor, 2010, ch. 1).

For this thesis project we decided to make use of the Swedish project model *Lips* (Svensson and Krysander, 2011) as the primary support for project structure and planning. This model was chosen because it is especially tailored for an educational context and has a high scalability (Svensson and Krysander, 2011, p. 14). The Lips model encompasses a set of useful document templates which can help the project manager to work systematically and we specifically used the Project Plan template (Svensson and Krysander, 2011, pp. 97-108) when planning how to structure the thesis project.

6.2 Wrapping your head around the problem

Our task at hand, to evaluate and improve education at Ericsson through ICT, proved hard to confine, meaning that we had a nice wicked problem (DeGrace and Stahl, 1990) before us. While Ericsson Academy did provide us with a problem statement of sorts they stressed that it was loose by design and that they did not want to give out too much information beforehand. They did not want us to be too influenced in our thinking by internal affairs or notions of what was impossible or undesirable with company management. Instead, we were told to keep an open mind and assume that everything was possible.

One of the most important aspects of project success is that one needs to truly understand the real problem before attempting to solve it. This is by no means trivial given that the client scarcely has the whole picture nor the ability to fully phrase the intended goals.

We spent the first few weeks at the company getting to know our new colleagues and trying to understand the structure of the business as a whole. This was important because as we set out to propose and develop a new technology and teaching aid, we recognized that its rollout would require planned organizational changes in both processes and in mindset. Ericsson is a global employer with in excess of 100 000 employees spread across more than 180 countries ¹. Quite naturally, such a large organization comes with quite a bit of organizational complexity. Trying to understand our task as thesis workers in order to plan it properly was dependant on understanding the needs of Ericsson Academy and Ericsson in general. Jacobsen and Thorsvik (2008, ch. 7) notes that organizations are made up of individuals and groups with different motivations and agendas that influence the ability of the organization to change. The sheer size of Ericsson almost guarantees that there be conflicts of interest, both explicit and implicit².

We had a meeting early on where our client gave his picture of Ericsson’s different business units and how they are all interconnected. His summary is presented in figure 6.1. After this meeting, we concluded that one important aspect of the thesis project was to find an alternative solution to the current binders, that tablets would somehow be involved, and that the thesis project should take the form of an *investigation* as well as an *implementation* of software. We would, when deemed necessary, not limit ourselves due to existing policies or other hinders at Ericsson. Instead we would proceed as though every hinder could be bridged. This did not mean, however, that we forfeited issues of organizational change altogether, it just meant that these were subordinate and were not to limit our creativity.

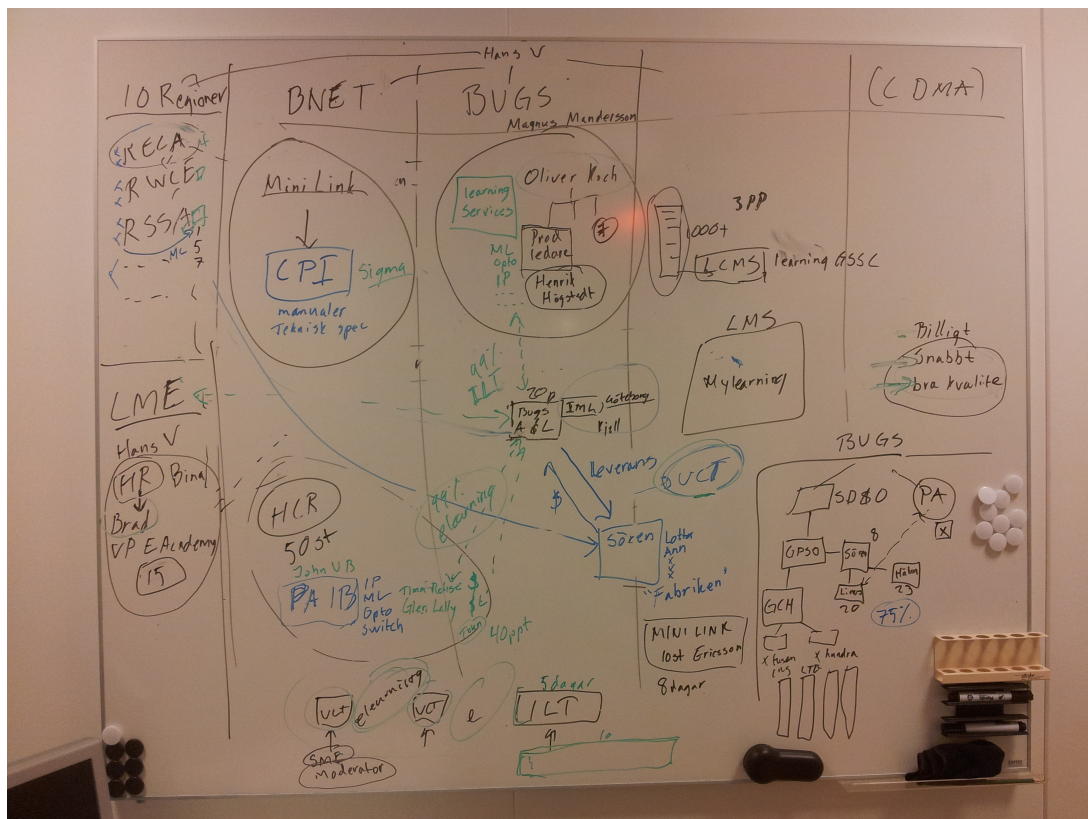


Figure 6.1: An overview of Ericsson’s complex and entangled organizational structure

¹See <http://www.ericsson.com/thecompany> for more information (available 2013-06-04)

²Lecture in *Leading in organizations*, Jan Wickenberg 2012

6.3 Classroom visit

As another part of getting to know Ericsson and planning the thesis project we attended a technical course early on called "MINI-LINK TN"³. Our focus during the course was on observing how it was carried out in general and how the course participants used their binders in particular. We got a few ideas from this first observation. For example, we noted that each classroom at the training center where courses were held had a SMART Board⁴ mounted on the front wall in addition to a typical whiteboard but that it was currently not utilized to its fullest potential. It was simply used as a regular video projector. We wanted to somehow find more creative use for it. We also noticed that while some learners made notes in their binders others hardly even opened them at all.

As described in section 3.1 the inner workings of the school teaching situation is quite complex. Pupils are not simply fed with knowledge, but they are critical subjects. We believe that adult professional training is even more complex. Lundgren et al. (2010, pp. 541-542) note that differences between learning for adults and children cannot be due to biology nor experience, but that one possible distinction is that of motivational factors. Adults may also have a clearer picture of what they need to learn. Furthermore, since the learners at Ericsson Academy come from various cultures all over the world (in this particular MINI-LINK course there were nine learners and four nationalities) and we have previously mostly studied the Swedish educational system it would be quite hard for us to try to change how the actual teaching is done in Mölndal. On top of that, to answer the fundamental questions in teaching, *what* and *how*, we would need a lot of knowledge in Ericsson's equipment. To be able to enhance the entire range of classroom courses at Ericsson Academy it would therefore be wiser to focus on how to facilitate the instructor's ability to develop well grounded training by introducing a new teaching aid.

6.4 Resources at hand

We were informed that costly resources such as development hardware or other items would be provided to us upon request when needed. We used our own personal laptops for developing but needed tablets to target. In order to avoid having to decide on a target platform at this early stage we received an Android based ASUS Transformer Pad TF300T and an iOS based Apple iPad. Depending on which platform we would choose more resources would possibly be needed later on. As an example of this Macintosh computers and Apple Developer licenses⁵ would be needed to be able to develop apps for the iPad. This type of decision was postponed until we would start creating the prototype so that we did not "close any doors" just yet.

We were given access to virtual remote desktops which we would access from our laptops and we were given email addresses on the @ericsson.com domain which we would use to send "official" email inquiries later on. We were also given two designated desks in Ericsson Academy's Mölndal office landscape. This gave us close access to the instructors working in Mölndal and made us feel part of the team. We anticipated that the close proximity to colleagues would be very useful later on in casual over-the-desk conversations which are so valuable and complementary to formal interviews and other methods of data acquisition.

³MINI-LINK is a microwave technology brand of Ericsson's

⁴SMART Boards are electronic whiteboards manufactured by SMART Technologies (<http://smarttech.com/smartboard>, available 2013-04-22). The units observed at Ericsson Academy in Mölndal combine a top-mounted video projector with a touch-sensitive whiteboard screen, four "colored" plastic pens and a whiteboard eraser. The pens and eraser allow the instructor to draw and annotate the displayed picture and the annotations can be saved on the computer for later distribution to class attendees. The position of the projector allows an instructor to stand in front of the screen without casting a shadow which obstructs the picture.

⁵see <http://developer.apple.com> (available 2013-05-20)

6.5 Time planning

The Lips model divides projects into three phases; the *planning phase*, the *execution phase* and the *closure phase*. A rough overall time plan was that the first fifth of the thesis project would enclose the planning phase while the last fifth would enclose the closure phase or in other words writing the thesis and a report and executive summary directed towards Ericsson. Between these the actual investigation and implementation would take place. This meant that time was the limiting factor in how thorough the data gathering could be and how many features could be implemented in the prototype, as opposed to the feature specification dictating the time schedule. By the semester schedule from our master's program at Chalmers we planned to have a work pace of half-time the first five months, after which we would go up to full-time for the remainder of the thesis project.

Before starting to code we planned to conduct interviews with the employees in the department and surveys with past course participants. Then we would somehow (the exact method would be decided later on) assess the gathered data and produce a concept idea on which the prototype would be based. The actual coding was initially planned to proceed in three iterations, but when we laid out our time (see figure 6.2) we quickly came to the conclusion that we would only have time for two iterations (or else they would be too short). We planned to perform continuous testing by ourselves and to try new ideas on select instructors in the office. Both iterations would end in a somewhat more extensive test session in the department where we would get additional feedback from more instructors.

The Gantt chart in figure 6.2 shows an overview of our planning for the whole thesis project while table 6.1 shows individual tasks in more detail, along with rough time estimates. Each main activity consists of a number of subactivities according to this table. The activities were derived by first creating a work breakdown structure (WBS) as shown in figure 6.3. The work breakdown structure was developed in a brainstorming session on a whiteboard. When we had the WBS the next step was to actually estimate how much time each activity would realistically take and how much time we could afford to allocate for it. This was a matter of reconciling the different activities based on previous experience, directions from our supervisor and wishful thinking (Maylor, 2010, p. 184).

6.6 Important dates

To track important progress internally during the thesis project and make sure we were on track we set up a number of milestones as shown in table 6.2.

We knew we would also need to report progress to various stakeholders a number of times. Table 6.3 outlines the more formal report occasions that we planned for. Having thought through these dates also helped us in continuously planning what to do next and how much time it could actually take.

6.7 Product specification

The planning stage resulted in a short product specification that specified our two deliverables to Ericsson. This document was then a type of contract between us our client to avoid feature creep and scope creep (Maylor, 2010, p. 101) during the project. The original specification, written in Swedish can be found in appendix C The two deliverables defined were:

- A business case report detailing the advantages and limitations of the concept and prototype, and what needs to be done within Ericsson for a product based on the prototype to be launched in full scale in all applicable courses. The report also includes a plan for how development could then proceed.

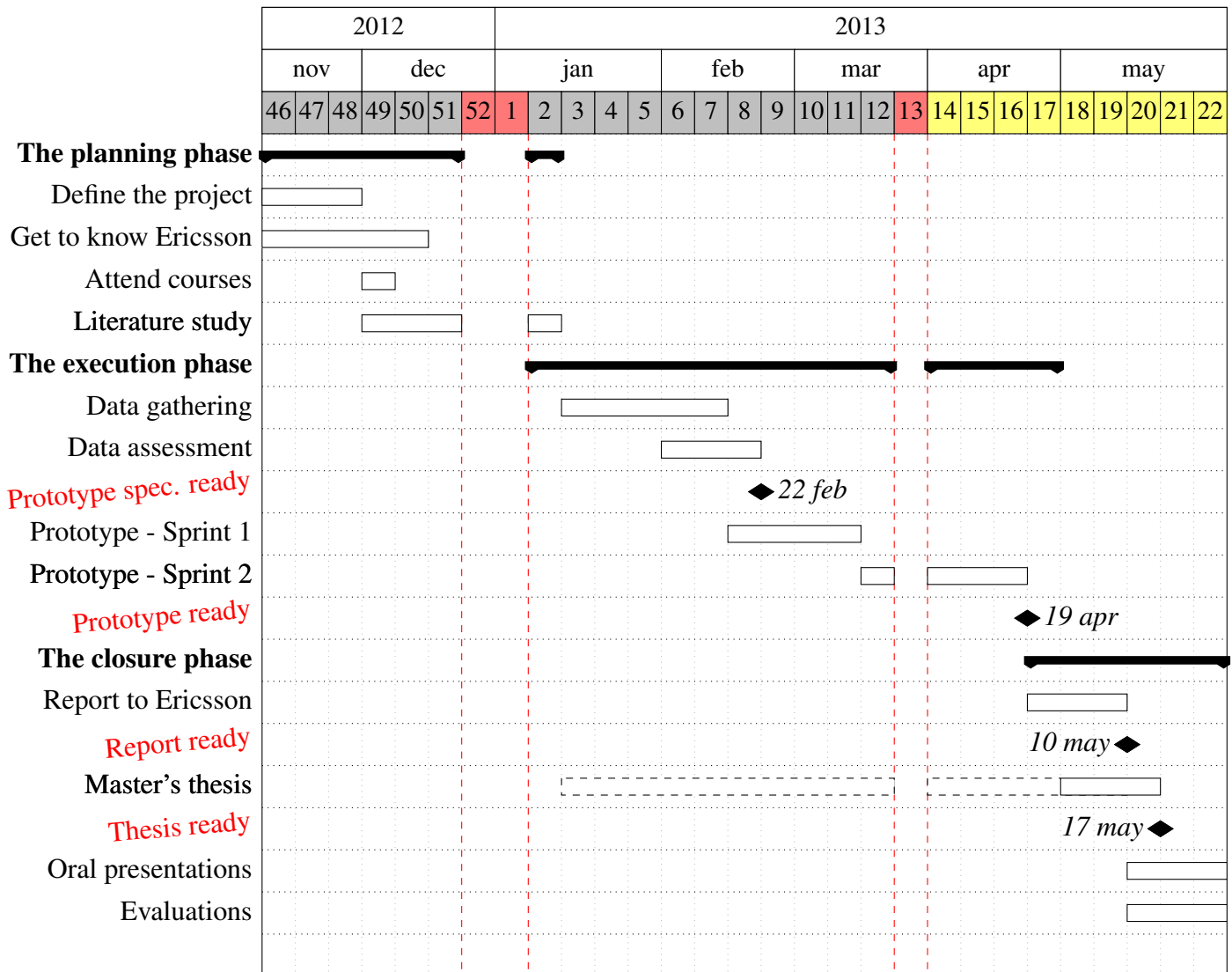


Figure 6.2: A Gantt chart from December 2012 showing our thesis project plan.

Time is broken down into years, months and weeks by number. In the weekly breakdown gray designates half-time work, yellow designates full-time work and red designates holidays.

- A prototype, running on an actual tablet, which shows how a digital platform can be used partly to replace notes and information on paper during and after the courses, partly to enrich the overall structure of each course. There is no guarantee that the prototype will have access to real data or be integrated with Ericsson’s other systems. Nor does it necessarily contain all features a finished product is expected to contain. The prototype’s purpose is to portray the concept for how a digital platform can be designed and what the interface presented to the learner can look like.

This is a quite general and brief product specification but this was intentional so that while we had something to hold on to we could still, if needed, move the thesis project in directions not thought of at this point.

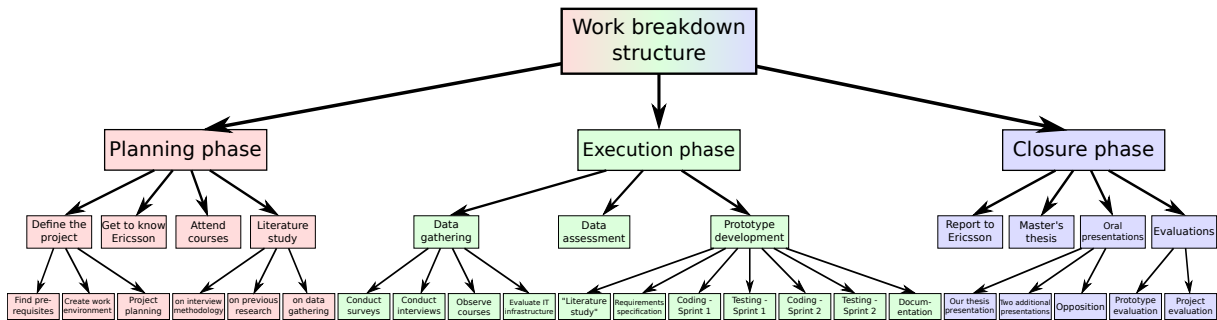


Figure 6.3: The work breakdown structure created early on in the thesis project. See table 6.1 for a tabular representation of this breakdown.

6.8 Documentation

We decided to keep a daily log with important decisions, thoughts, challenges and what had been done during the day. We also created a time log where we planned to log how many hours we worked each day, in which main activity that had been, and a short comment what had been done. This was done to aid the thesis writing process further on as well as for future planning and to help refresh our memories when needed.

6.9 Risk analysis

As a part of the planning process we made a basic risk analysis. Two types of risks were identified. The following risks concern the thesis project itself:

- When planning the employee interviews there is a risk that the first available time is many weeks later since many employees frequently travel. In that case we will settle with the interviews we actually manage to do no matter how many they are.
- It may happen that there are no suitable courses where we can conduct surveys. At a bare minimum we must find one such course.
- We will both take a separate course at the university at the same time as we are doing our thesis work, which can make time planning complicated and induce additional overhead.

Additionally we identified two main risks regarding the prototype itself. During development we would investigate these risks.

- It may prove impossible to implement certain features in tablet applications. Then those features will instead be included in the report to Ericsson as limitations.
- Since the prototype introduces even more technology new causes for concern arise: Are all tablets working? Is an active Internet connection available? Do the learners manage to do as much when they need to learn a new interface as well? Has everyone used tablets before? Is more preparation time (and hence budget) required for course developers to work with the new system? All these questions need consideration.

There are certainly many more risks, but these were the ones most probable to happen so we really had to keep track of them.

Activity	Estimate (h)
<i>The planning phase</i>	
Define the project	
—→ Find prerequisites	8
—→ Create work environment	16
—→ Project planning	24
Get to know Ericsson	24
Attend courses	24
Literature study	
—→ on interview methodology	8
—→ on previous research	8
—→ on data gathering	8
The execution phase	
Data gathering	
—→ Conduct surveys	24
—→ Conduct interviews	24
—→ Observe courses	32
—→ Evaluate IT infrastructure	32
Data assessment	16
Prototype development	
—→ "Literature study"	16
—→ Requirements specification	16
—→ Coding - Sprint 1	50
—→ Testing - Sprint 1	32
—→ Coding - Sprint 2	50
—→ Testing - Sprint 2	32
—→ Documentation	32
The closure phase	
Report to Ericsson	32
Master's thesis	56
Oral presentations	
—→ Our thesis presentation	16
—→ Two additional presentations	3
—→ Opposition	8
Evaluations	
—→ Prototype evaluation	8
—→ Project evaluation	8
Administration	100

Table 6.1: *Activities breakdown*

6.10 Priorities

Priority number one was at this point to create a report, intended for Ericsson, that defines the concept for the app as well as which obstacles must be overcome before the app can be developed and deployed. Priority number two was to manage to develop a working prototype that shows what the product could

Milestone	Comment	Date
Prototype specification ready	An assessment based on the gathered data has been done in order to create the prototype specification.	2013-02-22
Prototype ready	At this point the prototype of how Ericsson should introduce a digital platform in the classroom training to replace today's paper is ready for live testing.	2013-04-19
Report to Ericsson ready	To have enough time for feedback from Linus the report is handed over for review.	2013-05-10
Thesis ready	The thesis is submitted for assessment.	2013-05-17

Table 6.2: *Milestones in the project*

Report type	Receiver	Deadline
Project plan	Examiner, Supervisor, Ericsson	2012-11-29
Product specification	Linus Eriksson (manager at Ericsson)	2012-11-29
Intermediate report	Linus Eriksson	2013-03-22
Report to Ericsson	Ericsson Academy	2013-05-10
Thesis	Examiner, Supervisor, Ericsson	2013-05-17
Thesis presentation	Examiner, Supervisor, Ericsson	2013-05-31

Table 6.3: *Reporting schedule*

look like. It was more important that the visual interface was mature than that the prototype used real data backends. It was also more important that the prototype worked well for the learner than that it was convenient to use for the instructor.

6.11 Literature study

In parallel with our activities described in the chapter so far we started looking for relevant previous research and useful knowledge. Areas that we knew we had to look into were interviews, surveys, tablets in training/education, Interaction design and possibly organization theory. From the outset our philosophy was to start off with a reasonable literature study, but one that was focused on what we would need first. Then we would continue to read literature as it became apparent that it was needed.

Since we knew that we would create a prototype at some point we created a git repository that would keep and track our documents and future code. Frequently updated documents, however, were put on Google Drive. This includes interview notes and most importantly references to useful literature.

6.11.1 Search method

We primarily searched in the Chalmers online library, which in turn searches in various databases and of course the library itself. We also asked previous lecturers for relevant literature and searched in Google Scholar and the Internet in general for articles about recent uses of tablets in training or education. Some of the search terms we used are tablet, education, iPad (since we believe that many people use this term interchangeably with tablet), adult education, training, digital aid, Android and educational apps.

Important to note is that it turned out to be quite easy to find articles about ways to use tablets to make it easier for lecturers in large classes. However, at Ericsson the classes are never larger than 20 people and most often the size lies at around 10 participants. Why would you then use a tablet app that can create surveys when it is easier to just ask the handful of participants directly? Instead we looked for research where the purpose was to really incorporate the tablet pedagogically as a part of the training. This type of research turned out to be much harder to find.

6.11.2 Finds of interest

As expected it was very easy to find extensive literature about interviews and surveys. From Thomsson (2002) we used the idea that reflection is imperative throughout interview processes (and work in general) and the importance of planning the whole interview process before starting to interview people. We also noted thoughts about differences between the presence of one vs two interviewers and that one cannot do too many interviews in one day. Jacobsen (1993) helped us understand some different types of interviews and to relate that to our situation. Finally, with help from Lantz (2007) we would later create an interview template. It also planted the seed that sample interviews is a good way to improve the interview template before conducting all real interviews. When it comes to surveys Trost (2001) brought forth the, to most people, obvious but still too frequent pitfall that each question must not contain many questions. The question *Is book A and book B the best literature to use in your opinion?* asks about two books at the same time. The answer *Yes* to that question could mean that both books together is the best choice or that one of them is the best. He also noted that a response frequency of 50%-75% might sound low, but is what one can expect from surveys today.

When it came to tablets in education and training there exists a lot of research about tablets in elementary school and some about tablets in higher education, but for adult professional training we could not find much. This can be because we did not search with the just right keywords, or it can mean that there simply has not been any (public) research made in the area. The latter may very well be the case in that companies scarcely want to make findings they believe create a competitive advantage public, so there might have been much research, it is just not available to us.

For instance, Gupta (July 2012), van Oostveen et al. (2011) and Massey (2011) all address interesting research into how tablets can be used in education, but we could mostly only use these articles as inspiration and guidance in the matter since they were more tailored for primary education rather than professional training. They did however strengthen us in our belief that our approach to create a sample solution was a good one, and also attested that more active learning through e.g. collaboration proved fruitful. We hoped that these findings would be applicable also at Ericsson Academy.

The decision to let certain literature wait to have a closer look would later turn out to be a bad one. When we had gathered our data (see chapter 7) and started to look into Interaction design we found that we had not fully understood what that area was really about. We thought it was mostly concerned about the actual interface and interaction design, but it turned out to incorporate the whole process, including gathering data and planning. On the other hand we had anticipated that the decision could be suboptimal, and that we in that case would have to change our plans accordingly. We did like this because we considered it more important to get surveys for the courses ready as soon as possible to get as many answers as possible.

6.12 Logging our work

Based on this extensive planning it was time to start preparing for user studies, but an important aspect of the long-term planning was to already in the beginning of the thesis project start to think about the thesis

itself. Therefore we did a template for our thesis. The plan was to start adding text to the procedure part of it as we progressed through the thesis project, but that idea was later scrapped. Instead, to still keep aspects of the whole thesis project "alive" we every now and then compiled our daily logs into weekly logs, and then when appropriate into monthly logs. The latter were written in preparation for the actual thesis in that they included sections called "Procedure" where we wrote digests of notable things that had happened and discussions we had had.

7 | User studies

With some theoretical knowledge and a thorough plan worked out it was now time to start gathering more empirical data and ideas. As noted before the plan would still continue to be revised and we would also continue to read relevant literature when deemed necessary. Since we were interested in collecting ideas on *how* tablets could be used in training the interviews and surveys we conducted were qualitative in nature (see also chapter 4). The goal was to understand the opinions of various stakeholders and to have as solid a foundation as possible for what features would really be useful in a tablet app. This included the opinions of the target end users of the app (that is, course attendees) but also the opinions of the instructors that give courses and the developers that design course materials. We also wanted to be responsive to trends in the industry and good example from other companies that share Ericsson Academy's situation.

Interviews were held with employees within Ericsson Academy's Mölndal office; project managers, course developers, instructors and administrative staff. They were semi-structured (see section 4.1.1) in that we had a written plan which outlined the interview, but we also felt free to ask follow-up questions and were open to change direction when appropriate. The use of qualitative interviews as a method for this task was chosen because they allow for in-depth questions and reasoning and we felt that we had a lot of ground to cover to really understand the problem at hand.

Course participants on the other hand were given surveys on paper since we could not participate in all courses (many were held off-site and even in other countries). We planned to attend several ILT courses in varying subjects to make classroom observations during lectures and exercises. However this was very time consuming so the idea that we would be directly observing a great deal of courses was scrapped early on. Apart from classroom observations later during final testing, we only attended a single full-time course. It turned out that observing was not as rewarding as we had anticipated, since the course we attended gave no immediate surprises.

When we were in the middle of reading literature on how to conduct surveys and interviews we started to create a very ambitious plan with test interviews and focus interviews for learners (see section 6.11.2), but as we created our material we realized that we had gotten a bit carried away because of the extensive literature on the subject; we initially had a plan to conduct both test interviews and test surveys before moving on to the real deal. At this point, we instead decided to be more pragmatic about this and therefore the final way to conduct the interviews and surveys was more down to earth and time realistic. After all, the data collection was merely a part of our thesis project and a means to an end, not its core activity.

A reflection we had but never found a good answer to was that even though we searched for innovative and fresh ideas people tend to have a hard time thinking outside the box even when one urges them to think freely. We tried to create open-ended questions, but still there might be better ways to get such feedback that we have not found out about.

7.1 Business intelligence

To see if and how other companies in a similar situation to Ericsson's use tablets in training we contacted a few of Ericsson's so called preferred suppliers as well as other companies in the education business. The form of contact was by email. While Ericsson gives a lot of training on their own, for more general topics such as project management or SCRUM development external education companies are contracted. Ericsson has business agreements with quite a few such companies. In the email correspondence we asked how they presently work with their course materials and if they have any plans for digital distribution, check out section D.1 for the details. Out of eleven companies asked where seven were preferred suppliers we received responses from seven of them. They informed that they all supplied their course participants with some kind of course materials on paper. All except one printed the materials in color, and three could as a complement supply a PDF of the materials to the participants. One company was actually in the process of moving to only distributing the course materials in PDF form. Arguments for using hard copies included that people are used to paper, that they can make notes easily, and that the complete materials are typically "created" during the course with for example post-it notes on the whiteboard etcetera. The latter indicates a sociocultural approach (see section 3.1) to teaching, but we strongly believe that tablets could just as well facilitate, and even improve, this type of teaching too. This added to our indications that there has not been much research in how digital ways of distribution can supplement or replace existing paper distributed course materials. It also indicates that training most often is carried out without technical aids apart from Powerpoint presentations. The complete result can be found in section D.2.

7.2 Staff interviews

To begin to understand what was really the essence of our problem statement (section 1.3) and how the organization at Ericsson works we interviewed nine people with various duties in the department. Appendix E contains the template we created for the interviews (in Swedish). During a two week period we conducted all our interviews in the department. Each interview gave us new ideas for the concept and input on previous ideas from preceding interviews. In this way, we allowed the discussion to move forward through the series of interviews. We continued to air thoughts with people in the department through informal discussions on a continuous basis throughout the whole thesis project but these interviews constituted the only formal occasion when we gathered data from our immediate vicinity. Appendix E also holds anonymized transcripts from these interviews.

The interviews really helped us understand the organization better and get some insights into what has happened the last five years or so. One more specific example of discussion we had during the interviews is how crucial a smart search function is, especially if one uses OnCourse after the course. Cross-referencing between course materials and the CPI would also help very much when searching.

7.3 Previous studies at Ericsson Academy

One of the most interesting findings from the interviews was that an internal investigation on how course materials could be distributed digitally had been conducted already in 2009. We had a look at the report that came out of this investigation which turned out to be quite extensive. Among other things it detailed different ways to apply Digital Rights Management (DRM) to PDF files. Since nothing concrete had evidently happened since then we made a new decision at this stage; though Linus wanted us to ignore limitations caused by Ericsson policies and organizational structure we initially had a plan to really investigate how our solution could be integrated with existing systems. Now we instead decided to skip the whole integration part and focus on the best possible solution given that any such limitations could

be dealt with by other parties. Another reason to do so was that we had uncovered that the coming year had planned changes to existing systems that would make an integration obsolete quite soon. Therefore our future prototype would no longer, according to plan, have any real contact with Ericsson's systems.

7.4 Customer surveys

To get the perspective of the course participants we created a survey to be filled in by them at the end of each course held. Ericsson already had a standard course evaluation form which has been in use for a long time, and in addition the local line manager Linus Ericsson also had a second form that was presently in use. Therefore, instead of adding yet another one to fill in we supplemented Linus' survey with some additional questions. The complete survey can be seen in appendix F. We were mainly interested in seeing what people felt about a digital version of the course materials, if it would add value to them. As we expected - it had come up from everyone we had interviewed too - the main issue presented in the answers was that the course materials were printed in grayscale. This might seem like a very elementary problem easily solved by printing in color instead. However, that would make each binder much more expensive and was therefore not an option for Ericsson Academy. Furthermore, instead of just doing the quick fix and printing in color it would be much nicer to simultaneously modernize the distribution of course materials while they were at it.

To our dismay we only received course evaluation responses from three courses. We reminded the line manager once, and he in turn reminded all instructors about the survey, but we felt that we could not push those who held courses too much further either. From the ones we actually got we felt that most people simply had not experienced any other type of education or training than what Ericsson provided at the moment, so we did not really get any new ideas from this survey. To get people to think outside the box we would have to show a working prototype, which made us more certain that our overall approach was a good one. Appendix F details a compilation of the results along with all comments from the form. When we analyzed the data we did categorize the answers to easier get an overview of the results, but they were still by no means proper quantitative data. One significant reflection was that almost none of the people who answered the survey had a tablet available at work. On the other hand most had access to a smartphone, so this implied that our concept would need to work on smartphones too if it would be used after the course, at least for this target audience at this point in time.

Additionally we sent a short e-mail survey to everyone who had attended a course at Ericsson Academy in the period April 2012 - December 2012. In total we sent 502 e-mails and we kept the survey very brief in order to maximize the ratio of replies. Some of the e-mail addresses turned out to no longer be valid, and some returned an automatic reply, but in the end we received 111 responses. Most of these came quite quickly, but the very last one actually arrived two months after we had sent the e-mails. The actual e-mail message is depicted in appendix G. First of all it is important to note that this low response rate means that no quantitative data really can be extracted, and besides, the survey itself was qualitative anyway. It does also imply that one has to be very careful to draw conclusions based on such a small part of the whole group of learners asked, though since we were looking for ideas one can guess that those who do respond are those who have something to say, positive or negative. Nonetheless we also roughly categorized these responses to be able to get some kind of general picture of what people seem think of the course materials.

It turned out that 58 % of the ones who did answer had used the course materials at some point after taking their course. At first glance this suggests that the material itself is not of any use afterwards to half of those who attend courses, or it is too inaccessible when in binders. The comments why the learners use or do not use the materials does however reveal a different story. Most notably many of those who answered that they had *not* used the materials simply had not had the chance to work in the

area of competence the course had covered. Still, that is the reality Ericsson lives in, so it will likely continue to be this way in the future too. The most common comments both from those who had not used the materials yet and those who seldom had used it were about low resolution of pictures and that the Internet offers better search capabilities. A digital solution would be able to solve both these problems, so a solution that would be available not only during a course still proved to be a good idea.

7.5 Revising our understanding of the thesis project

Our initial understanding of what Ericsson Academy wanted us to do had been roughly that they wanted to get rid of the binders used in ILT through the means of tablets and that we were good candidates for the job since we were not (yet) affected by best practices and "common knowledge" (i.e. we could easier think outside the box). But at this point, having done our first bits of research, we were suddenly at a place where we had to decide on the future direction of the thesis project. As we saw it, we now had at least three possible directions forward:

- Roughly the original idea with a focus on creating an prototype app with an appropriate GUI and a specification for the complete app with all features - in other words a digital information distribution channel. An emphasis would be put on creating something of practical value that could be extended and put to real-world use.
- To investigate obstacles and possibilities for a new platform (or if there already is one that is suitable) for digital distribution of course materials in the Ericsson setting. This would include, among other things, policies and current infrastructure. This could be said to have been included all along, but we had now come to the conclusion that this direction would be a whole thesis project in its own right. The emphasis would lie on interviews, analysis and investigation, rather than prototyping.
- To explore what new possibilities arise when a digital platform is introduced in the classroom. This direction is quite similar to the first one but even more open in that we might end up with a solution/recommendation that does not distribute the course materials at all or even contain tablets, if that would seem beneficial.

The idea that we apart from some kind of prototype would create a distinct *concept* also started to materialize at this point in time. This was justified by the fact that we would want to explain our ideas on the big picture to Ericsson in a clear way without being limited by what we could implement for real in the prototype. In this way, the prototype would be a showcase of what things were possible if Ericsson Academy invested in a tablet solution but the concept would detail the vision on a higher level. We had also realized by now that our prototype would most likely not be developed into a finished app if Ericsson Academy were to move on; some future developers would probably start from scratch based on the concept.

7.6 Planning for usability testing

In parallel with the data gathering we continued to plan the rest of the thesis project in more detail, especially how we would want to test the usability and utility of our prototype once there was something to test. Our idea was that we would primarily test it ourselves during development and occasionally on other people in the department for feedback. At some later point, we would test it on other Ericsson employees outside of the department and finally on some actual customers.

7.7 Attentiveness to new data

We now had enough ideas to start sketching on a concept, which the next chapter digs deeper into. This did however by no means mean that we were finished gathering data. We continued to discuss thoughts with those around us in the department until the very end, and also had regular meetings with our supervisor at Ericsson Academy. These meetings would later on prove to be perfect as small brainstorming sessions for completely new ideas and small improvements alike.

8 | Prototype development

Having processed the responses from numerous staff interviews and customer surveys we thought we had enough data to be able to produce a first draft of a concept and decide on which parts of it would be feasible and most important to actually implement in the prototype. The ranking was based on what the employees in the department thought would help them the most in their classes, and feasibility was in the first stage based on our own previous experience in programming. One of the conditions of the thesis project were that we would use tablets in some way, but still there was room for some important choices, the most important one being which platform to choose. In order to not paint ourselves into a corner we kept that choice open for as long as possible. The three possible options we had were an Android app, an iOS app and a web page. Having discussed the pros and cons of each option we decided on developing the prototype for Android for the following reasons:

- We both have previous experience in the Java programming language.
- We both own Android phones and are therefore already accustomed to user interface best practices on Android and how they work in general.
- Compared to iOS there exist Android tablets with stylus capabilities, and this was something we wanted to look into further at some point.
- Developing for Android does not require any licenses or paid software, which iOS does.
- The hardware can be fully utilized with a native app whereas web apps are more limited in what they can do.
- A web based solution would require a server and Internet availability whereas one strong desire from some of the instructors was that the solution would work even when the connection to the Internet was unreliable or unavailable. An extra personal cause for this requirement is that during one of our observation sessions in a classroom the network did suddenly go down. The ongoing exercise had to be postponed and a short lecture was conducted instead. The lecture fallback would not have been possible (or at least not favorable) if no course materials could be accessed at all.

One initially open question for the concept was whether each learner would have their own account to log into or if a whole class would share all resources. A shared solution would be much simpler to use for learners, but to allow user-created content we decided to go for an individual user solution. There was also the option of having individual user-created content simply live on a local device with no cloud synchronization but that was deemed too risky; if that device failed the consequences were simply too big. Two other decisions we made at this stage were that the learner would be in focus, not the instructor, when it comes to the user experience, and that we would target primarily the learning

environment at Mölndal to ease our prototype development. The latter meant that we could assume that Ericsson provided tablets to each learner. N.b. that the concept would still have a broader target.

We drafted a requirement specification for the concept as follows (sic):

- Presentation features
 - A kind of PDF reader with the possibility to make notes.
 - The teacher's notes that she does on the SMART Board ends up as a layer on each learner's tablet.
- Exercise features
 - Show materials as a PDF, *or*
 - The learner gets to see one task at a time. When one task is done the learner clicks "Next". This way the instructor can at any time see each learner's progress in her own device.
 - Some of the exercise pages may contain a question. Then the instructor can also see if a certain part of the course was hard to comprehend or was misunderstood using response statistics.
- Feedback features
 - A clickers-system where the instructor can ask anonymous questions, just like response meters.
 - Possibility for the instructor to remotely see each learner's screen.
- Features used before the course
 - The learner can in advance log in and check out the course materials.
 - The app can give suggestions for relevant e-learnings.
 - General information such as who to contact with questions, who the instructor is and how many will participate.
 - Possibility to chat with the others who will attend the course?
- Features used after the course
 - Ericsson can push ads to those who have installed the app on their own devices.
 - The learners can log on and e.g. access their material or contact the instructor.
- Features used during the course
 - The instructor can on demand push new materials to each tablet.
 - At the end of the course the course evaluation form can be filled in directly on the tablet instead of on paper. Then a compilation of the answers can be stored in relevant places automatically.

The specification was quite basic because we decided not to make it too specific just yet. It just depicted main features that were really the bare minimum to make the app useful.

8.1 Feature priorities

Before actually starting to write code we needed to decide on a design and exactly which features from the concept to include in the prototype. Based on the staff interviews and the main requirements from Ericsson Academy we came to the conclusion that features relating to freehand drawing, making notes and sharing annotations were the most important to implement first. Though this feature set might sound a lot like merely a document viewer, which there are numerous variants of out there already, we had to be realistic. One has to start from the existing organization and try to evolve from that, otherwise our solution would never have a chance to be used for real at Ericsson. These exact features are what the binders presently enable, so they are the most crucial, while of course other features are what makes the solution stand out. To be able to test the prototype in live courses we also needed at least a mockup of the overall app, for instance with a working login system. Next on the prototype's priority list was interaction with the instructor, but already at this point the rest of the list was on the condition that we had time left in our future sprints. Table 8.1 shows our list of priorities at the time. Question marks denote features that we were uncertain about for the final concept.

Prioritized	Not prioritized
Peer-to-peer sharing	Dedicated server
Drawings	Integration towards existing systems
Show PDF documents	Real logins
Annotate	Integration towards the SMART Board
Polls?	
Share notes	
Anonymous questions?	
Share notes live	
See enrolled courses	
Export PDF	
Mock-up of individual login (as a QR-code, can be used in many situations?)	
Teachers can push updated materials	
Evaluations!	

Table 8.1: *A prioritized list of features to include and not include in the prototype*

At this point we had also started to more thoroughly read HCI literature and found that the field of Interaction Design was broader than we had anticipated in our planning. Not good, but still recoverable.

8.2 User interface prototyping

We recognized that we would need to develop ideas for the user interface and appearance of the app before we started programming it. Though we would still probably need to alter the user interface further down the road, it made sense to have a consistent idea that could be tested in some way before we invested too much time in it through coding. We argued that bad design decisions should be avoided at all costs as these would set the project back tremendously time-wise if they were uncovered too late in the process. The ideal prototype for user interface usability testing in terms of precision would obviously be the real app running on a device but it takes a lot of time and investment in developing software prototypes, even mockups. Therefore, other interface prototyping options were sought.

Though we had a reasonable idea of how we wanted the concept to be feature-wise and which parts of

the concept were reasonable to implement in the prototype we still had to decide on the actual interface design. The goal with having initial prototyping of just the UI was to expose our own ideas about features and the user interface designs to critical eyes and to get even more new ideas from others in the department. We had limited time available for this task given the staff's busy schedules so we wanted a rapid prototyping method that would let us quickly fix UI bugs and change things around in between the sessions. There are several methods for UI prototyping, but considering that we had no prior theoretical knowledge or practical experience in interface design we quite quickly settled on paper prototyping. The general idea of it seemed reasonable to us and we were appealed by its simplicity. Figure 8.1 shows our paper prototypes being developed.

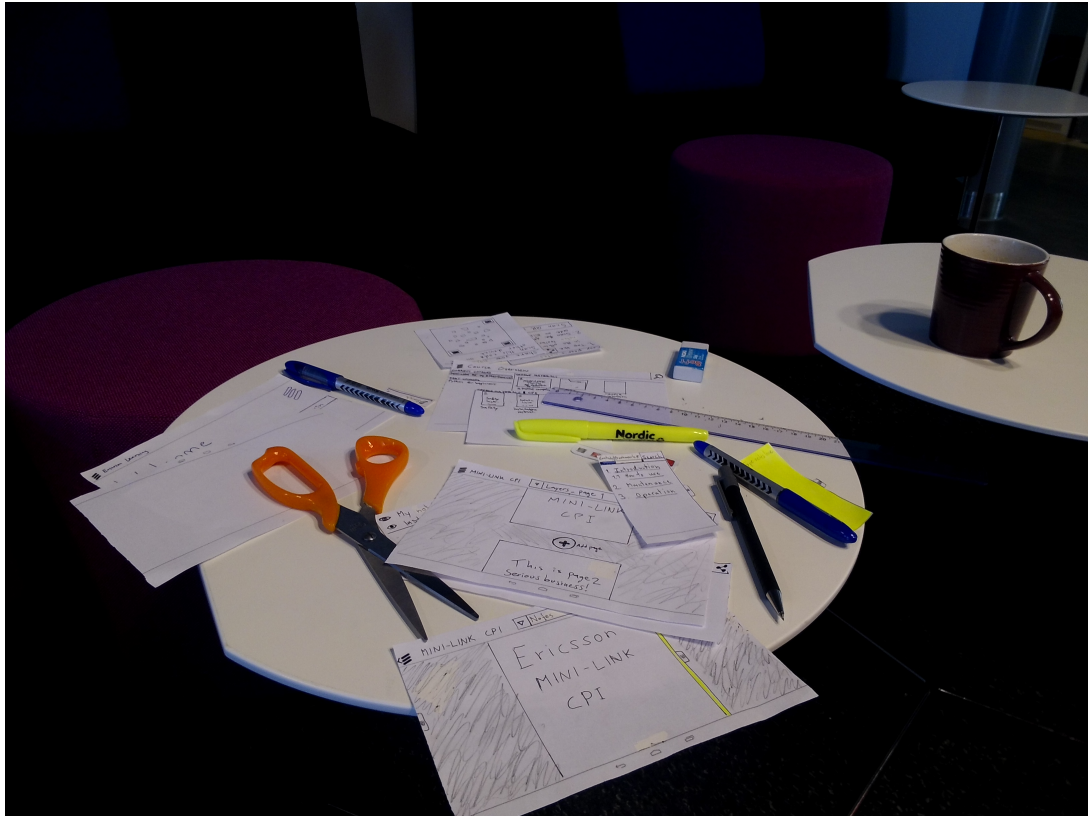


Figure 8.1: Paper prototyping in the works

For getting inspiration and some first pointers we looked at a few existing Android apps for making notes and viewing and annotating PDF documents. *iAnnotate PDF* (ver 1.1.4), as shown in figure 8.2 in particular had many useful features such as thought-out document navigation and options for freehand drawing. Based on these sources and our own ideas we created our very first paper prototype version.

From this first draft UI on paper we let four employees in the department try it out. First we had a short introduction where we gave them a fictional setting. They were told to pretend that they were on the first session of an ILT course as learners and that instead of a paper binder, they had been given a tablet with this app pre-loaded. Then they were told to look around in the app and get acquainted and to speak out their understanding of the UI as they navigated around and were presented with new UI elements and views. During all of this we observed their behavior and noted how they perceived the app. It turned out that some ideas that we had and that seemed obvious to us during design were very confusing the many of our testers and this helped us flesh out the user interface. In between each test session, we would take some time to discuss the feedback received and where appropriate change the paper UI somewhat

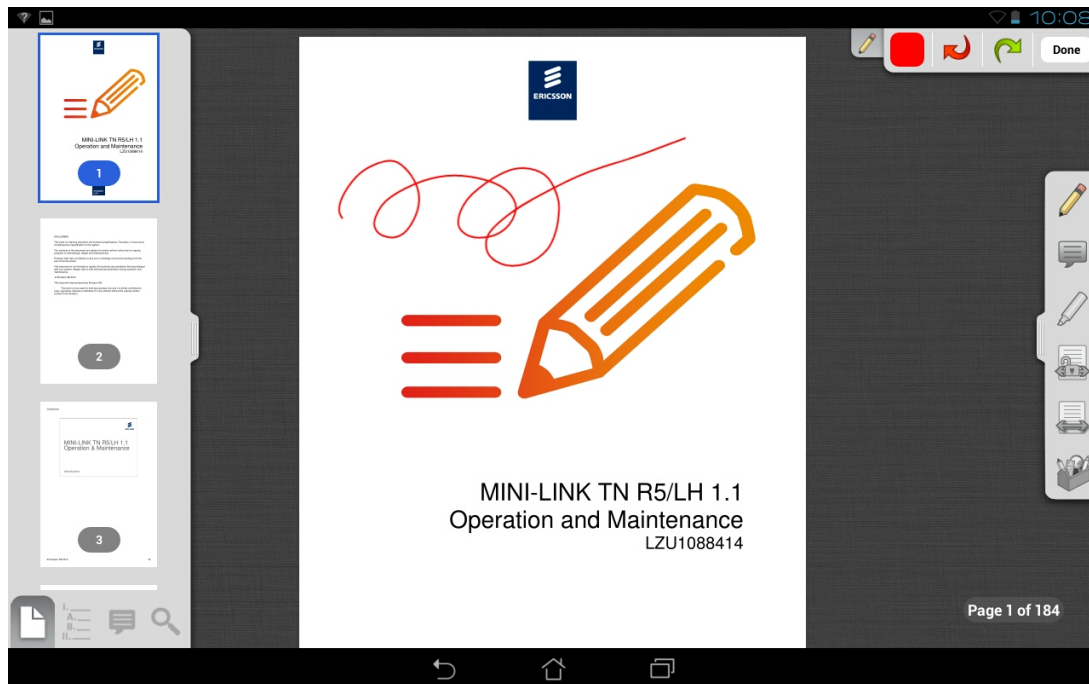


Figure 8.2: *The Android app iAnnotate PDF which was the primary source of inspiration for the user interface*

to accommodate for new ideas and improvements. The next testing session would then be used to see if the corrected UI appeared more usable.

An illustrating example of this is how we in an early design thought we would save time for the end user and make the app easy to comprehend by not having users log in using a username and password but instead by scanning a QR code that the instructor would display on the projector at the beginning of the first lecture. However, after this approach had failed miserably on all four test subjects we scrapped it and went for the ordinary login screen instead. We realized that while we might *in theory* save some hassle by avoiding the venerable password (which can be forgotten, lost, etcetera), in practice passwords are so widespread and understandable that the options we considered were simply too unexpected and confusing. A key driving force was to create a user experience that was as natural and obvious to the user as possible.

Another example of this was that we first had an idea of letting the *notepad area* (where the user can write and save notes for each individual page) slide up from the bottom of the screen (so that it can be hidden and give precious real screen real estate to the content when not needed). However, this turned out to be confusing since it would then not be directly attached to the actual page shown on the screen and hence the concept that the notepad was tied to an individual page as opposed to the document in its entirety would be lost. In the final design, we instead let each page have its own notepad attached directly to the page rather than to "the app" with the mental analogy that it would slide out from "beneath" the paper. At this point, we also chose to use bright pastel colors for the notepads to tie into end user associations with post-it notes.

Figure 8.3 shows the evolution from an early paper prototype to the final prototype app. Most notably, in the early paper prototype there are three sliders with attached panels that can be pulled out from the left, from the right and from the bottom (similarly to the UI in iAnnotate). The slider on the right would reveal drawing tools (not shown in the photo) that we later instead incorporated into the top bar (accessed

by entering the *draw mode* by tapping the upper-right button in final prototype app). The slider at the bottom would reveal the notepad where text notes could be written for each page. In the final prototype this has been changed in that a notepad is attached to the lower edge of each document page instead. The left slider on the other hand is still a part of the concept and is virtually unchanged from how we imagined it during paper prototyping. It has not been implemented in the final prototype app though as it was down-prioritized and time did not permit. When revealed, it would contain search, bookmarks and an outline of the document, arranged in three tabs. Another change that happened along the way of paper prototyping is the "layers" toolbox that is shown as a dropdown at the top of the paper prototype photo. In the final prototype app, this menu is instead accessed by tapping a hovering button attached on each individual page. During testing it became evident that this menu was not understood to be tied to a particular page if it was placed in the top bar.

A final major design change that we made thanks to the paper prototyping effort, one that is not evident in figure 8.3, is that since we initially had a typical PDF or Word document in mind we decided that all pages in a document would be presented after one another in a vertical strip. However, the test subjects all intuitively tried to swipe *sideways* to navigate in the document, probably because that is how you dip into a book and many e-book readers have adopted this analogy. Therefore our final prototype app also has this horizontal navigation idiom.

8.3 Coding sprint one

With the overall GUI design developed, refined and tested through the use of paper prototyping we felt confident in beginning the coding phase where we would implement the ideas and create a working tablet prototype app. At this milestone (as defined in section 6.6) we had what we could call an official interim meeting with our client to report our progress so far. From that meeting we could move on confident that we were working in the right direction.

We used our personal laptops as development machines during the thesis project, one running Windows 8 and the other running Fedora 18. Eclipse was used as the IDE together with Google's Android development plugin (the interested reader is encouraged to have a look at the Android Developer site¹). At the outset Ericsson kindly supplied us with an Asus Transformer Pad TF300 tablet for development. Later on, it was supplemented with a Samsung Galaxy Note 10.1 tablet which was procured specifically for its bundled stylus and Wacom input technology which allowed us to provide an enhanced experience on this particular tablet. Apart from these two tablets, we also used our own Android phones for testing the app on less capable hardware and smaller screens. Figure 8.4 shows what our work environment looked like in Ericsson Academy's Mölndal office.

8.3.1 Source code management

Since we were certain that we would be developing code in the thesis project, we discussed ways for managing source code early on and quickly decided that we needed a source code repository hosted in some version control system (VCS). Both of us had previously used Subversion for this task but we decided we wanted to try out something new for the learning experience. In the end we decided to use git², which is a distributed version control system, meaning that there is really no notion of a central repository. Each user hosts her own repository and changes can be *pushed* and *pulled* in both directions. In our work though, for ease of access, we did set up a central git server which was treated as the master repository and which acted as a proxy between our personal repositories.

¹<http://developer.android.com> (available 2013-05-17)

²<http://git-scm.com> (available 2013-05-16)

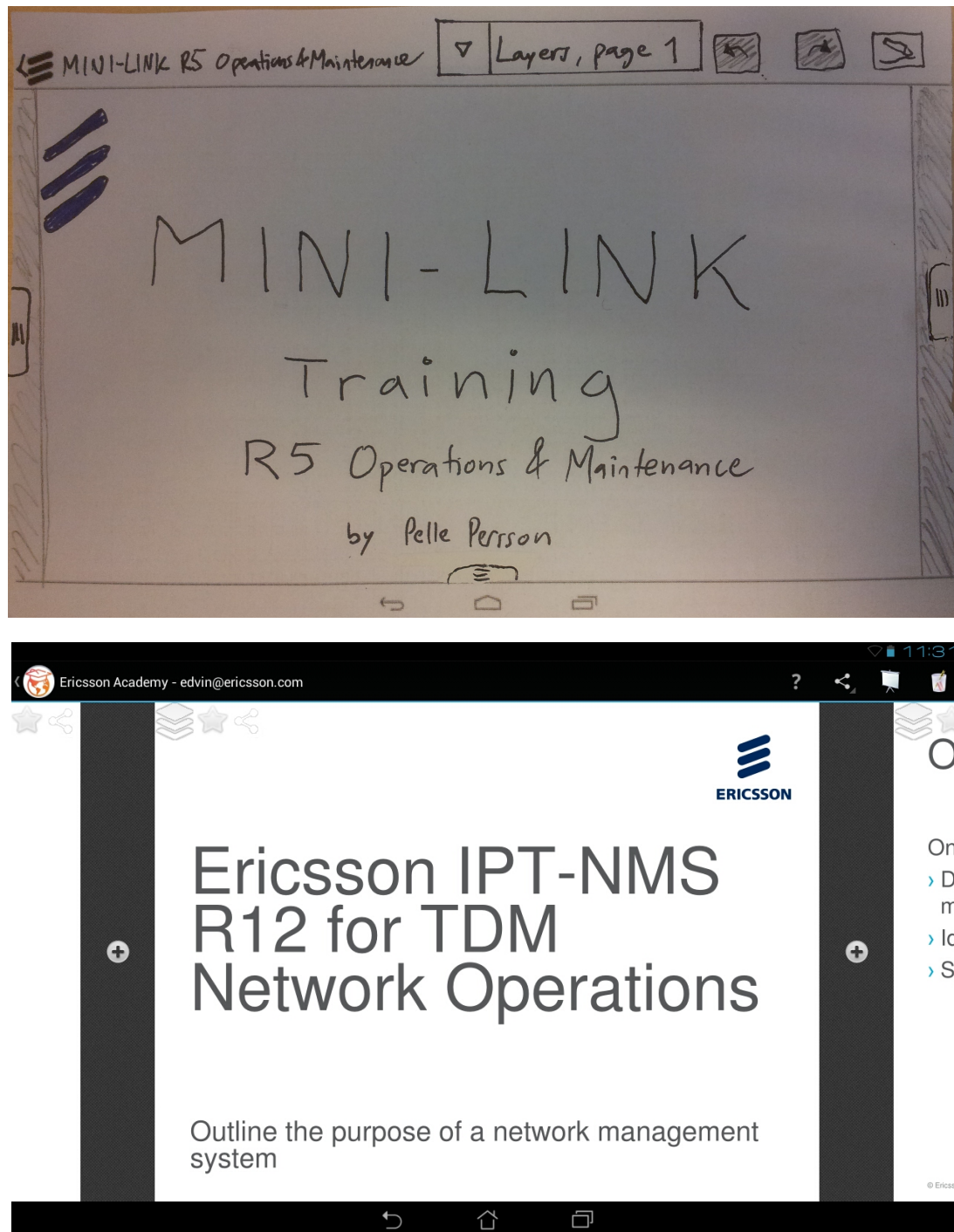


Figure 8.3: Evolution of the GUI from the early paper prototype to the implemented prototype app. The upper photograph shows what a particular view in one early paper prototype looked like before any usability testing had been conducted. The bottom screenshot shows what the corresponding view looks like in the final prototype app.

8.3.2 Development process

We had planned for developing the prototype full time during two coding sprints of four weeks each. Each sprint encompassed programming, testing, and (to a lesser extent) design and redesign of features

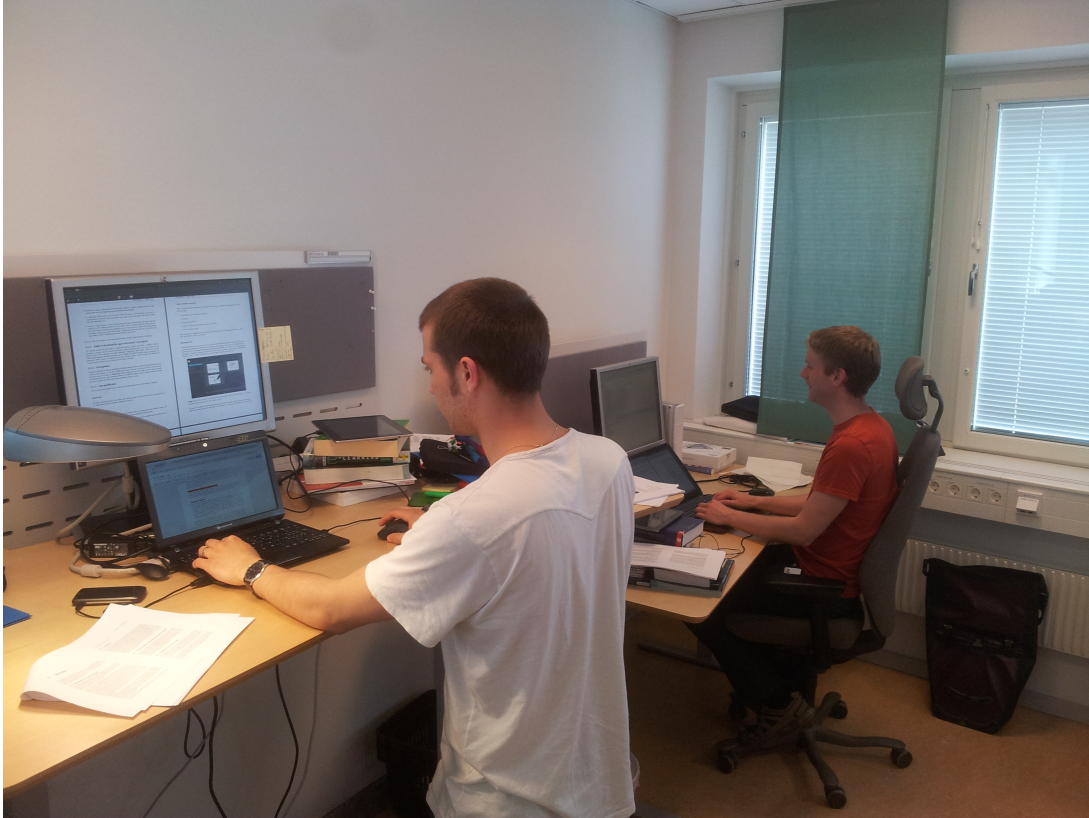


Figure 8.4: *Our work environment at Ericsson Academy’s Mölndal office*

and goals based on thoughts of ease of use and learning. Since we were only two developers, we chose to try to work on discrete and disjunct features of the program to maximize the autonomy and effectiveness while reducing the risk of code conflicts. However, we strived to commit code often rather than seldomly to the master repository so that code conflicts would be as scarce as possible, in line with the XP philosophy (see also section 4.3). Again, since we were only two people it would be overkill to follow any whole method explicitly. Instead we used the techniques we saw fit our way of working. We extensively used the concept of iteration, both for the programming period as a whole and on a smaller scale e.g. when conducting paper prototyping. With influences from Scrum we divided the period of programming into two sprints where each day started with a (seated) meeting, planning what to do during the day and current obstacles. Again, the fact that we were only two made it unfeasible to have shorter sprints than four weeks. To solve a few of the encountered problems we did pair programming without knowing the actual term at the time. Pair programming is a prominent part of XP. In summary our work has been imbued with the philosophies that come from agile development, but when it comes to project management techniques we have not needed to explicitly use any of the ones associated with the agile methods mentioned in section 4.3.

8.3.3 Ready, set, code!

Now that we had a design ready which we believed would work well it was time to delve into the Android world. The Android developer site³ was our first stop to learn the API:s of the Android platform. One example of items we looked into is basic look & feel such as themes and available graphical elements. Since there was no built-in PDF reader API for us to use we decided to look for existing work in the

³<http://developer.android.com> (available 2013-05-17)

area rather than developing our own. At this point we also decided to divide the first tasks between us in figuring out PDF rendering and working with the network stack and network service discovery (more on this in the following sections). That way we could quite independently work without treading on each others work.

8.3.4 Designing for Android

Android apps are built around the concept of *activities and services*. An activity is a single screen shown to the user while a service is something running in the background either indefinitely or as a response to a specific task. These elements of the app communicate through *intents* that specify what a given activity or service would like to do or get done. One intriguing design choice that you need to get accustomed to as a programmer for Android is the fact that an activity is destroyed and recreated when the user flips her device to another orientation (from portrait to landscape or vice versa). This has the effect of terminating services which will then need to recover their state within a newly created activity. Of course, the user should not have to know or care about this. In the first sprint we did not really come across this pitfall since we developed our individual parts, but later on it turned out to require quite some thought when it comes to the app's class architecture.

A "skeletal" prototype with a login screen and a course overview screen was very simple to construct since we would only use mockup data for these parts. Instead of naïvely hardcoding names, and to prepare for future user-created content, we created a basic database interface that for the time being only held information about the user's enrolled courses. We also managed quite rapidly to create a first implementation of drawing freehand lines on top of a displayed PDF page.

During the whole first sprint we repeatedly tried to use the Android emulator that came bundled in the Eclipse development environment since we had only one tablet to test on. Because it was incredibly slow and crashed unexpectedly now and then we eventually abandoned it in favor of our own smartphones, despite their limited screen sizes.

8.3.5 Rendering PDF documents

We spent a day or two searching on the Internet for available PDF rendering libraries which could serve as a basis for our app's document view. The search turned up a few different libraries and there were numerous discussion forums covering their use. There were both proprietary and open source libraries and we decided to start with evaluating the open source ones because they were readily available and also seemed to have larger and more vibrant development communities. Given our lack of expertise in the area of PDF libraries and our focus on quickly developing a prototype, we decided we could not afford spending too much time on this task. It seemed that the most popular free library was MuPDF⁴ which is a C portable library with bindings for Android. There was a demo Android app bundled with the source distribution which showcased the features of the library and we started looking at this code to understand how to use the library. The demo app also proved very useful from the perspective of understanding Android itself since it made use of a large cross-section of Android components and showed established programming idioms.

Initially, we had a discussion whether it would be best to fork⁵ and extend the MuPDF demo app or simply start from scratch using the demo app as a reference and source of inspiration. We decided to fork the code since we thought that there were enough similarities between the demo and our envisioned

⁴Developed by Artifex Software Inc., see <http://www.mupdf.com> (available 2013-05-22)

⁵a project *fork* happens when developers take a copy of source code from one software package and start independent development on it, creating a distinct piece of software (definition from [https://en.wikipedia.org/wiki/Fork_\(software_development\)](https://en.wikipedia.org/wiki/Fork_(software_development))), available 2013-05-16).

code to warrant reusing and extending the code. In the end it was a matter of estimating the value of saved time and bugs avoided through using a known good code base as a starting point against the time it would take to get familiar enough with the code base to really be able to understand and extend it. There were also risks associated with forking the code in that there could be fundamental choices made by other developers in that app which we would have to change later on and there was simply no way to know before committing to get to know the code.

In hindsight we do believe that it was worthwhile. The MuPDF code proved to be quite nice and well-structured and despite it having almost no comments or other documentation, we eventually gained a good understanding of how it worked and could make the required changes to make it work the way we wanted it to (such as by enabling simultaneous view of multiple pages instead of just one).

8.3.6 Networking in Android

When it comes to networking capabilities, a previous design decision dictated that the app should not *require* a central server to function. We quickly found that as of Android 4.1 there is an API for Network Service Discovery (NSD) in the platform itself. NSD means that a device can broadcast contact information and a *service name* on the local subnet on the connected Local Area Network (LAN). Devices that search for that service name can extract the needed information to connect to the broadcasting device. Since the objective throughout the coding process was to get as much functionality working as possible in the prototype we settled with this solution without much more investigation. The requirement of Android 4.1 (which is presently a very recent version) limited possible target devices immensely but if Ericsson decides to use our concept and/or prototype there are other libraries to use too that have the same functionality and can support older devices. After just a day or two, our devices could find each other on the network and create a network connection.

8.3.7 Testing

During development we continuously tested by ourselves, and we frequently tested new features together. We also sporadically let people who happened to be nearby try it out to give direct feedback. After coding for a week in sprint one we realized that we had not yet properly planned for how to test the prototype in a real classroom situation despite that we had earlier had this in our minds. Therefore we had to change our plan a little to make room for such a test.

At the end of sprint one we organized a test session with the department staff during a friday coffee break. In preparation for this "demo", we worked hard to polish the app as much as possible, e.g. by replacing ugly placeholder icons with reasonably well suited ones that we derived from online source materials. This was important to help new users understand the interface and its components but it also made the app feel much nicer and fun to try out. At this stage the app supported the user to:

- log in using a given dummy user name
- see dummy data about enrolled courses
- click on a course to show available course materials
- view and navigate in a PDF document using pinch-zoom and swipe gestures
- draw lines and erase them on one page at a time (although the lines were very "edgy")
- close the document, reopen it and find the previously drawn lines saved
- discover peer devices on the LAN, but not connect to them

The feedback from this demo session yielded mixed results. On the one hand people were impressed by what we had achieved in a short development time frame but on the other hand there were several small but important features that were notably lacking and that degraded the user experience. Because you could scroll and zoom in the document using natural swiping and pinching gestures which are ubiquitous in touch interfaces people also expected other navigation gestures to work such as double-tapping to zoom in or out by a large amount or flinging to start a *flywheel-like* scroll action. When their double-tapping and flinging ended up doing nothing, this was a letdown. Likewise, we were told that it would be nice if the zoom would *snap*⁶ to 100% when close enough to this zoom level so that it would be easy to go to a comfortable full-page (actually fit-height) magnification. In summary, though, we managed to complete all our goals that we set half-way through sprint one by the time we closed the sprint for the coffee break demo session.

8.4 Coding sprint two

For the second sprint we wanted to further refine the design and implementation of the prototype. There were still key features missing that had high priority such as the ability to take text notes and to insert *custom pages*. Custom pages are blank pages or pages with a photograph that the user can insert in between any existing pages in a document. These pages behave much like normal ones in that you can draw on them and take notes in the attached notepad. They can be shared with other users like ordinary pages, but can also be deleted altogether (unlike ordinary pages).

When we started implementing custom pages we quickly found ourselves with a new intricate design choice to make. The issue was related to the relative ordering of custom pages and synchronization challenges when three or more peers were involved in the sharing. Ideally we would have liked a set of custom pages in a sequence to be ordered in the same canonical way on a set of devices no matter in what order they were sent and received between devices and no matter what device originally created each custom page. But it turns out that without a central authority such as a server making these ordering decisions, we know of no straightforward solution to the problem. We had designed the sharing of pages to be peer-to-peer on purpose so that it would be robust and require no additional infrastructure so adding a server into the mix was not an option. As we saw it, we were left with two main options: Either we could try to preserve ordering as well as possible but accept that it could never be guaranteed if more than two devices were involved, or we could disregard the issue altogether and instead possibly provide for the user to at any time move custom pages around manually. Giving the user the possibility to move custom pages around manually however opened up new questions: If custom pages could be moved around, then why not ordinary pages as well? What would the interface look like for moving custom pages? Would it even make sense in general and be useful to the user? Or would it rather just be confusing? We deemed that it would take a lot of effort to implement movable pages in a user-friendly way and decided to go for the first option. Besides, we were not sure that moving pages around even made sense to the majority of users.

8.4.1 The GUI evolves

As we refined the GUI we made several changes to the design first fleshed out in the paper prototyping. For one, a design choice made early on was to have per-page GUI elements which would sit alongside each page, hovering on the background. In figure 8.5 we see these to the left of the blank page, and they represent from top to bottom:

⁶in computer graphics snapping refers to an object jumping directly to a precise position when in the direct vicinity of this position to aid the user in fine positioning

- The text **Me** and an eye button toggling the visibility of the user’s own freehand drawings
- The text **Instructor** and an eye button toggling the visibility of the instructor’s freehand drawings
- A sharing button (interconnected dots) for sharing the annotations of the particular page with other users
- A bookmark button (star) which toggles whether the particular page is currently bookmarked or not

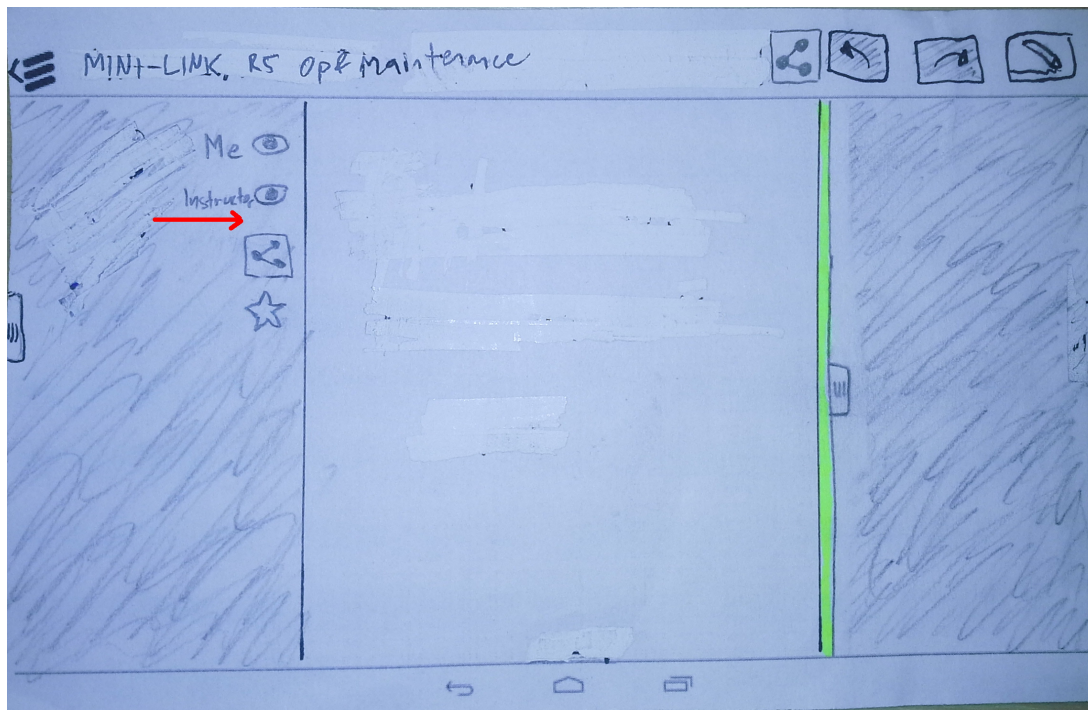


Figure 8.5: Paper prototype showing a design of the document view. The arrow depicts where new named entries would appear when a user received annotations from other users.

In this design the idea was that as new annotations were received over the network from other users, buttons for toggling their visibility would appear in the list after the entries for "Me" and "Instructor" (where the arrow is pointing in figure 8.5). Furthermore, when the user zoomed in on or out of the page the buttons would not zoom with it but keep their relative positions to the topmost edge of the page and the same touch-friendly dimensions. If the user would zoom in on the middle of a page, the buttons would eventually go out of view. But as we started implementing these features we thought it was a bad idea that the buttons would move out of sight and reach just because you zoomed in on a page. We wanted the buttons to stay out of the way as much as possible and not interfere with reading and interacting with the document content. Still we wanted them to be readily available when needed. Thus we opted for a mechanism whereby the buttons would stay "attached" to the side of the page if possible (primarily when the user had zoomed out quite a bit) but would "stick" to the edge of the screen (and become semi-transparent) instead of scrolling off-screen when the user zoomed in. This way they would always stay on screen and in reach while still being conceptually tied to a certain page in the document as opposed to what would have been the case if we had put the buttons in a toolbar such as the top action-bar instead or in a pull-out-panel (such as the navigation panel that can be revealed by pulling out the handle on the left in figure 8.5). Figure 8.6 depicts gradually zooming in on a page and shows the placement of the buttons in each stage.

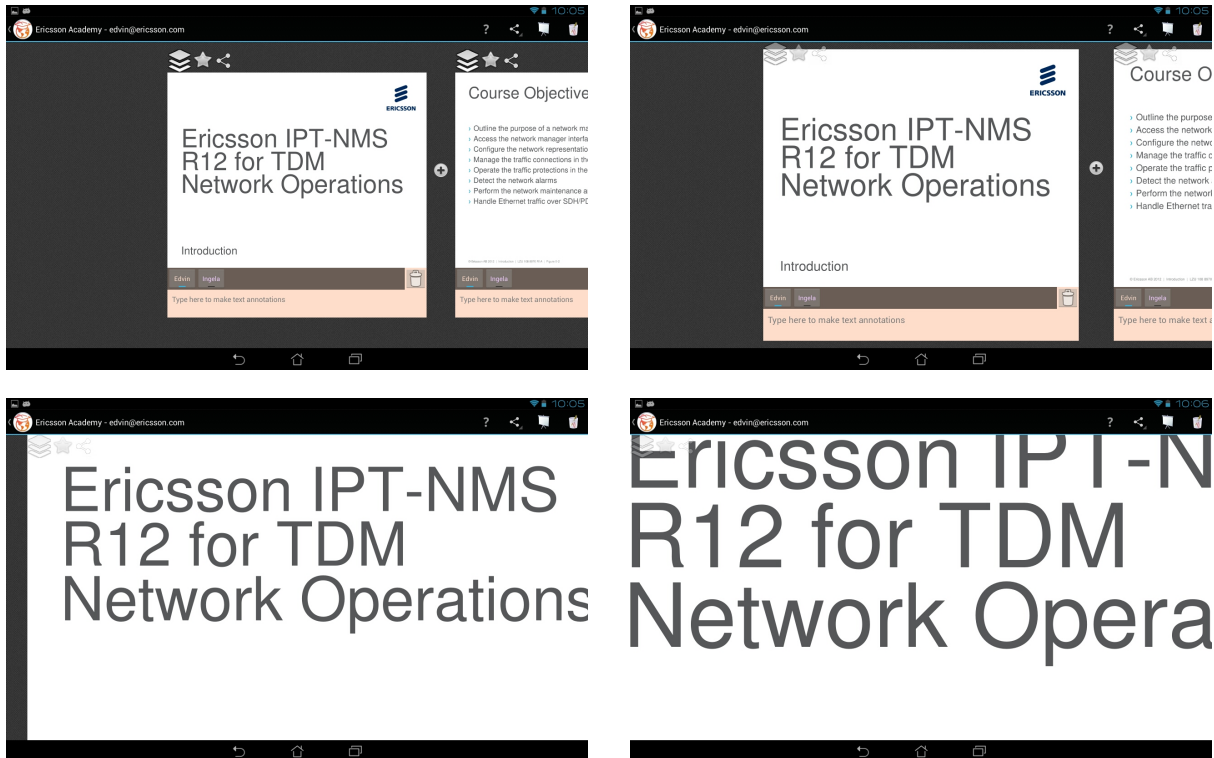


Figure 8.6: Zooming in on a page. Note how the three floating buttons in the top-left corner of the page move from a position just above it to floating on top of it while gradually going semi-transparent.

We gave quite some thought to what would happen if a user received notes from many people at once and thought it would clutter the interface as more and more eye buttons would stick to the side of the page. Also, there was the problem of how we would handle the case that there were so many received user layers that they would not fit on screen at once. Through discussing the issue we decided that we would try to put the layer visibility functionality in a pop-up panel instead. We argued that toggling layer visibility would not be a frequent enough action to warrant having the feature one tap away. Two taps would be just as fine (tapping once to open the panel and tapping a second time to toggle visibility). We did not want a pop-up modal dialog at a fixed screen position but rather wanted a panel that would pop up as an extension to a button itself. We decided on the idea of a *layers toolbox*, a panel which would allow you to manage all freehand drawings. In changing the design in this way we realized that a separate panel could not only be made scrollable (to allow for many users thus solving the above problem), it would also provide a perfect place for buttons to delete one's own freehand drawings in one go as well as deleting other users' drawings (from your own device or account only). After working on the panel for some time, we arrived at the final design shown in figures 8.7, 8.8, 8.9 and 8.10. There is a subtle difference between the icons used, as seen in figure 8.7; a *trash icon* is used on the user's own layer to signal that the contents of the layer are deleted but the actual layer remains (it can not be deleted) whereas for peers' layers (Rikard's in this case), the *cross icon* signals that this button deletes the entire layer. Also note that the instructor's layer can neither be cleared nor deleted (hence the lack of a button). This is on purpose. If a user was allowed to delete or clear the instructor's layer, it would simply reappear as soon as the user's tablet reconnected to the instructor's. We argue that the instructor's notes are generally important and should be kept on all devices. They can be hidden using the eye button, however, should they get in the way.

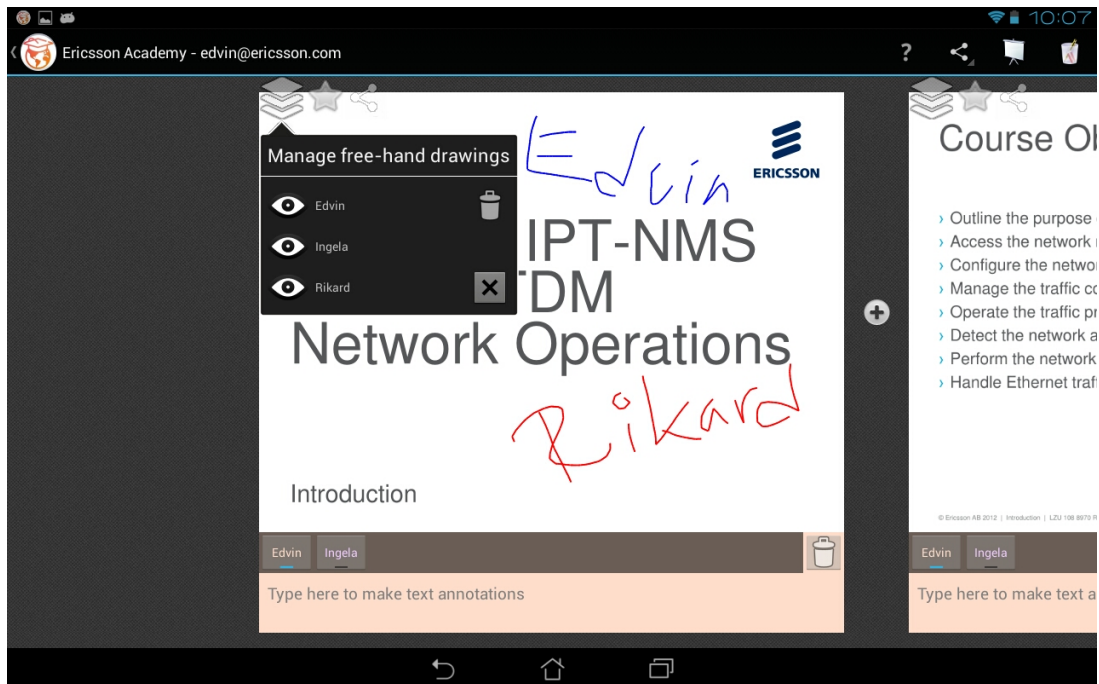


Figure 8.7: The layers toolbox where freehand drawings are managed. The toolbox is opened by tapping on the layers icon positioned in the top-left corner of each page. Note that all freehand drawings are currently visible (although Ingela has not actually made any).

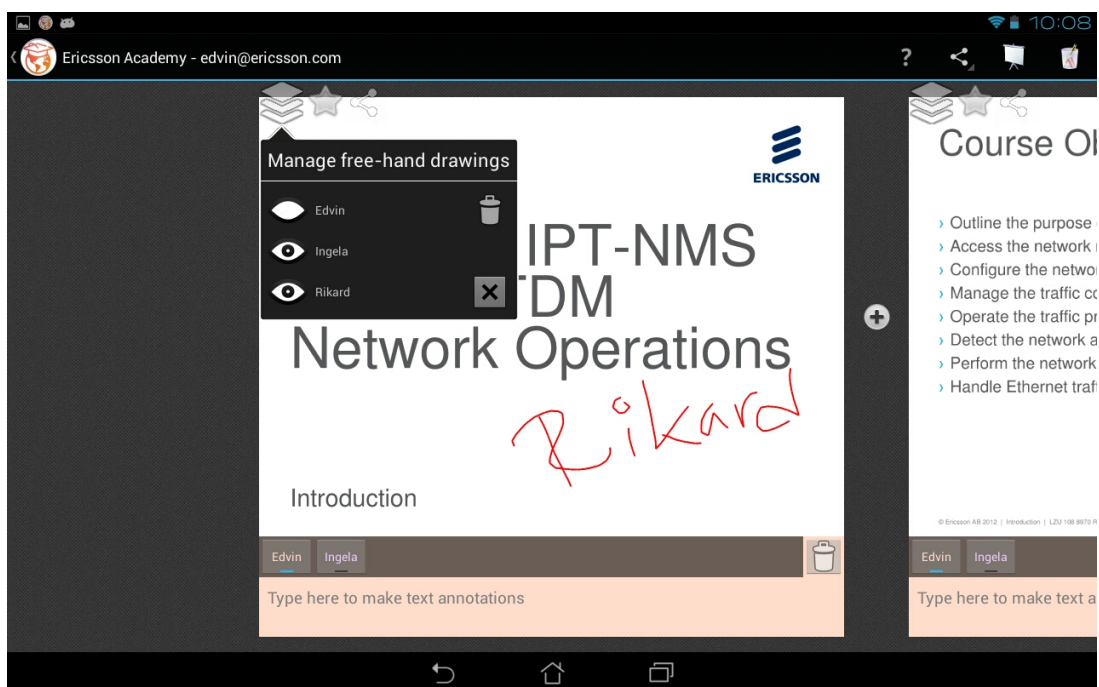


Figure 8.8: Edvin's drawings are hidden by tapping the eye next to his name

8.4.2 Networking refinement

With a lot of good feedback from the demo session in the previous sprint it was time to get some real networking up and running. First we created a simple connection scheme where the sending user (the

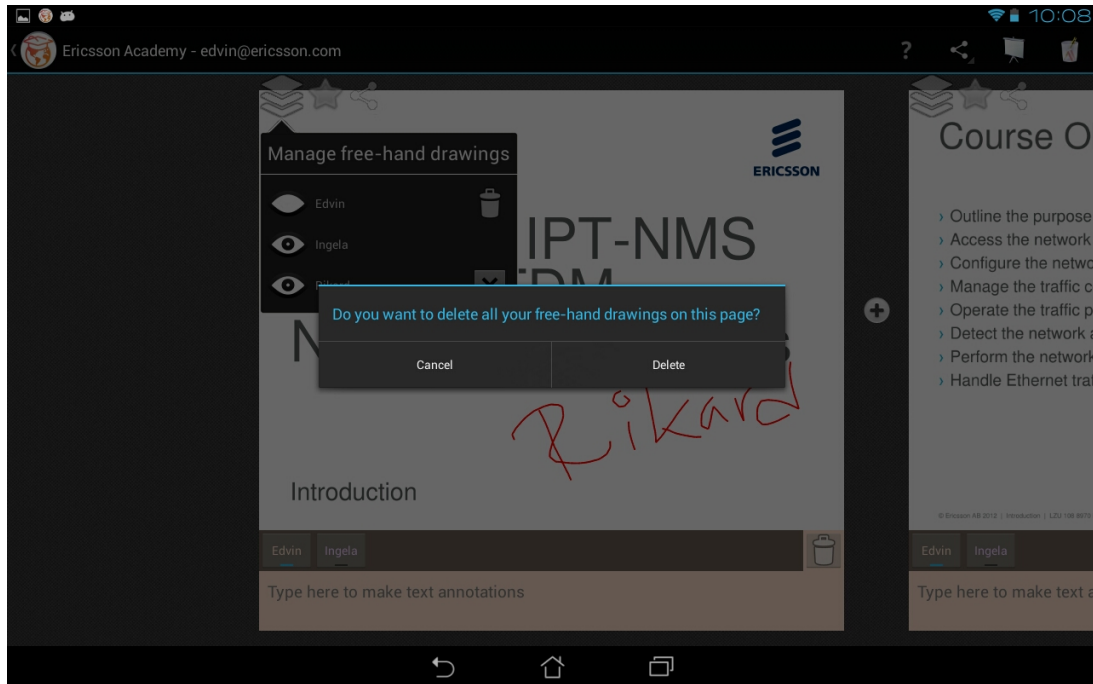


Figure 8.9: Deleting the user's own drawings. By tapping the trash icon, the user's own drawings can all be deleted in one go. There is a modal dialog asking to confirm the action.

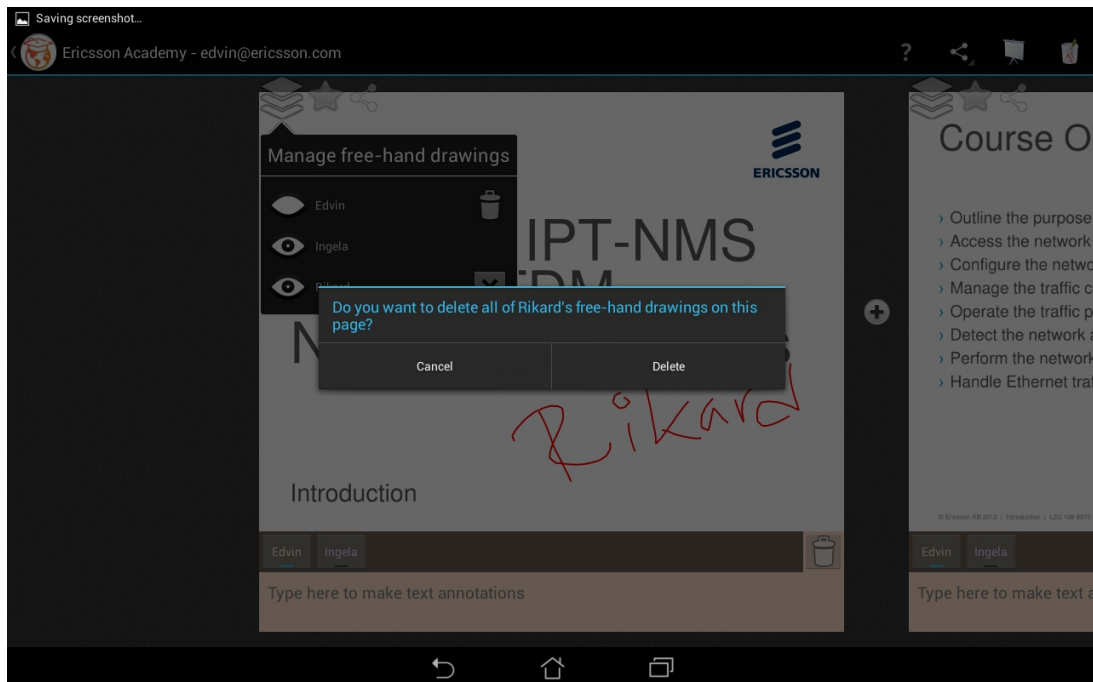


Figure 8.10: Deleting another user's drawings. Drawings received from other users can be deleted all in one go by tapping the cross icon next to the user's name. There is a modal dialog asking to confirm the action.

client) would just connect to the receiving user (the server), immediately send everything on the current page in one big chunk and then disconnect again. In other words the first iteration of networking was

a one way simple communication. The next step was to let the receiver first accept the connection before receiving anything, which was a very quick change. To prepare for future *live streaming* of the instructor's content and at the same time consolidate the code we decided to let all content be sent one part at a time (e.g. one line) so that both instructor and peer sharing would work in the same way under the hood. During a transfer both users were presented with a modal dialog showing current progress, which had the drawback that if a lot of content was transferred neither user could do anything else in the meantime (see figure 8.11). With the added possibility to send all pages in a document at once the networking functionality started to come together quite nicely, but both server and client were still very dumb in that they just connected, immediately sent everything and then disconnected.

During development and test the modal dialogs quickly became a frustrating step of every transfer, so we changed the design to instead show progress in the system notification area that all Android devices sport. This way the user could continue to work while a transfer was underway and additionally we did not have to consider and prepare for complicated orientation change issues (see section 8.3.4). We added another system notification to show the user if she was connected to the streaming instructor at the moment. A final bit of work in making the connection smoother was to make both client and server negotiate the transfers in order to avoid sending redundant data and to prioritize visible pages over invisible ones. In the final prototype a successful transfer works like this: The sending client connects to the server and says which pages are about to be sent. The server checks what pages are currently in its own view and then in turn asks for pages to be sent, prioritizing the pages that are in view. Before asking for another page the server confirms that the previously requested one has been received successfully.

To do this we had to improve our skills in multithreading on Android and conveniently found a perfect blog to read⁷. At first we had one thread on the receiving end and one on the sending end. In the final version there is one thread for the connection and then both a reading thread and a sending thread in both ends. This is a good example of our philosophy to rather get basic functionality working in a broad set of categories than thoroughly working one feature at a time to perfection, in XP called *Incremental Design* (see section 4.3). By working this way, we could almost always show off a working app. A possible downside of this approach is that more refactoring and changes in code might have been required than otherwise.

As time went by it became increasingly apparent that the Android NSD we used to find active devices on the local subnet was not as stable as one would hope. Our test devices sometimes rebooted without apparent explanation and each time our app crashed when debugging and this functionality was active a new lingering device would show up in the list of active devices. After some time a single device could appear to have more than 15 services running that other devices could attempt to connect to, though they did not actually exist anymore. The only way to stop them from showing up was to reboot the involved devices. When we had tracked these problems down to the internal implementation of NSD in Android we found many other people on the Internet who had similar issues and we never to date found a usable fix or workaround for this problem.

8.4.3 Final weeks of coding

When debugging and searching the Internet for solutions to some problem we stumbled upon a very interesting article called "Why I hate Android"⁸. It covered many of the annoying things we had come across in development, such as Eclipse and API bugs, and that the documentation is sometimes lacking or nonexistent. An incredibly annoying bug regarding permissions to write data on the device's external storage was after a long time of debugging resolved by duplicating a single line of code in one file and

⁷<http://techtej.blogspot.se/2011/02/android-passing-data-between-main.html> (available 2013-05-14)

⁸<http://darkdust.net/writings/whyihateandroid> (available 2013-05-15)

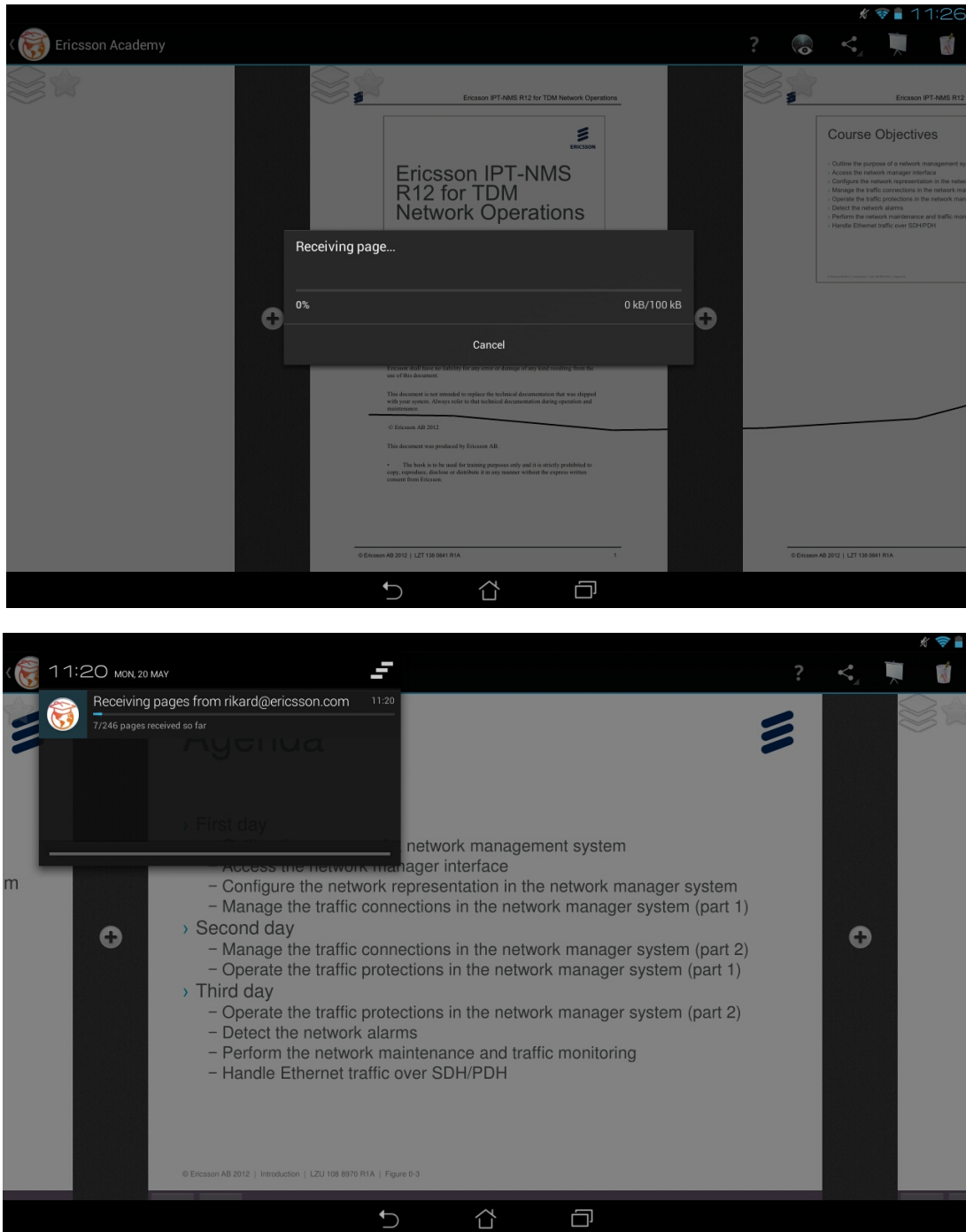


Figure 8.11: Receiving content from another user. The top screenshot shows the modal dialog used initially while the bottom one shows the final notification solution. The notification area normally just shows an icon in the upper left corner of the screen, but can be expanded to show more information as shown in the screenshot.

removing the old identical line. We still have no idea what happened, but we found more people who had experienced the same bug.

The very last feature we implemented during the last two weeks of coding was the *notepad* (the orange area shown in figure 8.12). The notepad is the text area shown just below each page and contains notes

that the user has taken or received from her peers. In section 4.2 we described how the notepad went from a fixed slide-out GUI component at the bottom of the screen to something that was "glued" to each page and that zoomed along with the pages. When that change was made the notion of something "sliding out" was still kept in that the analogy was supposed to be a paper that slides out from beneath the document page. Once we started developing it, however, we quickly realized that there was really no point in hiding the notepad at all. It was much more logical to just let it be as large as needed to fit all text at once (see figure 10.7 for reference).

Towards the end of the sprint when we had all major features ready we could start fixing non-prioritized bugs and adding minor features. One such annoying "bug" was that, until then, freehand drawings were quite edgy, and the edgyness was dependant on how fast the user drew. Some investigation revealed that we had simply not made use of all data we got for each input event and the fix was obvious. Figure 8.12 shows the improvement in visual quality that this seemingly minor fix brought with it.

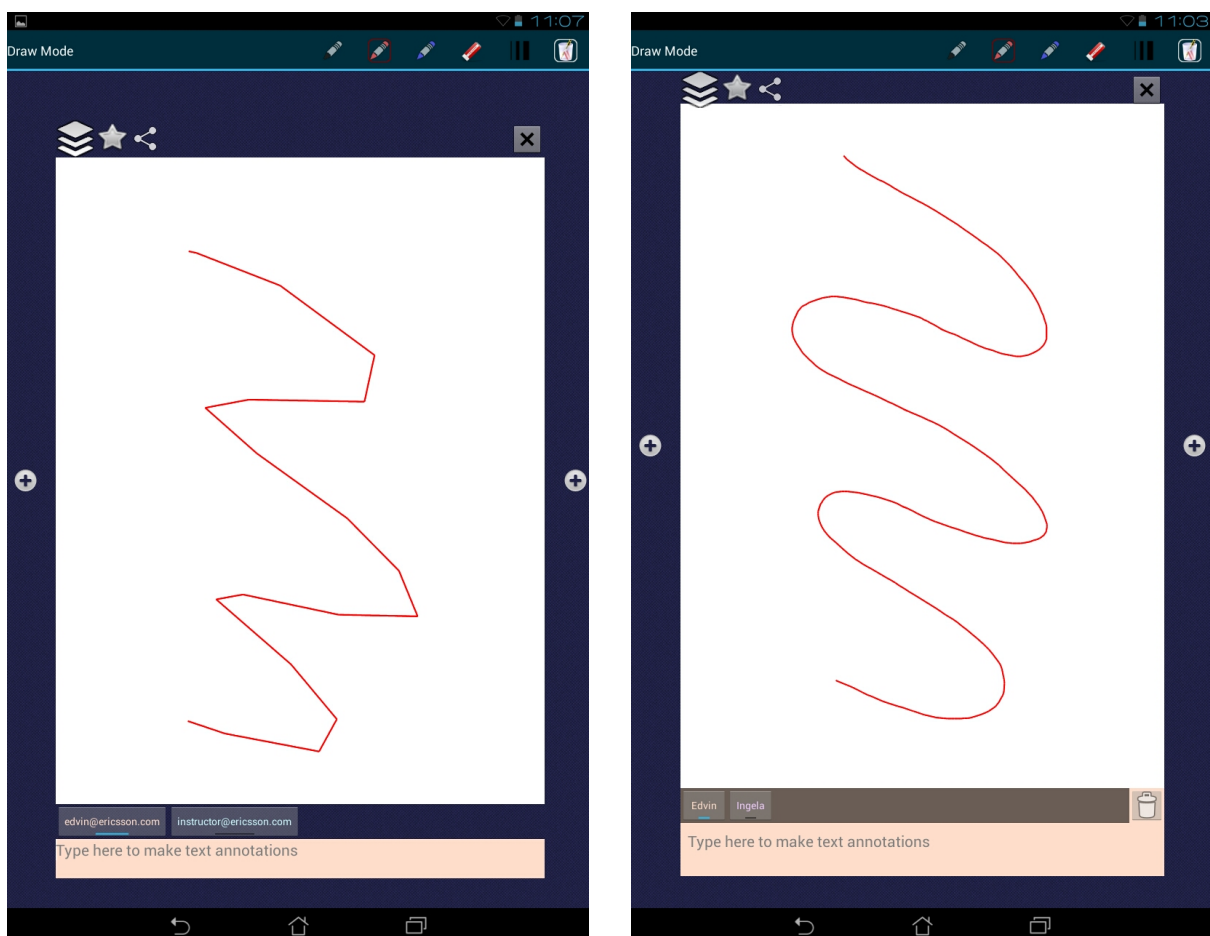


Figure 8.12: A comparison of line edgyness. The left shows a version before we fixed a bug relating to caching of touch events and the right shows the final prototype app. In both cases, the squiggle was drawn in roughly the same pace.

Sprint one ended in an internal test session with some employees in the department, but since sprint two was the final sprint, testing on other users than ourselves was left to the planned live testing sessions further described in section 9.1.

8.4.4 VCT and Adobe Connect

To keep up with current developments at Ericsson Academy we participated in a planned demonstration of *Adobe Connect* that Adobe gave to certain staff members. Adobe Connect is a browser based VCT tool that tries to cover everything a class could need in online live training and education. We were struck by how neat the interface was, both in design and usability. A surprisingly important detail in the overall look & feel of the tool was that the program background was a picture of an office with a table and some chairs and other props, which made you really feel present and together with fellow learners despite the geographical distance. The notion of presence and live communication has been a hot topic in many informal discussions with others in the department. In a real classroom there are all these small human interactions that we normally do not think about, like nods, humming sounds and frowns. Unless everyone has their microphone and webcam enabled all the time these small but important signals are lost in a VCT environment compared to a real classroom where everyone can see one another. Adobe Connect has support for webcam sharing, sound, PowerPoint presentations, whiteboards, chat, groups and much more. An idea we had, despite that the tool appeared to have everything one could possibly need, was that if each learner had a tablet in addition to an ordinary computer during a VCT session they could have course materials on the tablet and thus get more screen real-estate for things like webcam and chat. The idea was that you would use the computer for social interaction and the tablet for the course materials. In the end, we decided this was outside the scope of our thesis project and we would focus on ILT.

With the demonstration fresh in memory we still believe that ILT will last for many years to come even if VCT is an appealing and cheaper alternative. There is after all so much more tied into ILT courses that cannot be completely emulated through VCT: social interactions work somewhat differently and just going abroad for a few days to attend a training can be a way to reward an individual's good work. VCT trainings will never be able to copy that.

9 | Testing and evaluation

Though we had continuous testing during the development sprints, we also saw that a longer dedicated testing and evaluation was called for having completed the prototype app. This chapter outlines this testing process and how it worked out.

9.1 Live tests

To test the prototype in a real environment we first had to find suitable courses. Most importantly we sought courses with around ten participants, that would be held in Mölndal, and where the instructor was from our department. On the intranet there is a schedule with upcoming courses, but a course is not guaranteed to run until a few weeks before the actual date. Some weeks there are no courses at all. Once we had some courses we wanted to test on the next step was to check with the instructor if he or she would allow us to test the app during their lectures. If the course had been bought by an external company we would on top of that have to get approval from that company and then in turn by each participant. Once the tablets were prepared for "real usage", we could finally hand them over at the beginning of the first lecture. In the week following after sprint two we were fortunate to be able to test the prototype app in the setting of a real live course. It was a three-day ILT course given at Ericsson Academy in Mölndal and somewhat unusually it had only two Ericsson employees enrolled. This seemed a perfect fit for us because we only had two tablets available for our tests. We made an agreement with the course instructor that we would attend the course and observe the classroom interaction, provided that the course participants agreed to take part of our testing. Thus we sent e-mail messages in advance to the two participants to ask if they would agree to take part in a trial on using tablets in the classroom as an alternative to the traditional binder. We informed them that they would be free to opt out of the test at any point, should they choose to participate, and stressed that their learning on the subject matter was the priority and that they should in no way feel obliged to take part. See section 4.1.2 for our reasoning behind this.

In this test the participants were given the usual binder and in addition a tablet each with the course materials preloaded. The Samsung tablet had a stylus while the Asus tablet lacked that peripheral. Before the first lecture, we gave them a quick introduction to the capabilities of the prototype app and asked them to try it out during the course and use it if it felt natural. The instructor had no special equipment apart from the usual laptop computer with PowerPoint and a projector. No specific changes had been made in the course itself to tailor it to our app. A feature of the concept app that was notably lacking in the prototype was the ability for the tablet to follow the instructor as she switched slides in PowerPoint on her laptop. In order to compensate for this deficiency we sat in the back of the classroom as *Wizards of Oz* (see also section 4.2) with one of our smartphones running the prototype app and logged in as the instructor. When she switched slides on her computer and thus on the projector, we would manually follow along on our smartphone which would cause the learners' tablet apps to follow automatically. In this way, we simulated the automatic follow mode. Sitting at the row of tables behind them, we took the

chance to observe the behaviors of the learners to try and see how they would interact with the tablets. Unfortunately the two learners were not very keen on taking notes at all during the course, either in the app or by hand, and since they were only two present the sharing capabilities of the app were not very useful to them either. The binders were also left virtually untouched during the course.

We were interested in hearing the learners' feedback on having taken part in the trial. To allow them to be critical and facilitate for honest feedback we were away and had the instructor direct them to an online evaluation form that we had prepared in advance, see appendix H. Our reasoning was that because we were the authors of the software they might have felt compelled to be overly positive if we asked for feedback in person as opposed to anonymously. Regrettably, somehow only one form was submitted so we could not get their individual feedback. Nevertheless, the results from the single questionnaire received can be summarized as follows: a feature they really liked was the possibility to let the app follow the instructor when she changed slides. They also used the app to browse the course materials, for instance when they needed to look closer at a picture, thus using the zoom functionality. They also liked that the materials were in color but they would still prefer the binder for taking notes. It is worth noting here that only one of them got a tablet with a stylus and it is our opinion that a stylus is required to get freehand drawing accurate enough to be really useful. Also, in order to show off the app in its full potential the instructor needs to get into the loop in advance too, especially when it comes to supplying relevant auxiliary materials through the app, such as web links or video clips. During this first test we merely asked for approval to supply tablets during the course, so the instructor did not have the chance to change the actual training in any way to accommodate for the tablets.

We recognize that this testing in no way provides statistically significant conclusions but it was a good way to start off our tests. We wanted to conduct another live test in a larger class a few weeks later but to our disappointment there was no suitable course booked within that time frame which could facilitate this. We realized too late that such tests would really have to be scheduled several months in advance but at the same time courses are never fully confirmed until at the earliest a few weeks before the starting date, which complicates matters. With this in mind we anticipated that testing alone would take a few months, time we did not have. Therefore we had to leave more testing as an item for future work.

How can Ericsson Academy evaluate whether learning is facilitated or hampered by the use of tablets in the classroom, or if they frankly have no impact on learning at all? Given that courses are updated quite frequently, that learners come from diverse cultures all around the world, that classes are often small and that each learner's underlying cause for showing up often differs from the other's, getting reliable and valid results from such an evaluation is very hard. One can of course assess how learners perceive the training, which is presently done by the use of course evaluation forms at the end of each course, but that does not give much indication whether the learners have actually *learned* more or not. An alternative is to send evaluations to past learners between six months and one year after the course. At that point we believe that the learner's satisfaction of the course is more closely related to how much they learned since they have had the opportunity to use the new knowledge in their work. For some course that is held often enough to have the same content multiple times, a knowledge assessment at the end of the course might yield useful results, but again the diverse cultures of learners most likely affect the reliability of such a study. In essence, assessing whether tablets in general increase the learning in professional training is a tricky issue, but in the end it might not be the most important success factor. Learners' own satisfaction from the courses and their perceived learning are probably more important.

9.2 Wrapping it up

It was not until this point in time that the concept of OnCourse was nearing completion. The whole prototype implementation process had given us a lot of new ideas and input along the way. Having

completed (actually *prematurely* completed) our tests we made the final touches to the concept and started working on the report that we would give to Ericsson as a project deliverable (see appendix I for the result of this work). Finally, we prepared and clarified the source code and its documentation so that we could end the thesis project by handing over these items to Ericsson Academy.

We had a brainstorming session in the department followed by a poll to decide on a name for the app. The brainstorming session spawned five candidates as follows which were competing in the poll:

- **MyAcademy** ("This app contains your own content", Academy relates to Ericsson Academy)
- **Twonky** (A unique new name)
- **EriMate** (Starts with Eri and suggests that the app is a companion that follows you and supplies you with info, also short for Materials)
- **Ericoid** (Starts with Eri and has an AndROID touch to it)
- **TrainTracker** (Keeps track of trainING)
- **Ericsson Academy** (In a sentence: "did you download the Ericsson Academy app?")

The name *MyAcademy* received the highest number of votes but respondents could also suggest new names in the poll. One of these, *OnCourse*, caught our attention in particular and was ultimately chosen as the name of the concept. It gives rise to so many possible interpretations; learners do attend courses (they are *on* courses), the app should help them keep on track to learning (to stay *on course*, figuratively speaking) and the app is actually used during lectures and exercises. While the name *MyAcademy* emphasises that you as a learner have your own personal course materials and other resources in the app and is similar to the Ericsson Academy branding, it is also quite mundane. Of all the names proposed, *OnCourse* is the most exciting and it caught on.

10 | Results

Our plan states that the thesis project should result in two main deliverables (see section 6.7), namely a business case report introducing a tablet solution and a prototype of that solution. These two deliverables have indeed been developed, and we have chosen to name the solution, or Android app, OnCourse. The business case report has become quite extensive and it is therefore further divided into three distinct parts: a concept (see section 10.1), an analysis of how the concept can be utilized by Ericsson Academy and a recommendation to Ericsson Academy on how to take the work forward. In addition, it narrates a fictional future scenario about two employees from a Swedish network operator and their experiences during a course at Ericsson Academy. This scenario envisions what the future could look like on-site in Mölndal if Ericsson Academy invested fully in OnCourse. The report can be found in its entirety in appendix I.

10.1 Introducing OnCourse

The pivotal result of the whole thesis project is the concept for an tablet app named OnCourse. This section details all features of the concept and illustrates them using screenshots from the prototype app described in section 10.2. The screenshots were taken on an ASUS Transformer Pad TF300T. First of all there are a few key features we believe that a fully fledged app needs to have in order to fully utilize the possibilities of tablets as they are today.

- OnCourse should make use of the higher precision and additional functionality provided if the user is using a stylus instead of her fingertip to draw on a digitizer-enabled device, such as one from the Galaxy Note series of Samsung devices.
- A substantial effort needs to be put into making the app as self-explanatory and easy to comprehend for first-time users as possible since many course participants will arrive without any prior knowledge of it.
- Except for cloud storage of user-created content and initial authentication the app should not require an active Internet connection to be usable. The instructor should in the absence of Internet connectivity be able to create a local WiFi hotspot if needed and temporarily act as a local provider of course materials. Sharing documents among peers should only require a functioning Local Area Network. In summary, the app should be robust to shifting Internet and network connectivity¹.

10.1.1 Ability to download the app to the learner's own device

The learners should have the option to install OnCourse on their own devices. Should a learner enrolled in a course choose to install OnCourse before arriving at the course, she should have the option to

¹Ericsson frequently gives courses at foreign sites where Internet access is unreliable and using tablets must not reduce the instructor's ability to give courses

view course materials and other information before the course begins. There may also be additional information available including (but not limited to) a list of enrolled learners, suggestions for preparatory WBL courses or suggestions for other relevant courses. After the course has finished the learner should be able to access all materials for future reference.

10.1.2 Prerequisites

Presently, all learners are being registered in the *MyLearning* database at Ericsson, though currently only by their e-mail address. To be able to fully use the app's functions each learner needs a full login, and the server needs to be able to communicate with the app and store user-created content. Ericsson needs to investigate how the course materials could be distributed to tablets, especially when it comes to DRM and how to release documents which are considered company assets.

10.1.3 App specification

This section further specifies how we envision the tablet app and the features it supports.

Login view

The user is initially greeted with a login view where she logs in to the system (which is integrated with e.g. MyLearning, Ericsson's learning management system) using credentials supplied by Ericsson. Figure 10.1 shows this screen.

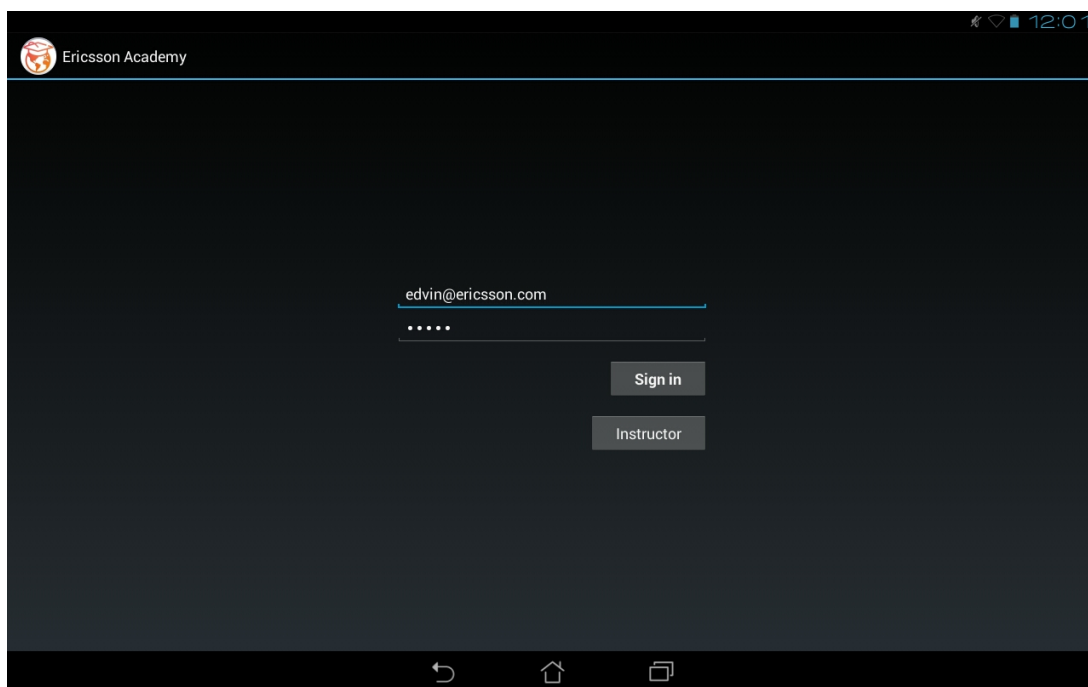


Figure 10.1: *The very first screen presented to the user is a login form.*

Course list view

When logged in, the user is shown a list of accessible courses, i.e. past, present and enrolled courses. By tapping on a course, the user is shown a list of resources associated with the course.

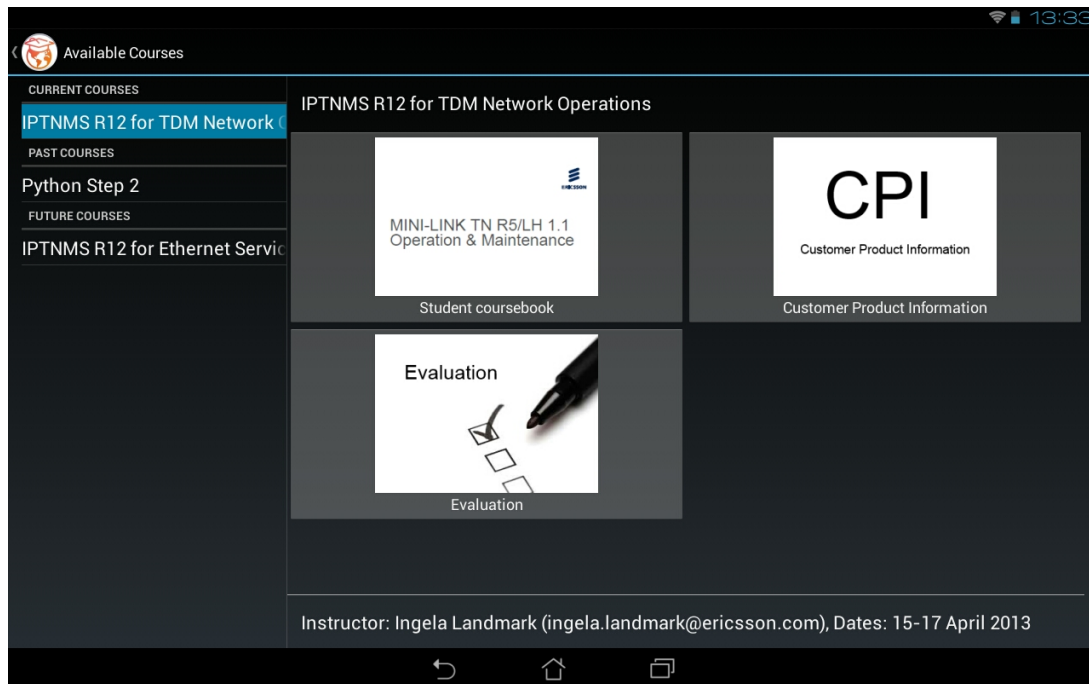


Figure 10.2: *The overview screen that the user first meets after she has logged in. It shows available courses to the left and resources for the chosen course to the right.*

Course resources overview

When a course has been selected this view shows course resources available for that particular course, which includes

- Documents, e.g. the Student coursebook
- Interactive exercises
- Links to relevant CPI documentation
- Links to external resources such as videos and articles
- The course evaluation form

The overview also contains some basic information about the course, for example the instructor's name and e-mail address, and key course dates. Figure 10.2 shows the course list to the left, available resources in the selected course to the right and some basic information at the bottom of the screen.

Document view

When selected in the course resource view, documents open inside the app. In this view the user can take notes, set bookmarks and make freehand drawings on each page of the document. The interface allows for zooming and panning, and the freehand drawings are vectorized to stay smooth when zooming in. Available navigation tools in this view are a document outline (table of contents), search feature and a list of set bookmarks. Figure 10.3 shows what the document view looks like in the prototype app.

The learner can choose to *follow* the instructor, which means that the learner's app always shows the same page as the instructor's. This saves the learner from the tedious flicking through pages when the instructor progresses through her presentation. Additionally, any notes or drawings that the instructor makes are

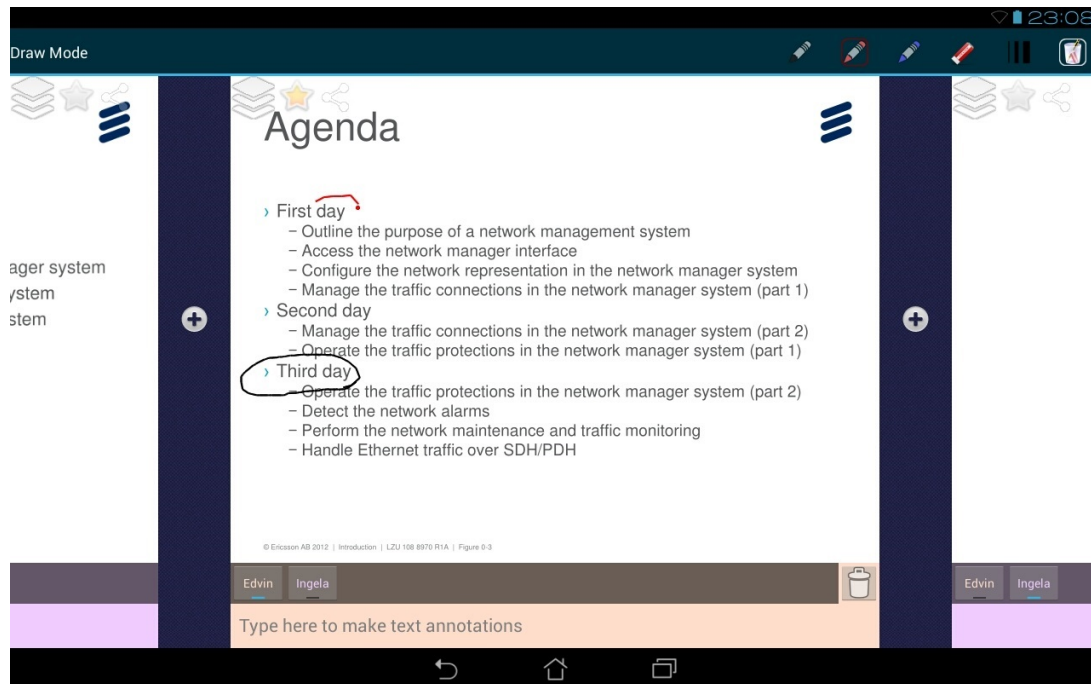


Figure 10.3: *The document view when the user is circling some headings.*

immediately streamed to all connected participants. The instructor can on demand add additional pages if needed and this is reflected on all enrolled learners' tablets. Note that an Internet connection is optional if all participants are connected to the same Local Area Network connection. The learner can also add new blank pages anywhere in the document or create a new page based on a just taken photo as shown in figure 10.4. The instructor can use the mouse (or hovering stylus pen if she is using a tablet) to highlight specific areas on the current page with a dot.

In figure 10.5 the user has started to make a note at the bottom of the page. The notepad automatically increases in size as more lines are added. There is one tab for the local user's notes, in this case the user is called Edvin, and one tab for the instructor's notes (Ingela). If yet another user shares her notes with Edvin, another tab will pop up on his device.

Interactive exercises

During class, after the instructor enables an exercise the learner can open it from the course resource view (similarly to how she opens a document). A new view is opened, which presents one exercise instruction at a time. Having finished the current task, the learner taps a button to proceed to the next. The instructor can then at any time see a summary of progress for all learners. The instructor may also, as a quick check, have added a question to answer on some pages. The questions do not stop the learner from moving on though, it is merely a way for the instructor to gather statistics that can be used to later on emphasize those questions many people failed to answer correctly.

External links

The resource list may also contain external links to e.g. Youtube videos or other interesting web pages such as the CPI portal. Note that an Internet connection is required to access links. When tapped the default web browser is invoked to open the web page.

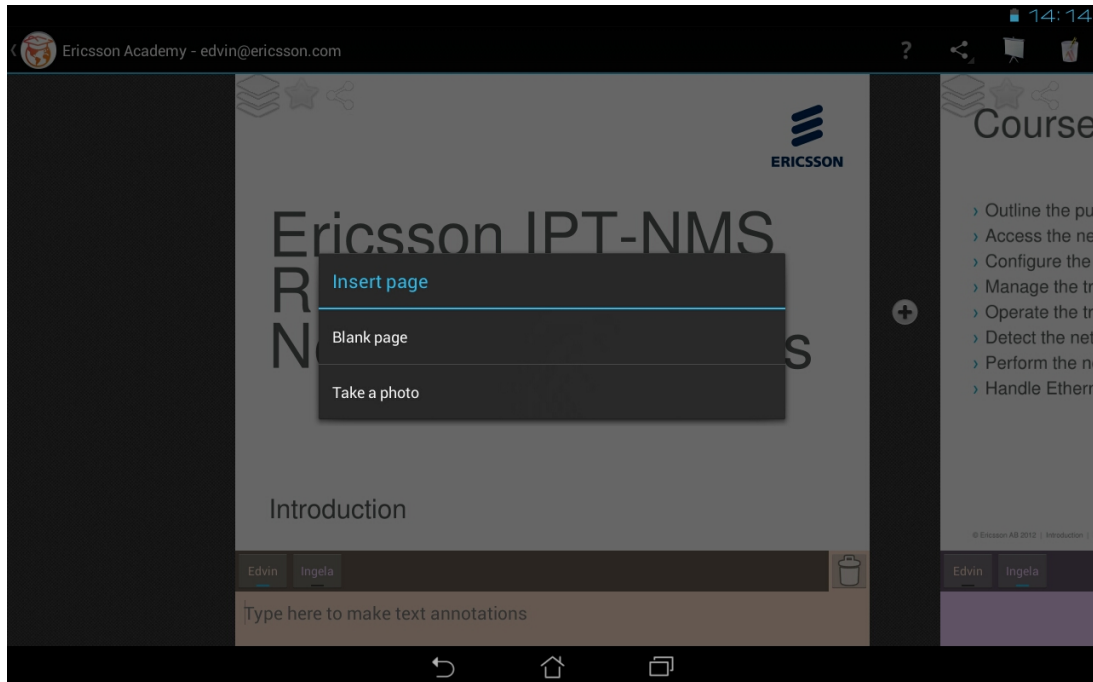


Figure 10.4: A user about to insert a new custom page gets two choices

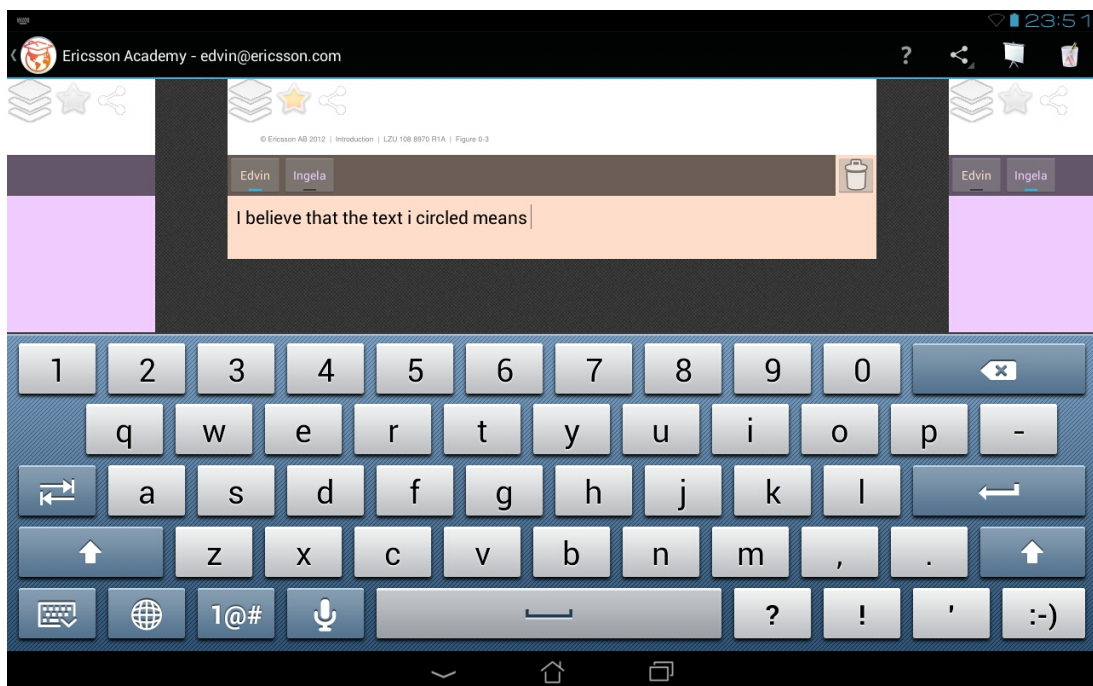


Figure 10.5: Writing notes associated with a single page.

Course evaluations

At the end of the course the instructor can enable a course evaluation that the users can answer directly on the tablet by choosing the corresponding resource in the resource view. Optionally, the instructor may remotely push the course evaluation to the front of the screen on all learners' tablets. After the course the instructor then simply taps a button to create a summary of the results for future reference.

Page sharing

All learners continuously get any drawings the instructor makes on the SMART Board in the classroom (or her tablet) streamed out to their tablets. They may also share their own page content (this includes notes, drawings and photos) with each other. When sharing such content, the receiving user gets a snapshot copy of the content through the network. Each person's notes are presented in individual tabs at the bottom of each page while drawings are presented as layers whose visibility can be toggled (see figure 10.6). That way every learner can choose any combination of layers to show.

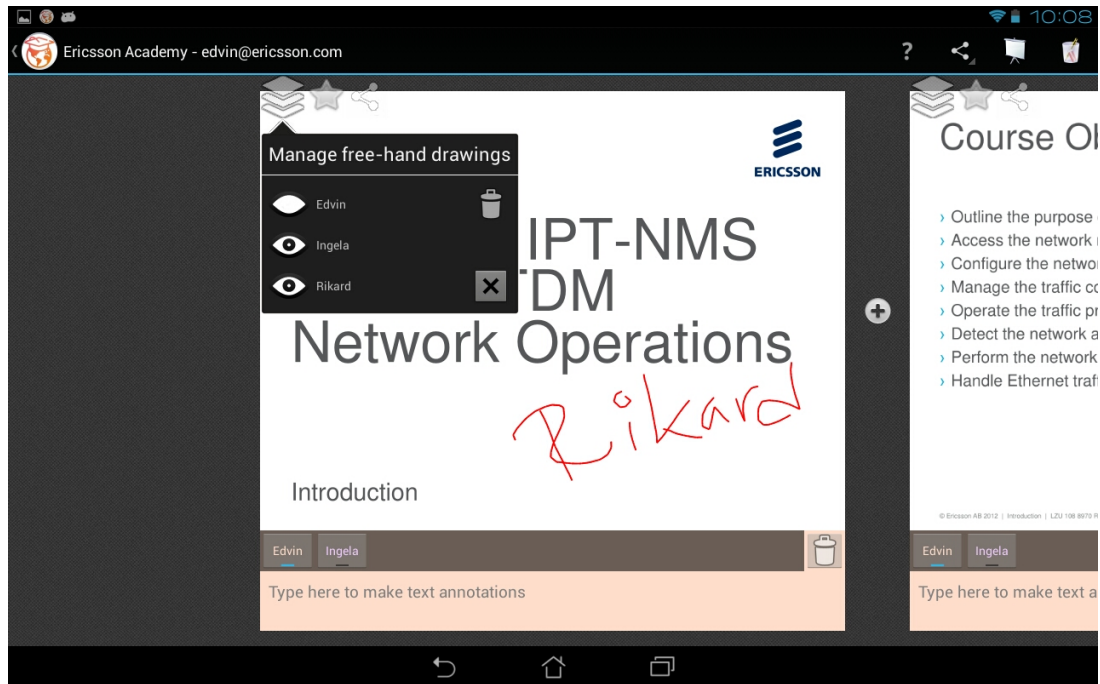


Figure 10.6: *The layer toolbox*

Figure 10.7 shows a user in the middle of sharing some created content. The user has pinch-zoomed out to get an overview of a few pages at the same time. She has taken a picture, made some notes about it and is now just about to share all her pages with a fellow learner. Note that on the second visible page from the right where Ingela's (the instructor's) notes are shown, the notes can not be deleted (there is neither a trash icon nor a cross icon in the tab bar).

Spontaneous questions

The instructor can choose to ask a question with e.g. four possible answers. Each learner then receives the answers as a new page. The instructor could also ask an open question to gather data from each learner for easy sharing to everyone. Then everyone do not have to manually copy interesting thoughts from each other's notes.

Links to the CPI (customer product information)

The course resources may, if applicable, contain links to specific sections of the target equipment's manual (CPI). When tapped, these links go directly to the correct section of the CPI in a web browser, with the possibility to easily return to the same place in the local course materials again.

Search

Throughout the app the user can do full text searches for anything she wants to find. The search is done in both resource names, document content, user notes and the CPI. Android requires compliant devices

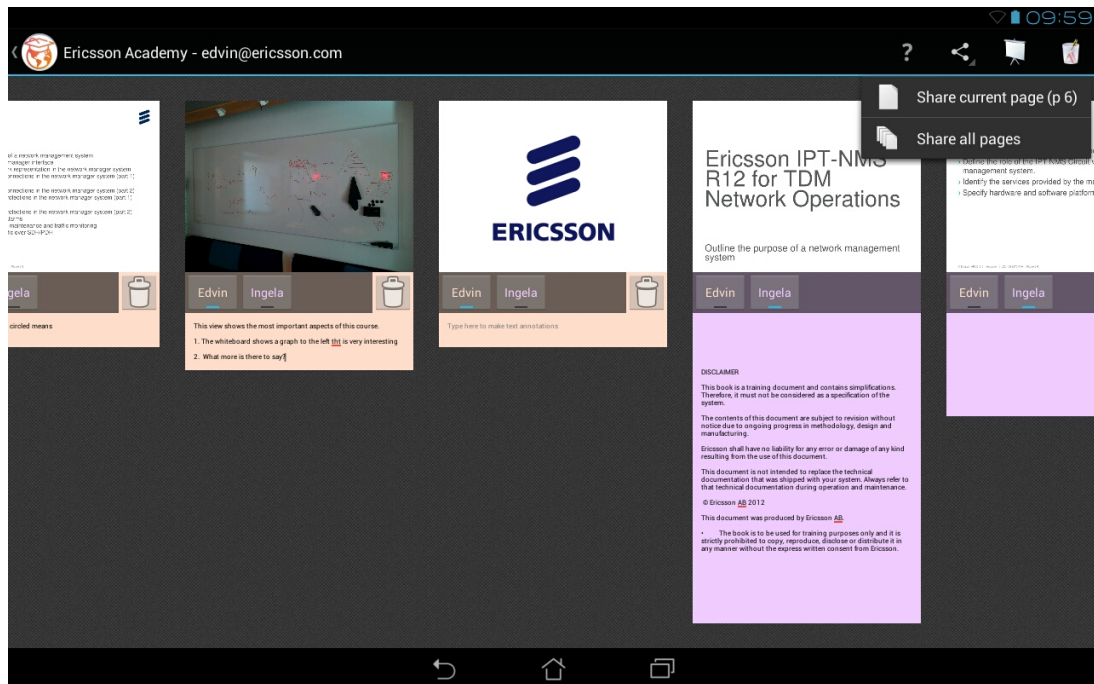


Figure 10.7: A zoomed out view of a few pages in the document

to have a dedicated back button (either physical or on-screen) and tapping this button allows the user to always go back to the previous view after looking something up by searching.

Export of all course materials created during the course

Documents, typically supplemented with the learner's content, can be exported as PDF-files for viewing on other devices.

Information about new relevant courses

If the learner has the app installed on her own device Ericsson can push notifications about new or updated relevant courses.

10.2 The prototype

As a proof of concept and to be able to test the concept for OnCourse in real courses we created a prototype app. It implements a subset of the features presented in the concept in section 10.1. The user can login, browse a few courses and access external links and course materials (documents or presentations). The document view is feature complete except for the left slide-in panel with search, bookmarks and document outline. Sharing of user-created content works over the network, and the prototype features letting instructors have additional privileges such as streaming page changes and new content to all users visible on the network. It is however not possible to use a PC and draw directly on a SMART Board. Other parts of the concept that have not been implemented include searching and browsing bookmarked pages. Perhaps most notably the prototype does *not* integrate with any of Ericsson's existing IT infrastructure. Therefore user-created content is only stored locally on the user's device (and on peers' devices with which the user has shared content) and this hinders seamless device migration. For instance, this implies that if a device crashes or is lost, the user has no way to recover the content. If content was instead stored on a server, as proposed in the concept, a user could log in on

any device and have instant access. There is also no dedicated exercise functionality in the prototype. Exercises are presently distributed on paper though, so it is possible to simply present these as ordinary documents inside the app.

10.3 Levels of commitment

While the app concept itself is designed to envision a great deal of things that could be done to enhance training at Ericsson through the use of tablets we recognize that there might be constraints that limit how much can realistically be implemented. Aside from aspects of cost and implementation time, there might be other factors that limit what is possible. Therefore, we have chosen to offer these four separate recommendations based on the level of commitment to the overall idea. They are arranged in numerical order from low to high commitment, and for each level more benefits to learning and user experience are available at the possible expense of higher risk and greater resource cost. After each level's definition we also state requirements for that level. *Note that a higher level requires everything from all lower levels in addition to what is stated for that particular level.* Table 10.1 shows a comparison of the four levels of commitment for easy reference.

10.3.1 Level 0: Minimal commitment

The minimal commitment level simply makes tablets available for all learners and instructors during ILT courses at Mölndal. It is up to the instructor how to use the tablet during the course, for instance finding useful apps, since OnCourse is not available. In this approach, we acknowledge that we do not fully know how tablets are best utilized in Ericsson's classroom setting but expect the users to find good uses when given the option.

Requirements: Class sets of tablets will need to be purchased. Each instructor will then need to book a set in some booking system, make sure that they are charged before the first course day and prepare each tablet to the extent she deems fit for that particular course.

10.3.2 Level 1: Minor commitment

At this level, OnCourse is regarded as a supplement to the traditional ILT teaching given. The tablets are used by learners to view course materials and to answer evaluations. Each learner can choose between a binder or a tablet, but when the course is finished only the binder can be taken home. Therefore an option to print a binder with the learner's own notes is required. The instructor uses either the app on a tablet or a special program on her PC to show slides so that learners' apps can follow along and get any content she creates. On completion of the course each participant fills in the evaluation form on the tablet. Learners cannot use their own tablets; they must borrow one from Ericsson.

Requirements: For each concurrent course a full class set of tablets is needed. As a rough estimate, if four courses are held at the same time this means at least 60 tablets. Maintenance will be required either as preparation work from the instructor or from a dedicated employee. Maintenance includes app installations, fixing faulty devices and making sure that loading cabinets are available on course day end. The issue of battery charging is not to be underestimated. The OnCourse app also needs to be developed according to the concept specification, though some parts such as exercises and individual account logins are not needed. Some training of instructors is needed too.

10.3.3 Level 2: Major commitment

On this level OnCourse is also available for download to your own device. The learner can view all course materials both before, during and after the course, but no content can be extracted outside the app. Instructors may to some extent adapt their course materials to this new platform, for instance by creating an interactive exercise.

Requirements: This level requires that a backend exists to log in to, both for user authentication and for storage of user created data. A fully functioning app as specified by the concept needs to be implemented and maintained. Instructors and course developers also need more extensive training how to use the tablets and the app.

10.3.4 Level 3: Full commitment

At this level the full potential of the concept is used. The learner can extract all content from the app to a PDF, which possibly has DRM.

Requirements: The final level requires asset policies to change so that non-Ericsson devices are allowed to store PDF-files - with or without DRM.

Functionality	0	1	2	3
Tablet available during course span	✓	✓	✓	✓
Printed binder provided to participants	✓	✓*		
View course materials on tablet	✓**	✓	✓	✓
Draw, make notes and take photos stored in the app		✓	✓	✓
Follow instructor page changes		✓	✓	✓
Stream instructor drawings and notes		✓	✓	✓
Digital evaluation form		✓	✓	✓
Possibility to use the app before and after the course			✓	✓
Participants can use their own device during the course			✓	✓
Ericsson can push notifications about e.g. new courses			✓	✓
PDF export functionality available				✓
PDFs with DRM				✓•

* Since course participants cannot access their created content anywhere it will have to be printed after the course.

** The instructor may decide to prepare the tablets by putting parts of the course materials on each tablet. Then course participants will be able to view it in a suitable PDF viewer app.

• May be required depending on current policy regarding course materials.

Table 10.1: A comparison of the four levels of commitment and which features they enable.

10.4 Our Recommendation

Out of the four levels of commitment described in section 10.3 (levels 0-3) we recommend Ericsson to aim for level 3. Level 2 is also a reasonably good way to go, but customers will most likely dislike that they cannot view the materials on any device they have at their disposal, for example a PC. An alternative though, would be to also develop a web page where the user can log in and view the materials, but then there would be two systems to maintain.

Level 0 may very well increase the tech- and wow-factor for courses and create a modern appeal to it, but it does not enhance the learning experience at all. It will probably even lower it since a new distraction is introduced in the form of tablets that poke for attention. It also requires maintenance, so all in all this level is not worth the cost.

Level 1 does allow for improved learning, but the main issue is how to distribute user-created content to the respective participants after the course. If Ericsson chooses this level of commitment more investigation is needed in this area. The advantage is that there is no need to change any existing systems.

All levels require instructors to embrace and explore new ways of performing training, so in order to succeed training and time is needed for them too. Especially levels 2 and 3 mean an organizational change both for those who create courses and those who deliver them. This cannot be stressed too much. To really enrich the training *it is not sufficient* to develop an app and then leave it at that. Conscious structural change is also required to be able to utilize the app as intended.

10.4.1 Next steps

Before more resources are put into a fully functioning app we recommend Ericsson to do more testing with our prototype on live courses to get more feedback. Classes of about ten people would be perfect, but more tablets will need to be bought to do this. At least four courses should be tested with the same instructor to also get feedback from an instructor that during those four courses has become accustomed to the app. In order to really take advantage of using tablets pedagogically we also recommend some research into how the structure of courses can change when tablets are available.

10.4.2 Uncertainties

Our customer surveys indicate that a majority of course participants do not have access to a tablet of their own in their everyday work today (see also section 7.4). Furthermore, only 58% of those who attended a course during 2012 have used the course materials as they look today afterwards. We nevertheless vote for a continued investigation towards the complete concept. This is because one can pose the question what is the cause and what is the effect of course materials usage. If you as a technician can download an app to your own device, maybe many more will use the materials afterwards, and they may even tell their boss that they need a tablet to do this? At the same time it is of course extremely hard to predict how people's behavior change with new tools at their disposal. The only way to find out is to try. We are also uncertain whether it is actually possible to easily change the way teaching is conducted. Even a well thought out planned change (see also section 3.2) will probably require much effort and continuous change for many years to come to be successful.

11 | Discussion

In hindsight the path taken on a long journey seems rather clear and obvious. Perhaps it is because there are footmarks left behind that tell a tale. When looking back you can see forks in the road, points in time where you made decisions. Some of these turned out to be minor while others changed the direction of travel and ultimately the final destination. At the time telling these two kinds of decision apart was not straightforward and indeed in some cases impossible. Such is the nature of journeys into uncharted territories and our thesis project has been a bit like this. Given what we now know at the end of the project there are many things that we could have done differently, to a greater extent or refrained from doing altogether. At a given point in time, however, one can only base decisions on past events while also trying to second-guess what lies ahead. In this chapter we discuss various thoughts that have surfaced during the thesis project, lessons we have learned for future projects and finally suggestions for future work in this area.

11.1 Introducing ICT in the classroom

So far we have not mentioned the pedagogical aspects of this project in any great detail. This is because the main effort in our work has been put into working out how tablets could be incorporated in the training as it currently stands and to develop the OnCourse concept. We will thus only briefly discuss select pedagogical aspects - these are major topics that could develop into whole theses in their own right! For instance, once tablets are available in the classroom maybe instruction could and should be fundamentally changed into some completely new way of teaching which might have no traditional lectures at all? Or maybe should you more heavily invest in making course materials incorporate audio and video or interactive elements rather than static text? During lectures, how can you prevent learners from using their tablets to watch YouTube videos instead of listening? Should you even try to prevent this or is there something fundamentally broken about the training if learners prefer watching videos to paying attention? There are many questions that can be delved into.

A very topical issue in this regard is what happens when a new tool as such is introduced in the classroom. No matter what the new tool or equipment is it can be a potential distracting factor both for the instructor and the learners and thus decrease learning¹. The instructor may have to focus on making sure that the tool works as intended while the learners may find the tool fun to use for other things than intended. As of today tablets are principally designed to have only one app active at a time which is good for avoiding distractions, but the ever decreasing gap between laptops and tablets indicate that this will not be the case in the future. For instance, Samsung has developed Android extensions on its Galaxy Note 10.1 to allow supported apps to run in windowed mode or split screen. Another distraction issue is that each

¹See for instance http://www.nbcnews.com/id/14014219/ns/health-childrens_health/t/too-many-distractions-get-way-learning/#.UbRjZ5wgIuN or <http://stephenlazar.com/blog/2012/04/must-read-distractions-drastically-effect-learning/> for a brief introduction on the subject (available 2013-06-09)

learner is presented with a possibly completely new tool on arrival, and no matter how easy to use and user friendly the app is it takes some moments to get to know the tablet environment. At the same time this could be a positive influence in that the possibly (according to some) dull but necessary curriculum gets more interesting with an intriguing tool to use as a mediator. The same is true for the instructor; a new tool allows her to explore new ways of tutoring that might enhance learning as a whole just because of the variation in techniques used.

There are even more possibilities for distractions once learners are encouraged to bring their own (personalized) tablets to class. Despite the app design which encourages single-tasking and staying focused on the lecture, system notifications can alert of new work e-mails or online status updates from social networks. In essence, there are more temptations to let the mind wander away. On the other hand, when compared to a laptop computer we believe that the tablet makes it somewhat easier to stay focused because when if you happen to go to another app and get distracted, the OnCourse app really gets minimized. In contrast, on a truly multitasking laptop computer, you can easily keep the lecture window partially visible and therefore feel that you are somewhat focused on the real task while really you are not paying attention anymore to the lecture.

Though we have not dug much into the subject we do believe that the perceived quality and visual appeal of materials and aids in use affect the learning², that intuitive aids and good looking materials increase motivation for learners. It is important to keep this in mind as the OnCourse concept is developed further and eventually implemented at Ericsson Academy.

Administratively speaking the tablets need to be charged every day (or night). What if one battery is drained in the middle of a lecture? The tablet could also crash or break, and if it is crucial for the lecture the whole class might get interrupted because of this. Someone also needs to make sure that all tablets are sufficiently prepared with correct materials and apps. On top of that there are ethical aspects since digital media enable monitoring or snooping/spying on learners, for instance by gathering statistical data throughout the sessions. Even just the suspicion of it might be a problem in the minds of users, even if no actual monitoring or snooping occurs.

We still believe that tablets enable richer collaboration and learner involvement during lectures. From what we have seen, exercises are already very collaborative in nature and require learners to help each other out and discuss issues at hand, but the lectures themselves could also benefit from increased learner involvement. Throughout planning and development we have had Vygotsky's sociocultural views in mind (see section 3.1). We hope that the tablet can serve as a new physical tool to help mediate and appropriate knowledge in the classroom through extended collaboration and discussions. We also hope that it helps the instructors to find new ways of teaching, for instance to bridge cultural barriers.

11.2 Challenges

Paper has been used by most parts of the world for hundreds of years and is thus a very familiar concept. We are so accustomed to working with paper that we sometimes forget how much our methods are tailored for use with paper. You can browse a binder in virtually any desired pace, you can take out one or many papers and put them on the table by themselves. You can easily put bookmarks on interesting pages and view e.g. four pages at once laid out on the table. None of these things are possible on a tablet, and the screen real-estate is only equivalent to roughly A5, but on the other hand it enables a bunch of other things not possible with paper. Two examples are that you cannot insert a just taken picture in the middle of the binder with a suitable comment without going through a whole lot of steps and involving

²See http://www.westga.edu/~distance/ojdla/winter134/david_glore134.html for some related research (available 2013-06-09)

a printer, and you cannot easily copy what you have written into one of your friend's binders without a copying machine or a lot of time. If you are not in the same room it gets even more complicated. These tasks, and many more, are extremely easy on a tablet. The problem is that those who attend ILT probably have not used tablets since they were born, in contrast to paper. As intriguing as it is, for young people this may however have changed in twenty years from now, so we are eager to learn what training and education looks like in the future!

11.3 Deviations from planned results

We would have liked to test our prototype on more courses and evaluate those tests. Unfortunately the time it takes to prepare for such tests is in an entirely different time scale than we anticipated, and on top of that there were during the weeks we could have done the tests no courses held at all. Therefore our results have an even heavier emphasis on a proof-of-concept that will need more testing than we had originally intended. Still we believe that this fits Ericsson's needs better than what a more thorough investigation without a working prototype would since they do have something to show off now.

It is quite interesting to compare our very initial plan (see chapter 5) to what actually transpired. Back then we had a plan to focus on how to integrate our solution with Ericsson's systems, but in the planning process this thought completely vanished in favour of the opposite, namely that our prototype would have no integration at all since it would take too much time to implement and may not be possible at all anyway because of policy limitations. The notion of a specific concept in addition to the prototype did not exist from the beginning either, but emerged as a natural way of proceeding during development.

11.4 The resulting concept and prototype

While there are immensely many possible features for a training app each feature needs to really add value to the overall course experience, either in terms of actual improved learning (which might or might not be discernible to the individual learner) or in terms of added flexibility or useful tools. Some features that were discarded with this in mind are polls, chat and video. Polls could in theory be useful, but the two main reasons to not include a feature like that is that it would add more complexity to the app and that in classes of around ten people the preferred way should always be to simply ask instead. Additionally there are many free apps that can do this already. Chat for that matter would be too big of a distraction and again live conversations are more useful. That participants would like to chat with each other before or after the course seem almost non-existent, and they would probably choose another app in that case anyway. Finally, integrated video could be useful but it adds another choice and therefore too much complexity. Still, a link in the resource view can very well lead to some video on the Internet. When an initial version of the app has been introduced and used for a while video may arise as a feature again though.

Though we recommend Ericsson to try to incorporate tablets in their training we are not at all sure it will become a reality. Most learners are quite satisfied with how training is done today, and since they do not know of anything better it will be hard to sell that tablets could be worth an extra fee. The unknown is always frightening, and normal classroom education is familiar to virtually everyone. It is impossible to predict how well tablets work without test using them in courses for a much longer period of time, possibly a year, but as long as Ericsson Academy manages to persevere we believe tablets will become a success in the end.

We think that it is better to create a concept and a prototype, use it, and then evaluate it than to investigate the situation more thoroughly than we did and not have a finished concept or prototype.

11.5 Our methods and processes

We are well aware that our concept is tailored closely to the current way of conducting training. It may happen that, from a pedagogical view, a whole new approach to the training would add just as much value to the course experience and make our concept obsolete, but we believe that change has to come in small chunks in order to have the slightest chance of surviving in the long run, see also section 3.2. Therefore our concept is a first step in a new direction, not the whole yard.

In retrospect it would have been useful to ask previous course participants whether they use a smartphone or tablet to browse the CPI today in addition to whether they use the course materials, but that may come in a future survey.

On first look our overall project process might seem very linear and progressive, much like the Waterfall method discussed in chapter 4. The overall structure has indeed had such a layout. It would be completely unreasonable to start coding before we had a plan and had some kind of data or design. Without any feedback during the process such an approach would probably not work out very well. At the same time we have tried to keep to the plan of "What do we know at the moment? What is the next step based on that?". This means that there of course has been planning throughout the thesis project and that we have continued to gather data after the explicit gathering-data-phase etcetera. Therefore each week could be said to have been an iteration in the complete project process.

If we were to do the same type of thesis project again we would definitely have read more about human-computer interaction and interaction design early on! Our whole program has a breadth seldom seen on the master level and that is for better or worse reflected in this thesis project. Many research areas are touched and used, but we cannot be experts in them all. At the same time we believe this approach is closer to jobs of today.

If we had known that live testing would require so much administration we would have put more time on that activity in the time plan, and also planned testing sessions differently because of the long lead times from plan to completed course evaluation. Of course this would mean that the app would need to be finished earlier, which in turn would mean that fewer features would be included. We should also have asked for more tablets early on for testing. As students we are just so used to saving every last penny that we hesitate to ask for more resources.

Another thing we believe it would have been useful to do more of is observation sessions in classrooms during courses. The downside of observation though is that it takes so much time. It could very well be worth it, but we would have had to cut down considerably on other parts of the thesis project which in turn may have been more important for the final result that observation would be.

11.6 Generalizability

From the outset of the thesis project we did not expect our envisioned results to be very general. After all, our goal was to investigate an internal challenge within Ericsson and to come up with ideas for how to mitigate these. We were consciously adapting our study to the local conditions rather than trying to ignore them in order for our results to be applicable and useful to Ericsson. Despite this, we do expect that other companies might be facing similar challenges to Ericsson's in adapting their trainings to incorporate digital aids. If that is the case, some of our findings from this context might very well prove useful in their setting. We especially believe that our *methods* for investigation and development are sound and applicable in other settings. Modern technology is evolving at an astounding pace and technologies can become obsolete overnight. The question is for how long tablets are the way to go. In two years time there may be something all new that takes over? Our *results* might then be outdated but

our *methods* are not.

11.7 Future work

As we have noted many times earlier the next step as we see it is to test the prototype app in action in more courses to get more feedback from customers and instructors alike. Especially valuable is feedback from instructors who have used the app actively for a while and gotten accustomed to it. After that the prototype needs to be polished and integrated with Ericsson's systems. Therefore a complete system could be rolled out at the earliest in one and a half years. We also suggest that some effort is put into research about how course structure can be changed to really make use of the possibilities of tablets.

When development on the app is resumed we argue that the most prioritized features to add are integration towards Ericsson's systems and a search function. Until these features are implemented the app cannot feasibly be used outside Ericsson's premises because learners must be able to take their own notes and drawings back home and without search it will have very limited usefulness in the field.

To get more knowledge about the current state of ICT in general one could ask textbook publishers what they are currently working on. The Swedish publisher Liber has started to publish e-books, and the next step might be to create specifically tailored apps.

As a final note, when it comes to interaction design and interface design we have not investigated how our design works for those who are color-blind, visually impaired or physically impaired.

12 | Conclusion

The thesis project was originally started because Ericsson Academy saw a need to modernize how course materials are presented to customers and that tablets were hot on the market; the combination seemed perfect. They also saw an opening to change and improve their ways of teaching at the same time since organizational change is most often hard to succeed in unless there is a clear vision and a desire from the organizational as a whole to change; the introduction of tablets could help with that. This was a very broad entry point, and we chose in agreement with Linus at Ericsson Academy to approach it by creating a solution for one way to accommodate these needs. In other words we realized quite early that it would be a much too large commitment to try to create many solutions and compare them. Instead we settled with creating one feasible solution so that Ericsson has a solid basis they can continue working on.

First we planned the project thoroughly, as depicted in chapters 5 and 6. We created a work breakdown structure (WBS) that we used to create a time plan and Gantt chart and also specified both deliverables and milestones within the thesis project. Planning was deemed important in order to have something to hold on to throughout the thesis project. We then gathered enough data (as described in chapter 7) to get a decent overview of needs and the current situation by conducting interviews on staff and surveys on past learners. We believed that what Ericsson Academy really needed was something to show off to those who are sceptical towards changing anything, so the next step was to develop a prototype app for Android, in the end named *OnCourse*, which chapter 8 gives more details about. The main feature present in the prototype is a document viewer where the user can view the course materials to make notes and drawings, take and insert photos and easily share their content with other learners in the class. More importantly the app can keep itself updated on which page the instructor currently displays on the projector screen and instantly receive any notes or drawings she makes if she uses her own tablet.

We would have liked to do more live testing of our prototype, but nonetheless we believe that the thesis project overall is a success. Ericsson Academy has now got a solid foundation on which to continue their work towards using tablets in their classroom training. They can also use the prototype to convince others that tablets could be the way to go. The next step is to evaluate the prototype further and decide if tablets still are a viable option or not. After that integration with Ericsson's systems is also needed before full-scale usage is possible.

Let us now have a look at the problem statement introduced in the introduction.

How could Ericsson incorporate tablets in their classroom training to improve course experiences?

We believe that classroom training experiences at Ericsson Academy indeed can be improved a lot through tablets. One way to do so is for Ericsson to create their own app for tablets, which is what we have created a starting point for. Most of our efforts have been put into how learners and instructors can share their content among each other and how the learners with these new collaboration possibilities may become more active during lectures. The final result of the thesis project was a report given to

Ericsson Academy as shown in appendix I. It tells the tale of what the future could look like with tablets, and describes a concept for OnCourse that apart from what the prototype can do also contains additional features like a comprehensive search function and interactive exercises. The working prototype app for Android is then supposed to accompany the report. The report concludes with four levels of commitment to let Ericsson have more than the choices go/no go and finally our recommendation of what to do next. We recommend Ericsson to go for the fourth level of commitment as long as they investigate further how tablets and OnCourse can enhance pedagogical and structural aspects of the training too. Without such aspects included we do not believe that the benefits of tablets in classroom training outweigh setbacks such as new distractions.

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Appendix A

| Initial plan

The following pages contain the initial plan as it looked in October 2012. The document is in Swedish and outlines a very rough time plan together with a planned method how to go about investigating the given problem statement as it was understood at the time.

Bakgrund

Ända sedan skrivaren blev tillräckligt billig för gemene företag har papprets undergång förutspått om och om igen, men mycket informationsspridning sker ändå fortfarande med traditionella medel i pappersform. Utbildning har traditionellt varit en flitig användare av såväl papper som böcker för att förmedla information, men den digitala utvecklingen skapar förutsättningar för en rikare upplevelse än vad skrift i tryck kan åstadkomma.

Ericsson Academy

Ericsson Academy är en avdelning inom Ericsson AB, en global aktör inom telekombranschen. De levererar utbildning till tekniker dels internt inom Ericssons organisation, dels externt till de operatörer som köper telekomutrustning av Ericsson. En del av denna utbildning sker idag i klassrumsform antingen i Ericssons egna lokaler eller på plats hos kunden medan annan utbildning bedrivs helt elektroniskt, så kallad e-learning. Som en del i klassrumsundervisningen genomförs både föreläsningar med Powerpoint-presentationer, praktiska labbar på testutrustning och datorbaserade tester. Efter avslutad kurs får de medverkande med sig presentationsbilderna i en pärm tillsammans med egna anteckningar. Detta material tillsammans med Ericssons tekniska manualer är viktiga resurser i teknikerns praktik. Det är kostsamt att ta fram dessa pärmar och Ericsson vill ersätta dem med en digital plattform för surfplattor.

Examensarbetet

Som studenter på masterprogrammet Lärande och Ledarskap ser vi här ett intressant utvecklingsprojekt. Med våra bakgrunder inom datateknik och teknisk matematik intresserar vi oss för programmering och gränssnitt samtidigt som lärande och pedagogik är ett viktigt inslag i utbildningen. Vi vill därför undersöka den nuvarande situationen på Ericsson Academy beträffande de kurser som inte är digitala idag och där material fortfarande distribueras på papper. Vi vill utvärdera hur digitala plattformar kan användas för att förbättra och effektivisera kursernas genomförande och kundupplevelsen. Genom att skapa förutsättningar för att samla kursinformation digitalt öppnas nya möjligheter för hur kurserna och dess uppgifter kan utformas och presenteras.

Problemformulering

Hur kan Ericsson effektivisera kursutformning och skapa mervärde till sina kursdeltagare genom att ersätta pappersdistribuerat kursmaterial med en digital plattform för surfplattor?

Milstolpar

Projektet är visionärt till sin natur och följande milstolpar vill vi uppnå för att besvara problemformuleringen.

- Kartlägga hur Ericsson Academy idag arbetar med utbildning internt och mot kund.
- Undersöka hur andra företag och lärandeinstitutioner använder digitala plattformar för lärande idag.
- Ta fram ett underlag för hur Ericsson bör införa en digital plattform i klassrumsundervisningen för att ersätta dagens pappersmodell.

Metod

Att undersöka hur instruktörsledd utbildning bedrivs på Ericsson idag och upplevs av kunderna t.ex. genom att intervjua anställda och genomföra enkätundersökningar bland kursdeltagare. I projektplaneringen kommer vi läsa in oss på och värdera olika arbetsmetoder för att genomföra undersökningen och planera den därefter. Med utgångspunkt i resultatet från denna studie kommer vi att utveckla en prototyp inriktad på surfplattor, antingen i form av en app eller en webblösning, där kursmaterial kan publiceras. I kodutvecklingen av prototypen kommer vi arbeta i två sprints där den första sprinten testas av anställda och utvärderas för att ge feedback för förbättringar.

Leverabler

Till Ericsson ska vi leverera följande:

- En prototyp som visar hur en digital plattform kan användas dels för att ersätta anteckningar och information på papper under och efter kurser och dels för att berika dessa kursers upplägg.
- En säljande rapport som beskriver fördelar och begränsningar med prototypen samt vad som behöver åtgärdas för att en produkt baserad på prototypen ska kunna lanseras i organisationen. Prototypens syfte är att gestalta ett koncept för hur en digital plattform kan utformas och hur gränssnittet mot kursdeltagaren kan se ut. Det är inte säkert att prototypen kommer ha tillgång till skarp data och vara integrerad med Ericssons övriga system.

Tidplan

Examensarbetets omfattning är 30 hp, vilket innebär 20 veckor av heltidsstudier. På Chalmers läser vi dock i en studietakt som motsvarar 125%. Det innebär att 16 veckor på Chalmers-helfart motsvarar 20 veckor helfart eller 30 hp.

Nedan följer vår preliminära planering efter kalenderveckor.

Projektet sker inledningsvis på Chalmers-halvfart	
Lära känna Ericssons organisation och planera arbetet, läsa litteratur	v47-v51
Planera och genomföra intervjuer med personal och kursdeltagare	v3-v5
Förstå och lära känna Ericsson backend-system, databaser mm.	v6-v7
Ta fram prototypidé	v8
Sprint 1 - programmera en första prototyp	v8-v10
Utvärdera första sprinten	v11
Från och med nu sker projektet på Chalmers-helfart	
Sprint 2 - utveckla prototypen efter feedback	v12, v15 (påsklov v13-v14)
Utvärdera andra sprinten	v16
Färdigställa prototyp, Ericssonrapport	v17-v18
Färdigställa rapport, redovisning, opponering	v19-v22

Appendix B

| Project plan

The following pages contain the more comprehensive project plan as it looked in the end of November 2012. Compared to the initial plan in appendix A this document includes a more detailed time plan, and in general more information about how we would work in the thesis project. The document is in Swedish.

**Projektplan:
Using tablets to enrich education at Ericsson AB**

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2012-11-29

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1 Bakgrund

Sedan skrivaren blev tillräckligt billig för gemene företag har papprets undergång förutspått flera gånger¹, men mycket informationsspridning sker ändå fortfarande med traditionella medel i pappersform. Utbildning har traditionellt varit en flitig användare av såväl papper som böcker för att förmedla information, men den digitala utvecklingen skapar förutsättningar för en rikare upplevelse än vad skrift i tryck kan åstadkomma.

1.1 Ericsson Academy

Ericsson Academy är en avdelning inom Ericsson AB, en global aktör inom telekombranschen. De levererar utbildning till tekniker dels internt inom Ericssons organisation, dels externt till de operatörer som köper telekomutrustning av Ericsson. En del av denna utbildning sker idag i klassrumsform antingen i Ericssons egna lokaler eller på plats hos kunden medan annan utbildning bedrivs helt elektroniskt, så kallad e-learning. Som en del i klassrumsundervisningen genomförs både föreläsningar med Powerpoint-presentationer, praktiska labbar på testutrustning och datorbaserade tester. Efter avslutad kurs får de medverkande med sig presentationsbilderna i en eller flera pärmar tillsammans med egna anteckningar. Detta material tillsammans med Ericssons tekniska manualer är viktiga resurser i teknikerns praktik. Det är dock kostsamt att ta fram dessa pärmar och Ericsson vill ersätta dem med en digital plattform för surfplattor.

1.2 Examensarbetet

Som studenter på masterprogrammet Lärande och Ledarskap ser vi här ett intressant utvecklingsprojekt. Med våra bakgrunder inom datateknik och teknisk matematik intresserar vi oss för programmering och gränssnitt samtidigt som lärande och pedagogik är ett viktigt inslag i utbildningen. Vi vill därför undersöka den nuvarande situationen på Ericsson Academy beträffande de kurser som inte är digitala idag och där material fortfarande distribueras på papper. Vi vill utvärdera hur digitala plattformar kan användas för att förbättra och effektivisera kursernas genomförande och kundupplevelsen. Genom att skapa förutsättningar för att samla kursinformation digitalt öppnas nya möjligheter för hur kurserna och dess uppgifter kan utformas och presenteras.

1.3 Syfte och mål

Syftet med projektet är att utveckla kursupplevelsen för de kunder som får lärarledd undervisning från Ericsson Academy. Det ska också bli lättare för kunderna att få en överblick genom att de får all information via en plattform istället för flera olika.

Målet är att lyckas ta fram en fungerande prototyp av en sådan plattform och en tydlig specifikation vad som behöver åtgärdas inom Ericsson för att prototypen i framtiden ska kunna utvecklas färdigt och fungera fullt ut.

1.4 Problemformulering

Hur kan Ericsson effektivisera kursutformning och skapa mervärde till sina kursdeltagare genom att ersätta pappersdistribuerat kursmaterial med en digital plattform för surfplattor?

¹ Se bland annat <http://www.nyteknik.se/nyheter/verkstad/verkstadsartiklar/article270866.ece> och <http://folket.se/nyheter/eskilstuna/1.720414>

1.5 Leveranser

De leveranser som ska genomföras till Ericsson återfinns i ett separat dokument kallat produktspecifikation.

1.6 Begränsningar

Vi kommer endast att utveckla en prototyp, vilket bland annat innebär att vissa funktioner från specifikationen inte implementeras och att påhittad data användas i vissa fall.

1.7 Metod

Nedan sammanfattar vi vilka metoder vi kommer att använda i olika faser av projektet. Under projektplaneringen kommer vi även läsa in oss mer på och värdera olika arbetsmetoder för att genomföra undersökningen och planera den därefter.

- Datasamling
 - Intervjuer med anställda på Ericsson Academy för att ta reda på hur situationen för de som undervisar ser ut idag, samt vilka idéer de har för framtiden. Intervjuerna kommer att vara åt det kvalitativa hållet, men den exakta formen är inte bestämd ännu. Eventuellt kommer vi också att intervjua utvalda kursdeltagare.
 - Enkäter till kursdeltagare beträffande hur de upplever informationshantering under kursens gång i dagsläget samt hur de önskar att det skulle fungera.
 - Någon metod för att värdera all data och komma fram till en specifikation för en prototyp kommer att användas, men hur det går till återstår att undersöka.
- Implementering
 - Två Sprints för att möjliggöra en ordentlig omgång feedback från anställda på Ericsson Academy.

2 Fasplan

Projektet är planerat löst efter den svenska Lips-modellen² och kan grovt indelas i tre tidsfaser. Före det operativa arbetet planeras aktiviteter och arbetsförfarande fastslås. Under projektet genomförs intervjuer och research och en prototyp tas fram. Efter projektet levereras rapporter till beställare och kursansvarige och lärdomar i projektgruppen dras och dokumenteras.

2.1 Planeringsfasen

Uppgifter som görs under denna fas inkluderar att

- upprätta produktspecifikation under dialog med beställaren på Ericsson
- upprätta en tidsplanering och resursplanering
- genomföra riskanalys

Arbetet mynnar ut i en projektplan.

²se <https://www.liu.se/cul/resurser/lips?l=sv>

2.2 Genomförandefasen

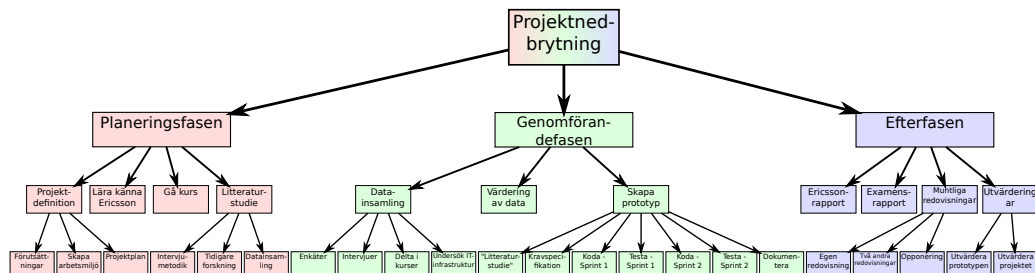
Under genomförandefasen görs alla intervjuer, enkäter och litteraturstudier. Med utgångspunkt i den data som samlats in kommer vi att utveckla en prototyp inriktad på surfplattor, antingen i form av en app eller en webblösning, där kursmaterial kan publiceras.

2.3 Avslutningsfasen

Även om slutrapporten påbörjas redan i planeringsfasen intensifieras arbetet med all skriftlig dokumentation i avslutningsfasen. I denna fas ingår också de övriga moment som examensarbetet innefattar, bland annat opponering på ett annat arbete.

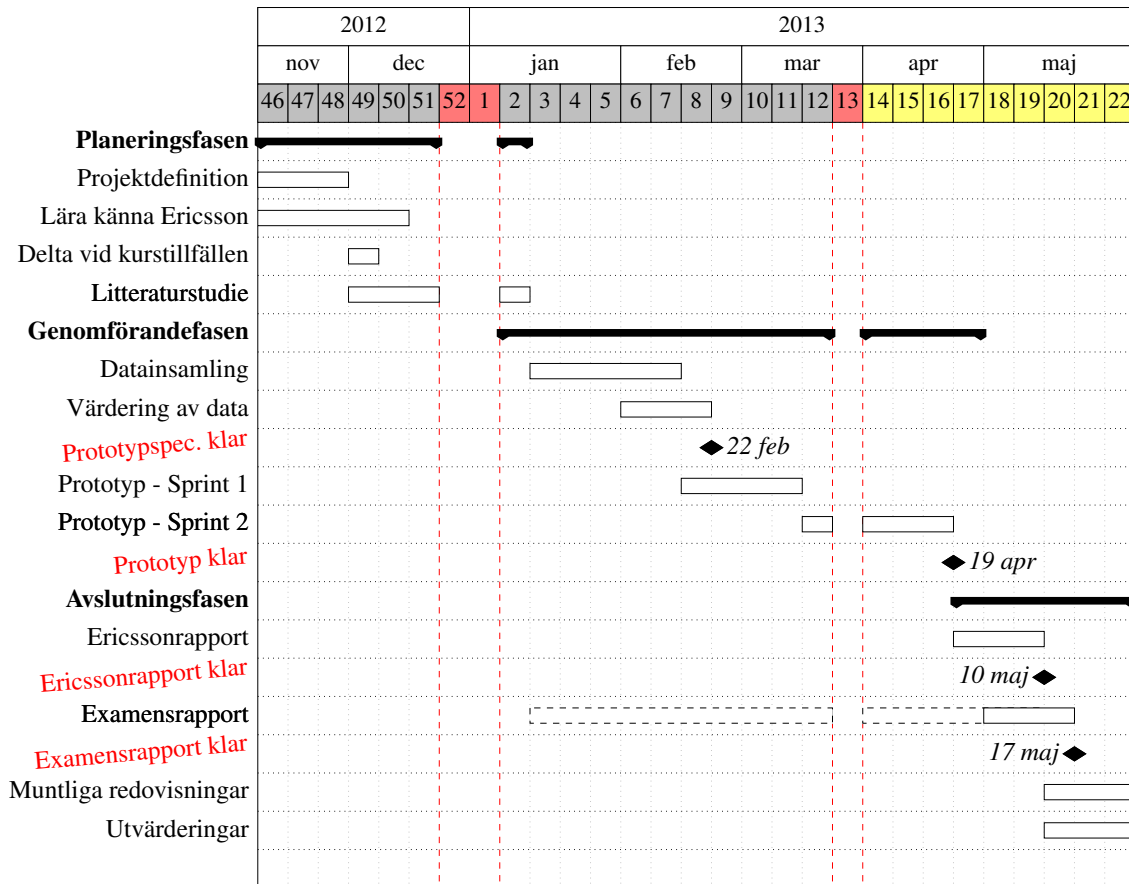
3 Operativ planering

Vi har delat upp projektet i olika funktionella delar i en Work Breakdown Structure (projektnedbrytning) enligt figur 1.



Figur 1: Projektnedbrytning

Figur 2 visar Gantt-schemat för examensarbetet. Siffrorna överst i figuren är veckonummer. Under de veckor som är rödmarkerade är vi lediga. Gråmarkerade veckor jobbar vi halvtid med projektet, medan gulmarkerade veckor betyder heltidsarbete.



Figur 2: Gantt-schema över projektet

3.1 Milstolpar

Tabell 1 listar de milstolpar vi har ställt upp som hjälper oss att besvara problemformuleringen.

Milstolpe	Kommentar	Datum
Prototypspecifikation klar	En värdering baserad på datan som inkommit görs för att ta fram prototypspecifikationen.	2013-02-22
Prototyp klar	Här är prototypen för hur Ericsson bör införa en digital plattform i klassrumsundervisningen för att ersätta dagens pappersmodell redo att testas på kund.	2013-04-19
Ericssonrapport klar	För att hinna få feedback från Linus lämnas rapporten för granskning.	2013-05-10
Examensrapport klar	Examensrapporten lämnas in för bedömning.	2013-05-17

Tabell 1: Milstolpar i projektet

3.2 Viktiga beslutspunkter

Efter en kortare litteraturstudie kommer vi att besluta exakt hur våra metoder för datainsamling ska se ut. Den insamlade datan ligger sedan till grund för en värdering och ett beslut vad för prototyp som ska tas fram och vilka specifikationer den ska ha. Bland annat innehåller den specifikationen vilka delar av prototypen som blir korrekta och vilka delar som endast blir platshållare. Tabell 2 de viktiga besluten.

Beslut	Kommentar	Datum
Metodval	Beslutet avgör bland annat hur intervjuerna ska genomföras	2012-12-13
Prototypspecifikation klar	En värdering baserad på datan som inkommit görs för att ta fram prototypspecifikationen.	2013-02-21

Tabell 2: Viktiga beslut att fatta i projektet

3.3 Aktiviteter och tidsplanering

Gantt-schemat i figur 2 visar den övergripande bilden av projektet, men varje del är också indelad i mindre aktiviteter som syns i tabell 3. Examensarbetets omfattning är 30 hp, vilket innebär 20 veckor av heltidsstudier eller med andra ord 800 timmar (100 dagar). I tabellen följer vår preliminära tidsplanering för de aktiviteter vi identifierat, se även projektnedbrytningen i figur 1. Notera att tidsestimeringarna är per person. Totalt antal timmar blir 707, vilket är ett medvetet val för att ha mycket tid som disponibel där det senare behövs.

Punkten ”Undersök IT-infrastruktur” innebär att vi behöver undersöka Ericssons nuvarande IT-system och ta reda på var och hur till exempel information om kurser lagras, och hur den informationen kan tas ut av andra system. I slutet av Sprint 1, då vi utför tester, ingår även en utvärderingsdel där andra medarbetare får chansen att prova på och komma med förslag på förändringar av prototypen. På motsvarande sätt innefattar slutet av Sprint 2 ett test mot kund. Punkten ”Muntliga redovisningar” inbegriper de olika obligatoriska moment som finns i alla examensarbeten på Chalmers. I litteraturstudien vill vi också undersöka hur andra företag och lärandeinstitutioner använder digitala plattformar för lärande idag.

Aktivitet	Beräknad tidsåtgång (h)
<i>Planeringsfasen</i>	
Projektdefinition	
→ Förutsättningar	8
→ Skapa arbetsmiljö	16
→ Projektplan	24
Lära känna Ericsson	24
Gå kurs	24
Litteraturstudie	
→ Intervjumetodik	8
→ Tidigare forskning	8
→ Datainsamling	8
Genomförandefasen	
Datainsamling	
→ Enkäter	24
→ Intervjuer	24
→ Delta i kurser	32
→ Undersök IT-infrastruktur	32
Värdering av data	16
Skapa prototyp	
→ "Litteraturstudie"	16
→ Kravspecifikation	16
→ Koda - Sprint 1	50
→ Testa - Sprint 1	32
→ Koda - Sprint 2	50
→ Testa - Sprint 2	32
→ Dokumentera	32
Avslutningsfasen	
Ericssonrapport	32
Examensrapport	56
Muntliga redovisningar	
→ Egen redovisning	16
→ Två andra redovisningar	3
→ Opponering	8
Utvärderingar	
→ Utvärdera prototypen	8
→ Utvärdera projektet	8
Övrig administration	100

Tabell 3: Tabell över vilka aktiviteter som finns under respektive huvudaktivitet

3.4 Tidsfördelning

Under *höstterminen* jobbar vi måndag, onsdag och torsdag fram till den 13:e december, cirka 8:30-16:30. På tisdagar har vi handledarmöte på Lindholmen och kan då också jobba någon timme. Beroende på hur den parallella kursen ser ut är även 17-20 december disponibelt.

Under *vårterminen* startar verksamheten igen den 14 januari. Förutsatt att det går att samköra examensarbetet på halvfart med våra praktikplatser i den andra parallella kursen fram till 15 mars siktar vi på att alternera mellan två och tre heldagar i veckan. Därefter, från och med 18 mars, arbetar vi heltid och slutför arbetet fram till sommaren. Planerat avslut runt månadsskiftet maj/juni.

4 Dokumentplan

De officiella dokument som produceras är en rapport till Ericsson, projektplan, produktspecifikation samt en examensrapport. De finns tillgängliga via förfrågan till någon av författarna (se försättsbladet).

Interna dokument innefattar arbetsdokument med tidslogg, tidsplan, WBS, intervjumall, intervjuresultat, enkäter, enkätresultat och utvärderingsresultat. De är endast tillgängliga för projektgruppen och lagras på en privat server i ett git-repository.

5 Rapporteringsplan

Produktspecifikation och projektplan färdigställs vecka 48 och ska därefter godkännas av examinator och handledare. Examensrapporten planeras vara färdig för korrektur den 17 maj. Se figur 2 för planeringsdetaljer. I tabell 4 sammanfattas när respektive rapportering ska ske.

Rapporttyp	Mottagare	Deadline
Projektplan	Examinator, Handledare, Ericsson	2012-11-29
Produktspecifikation	Linus Eriksson	2012-11-29
Mittappport	Linus Eriksson	2013-03-22
Ericssonrapport	Ericsson	2013-05-10
Examensrapport	Examinator, Handledare, Ericsson	2013-05-17
Examenspresentation	Examinator, Handledare, Ericsson	2013-05-31

Tabell 4: *Rapporter som produceras i projektet*

6 Mötesplan

Vi kommer att ha regelbundna veckovisa möten med vår handledare på Chalmers, Staffan Björk. Till en början sker dessa på tisdagar kl 13:00-14:00 på Lindholmen. Syftet med mötena är att kontinuerligt stämma av arbetets fortgång. Övriga möten med till exempel handledaren på Ericsson sker efter behov.

7 Resursplan

7.1 Personer

Följande personer är inblandade i projektet:

- Staffan Björk (staffanb@ituniv.se) - handledare på Chalmers.
- Linus Eriksson (linus.ericsson@ericsson.com) - beställare från Ericsson Academy.
- Tomas Hagman (tomas.hagman@ericsson.com) - handledare på Ericsson Academy.
- Edvin Linge (edvin@student.chalmers.se) - Examensarbetare från Chalmers.

- Rikard Ljungstrand (Irikard@student.chalmers.se) - Examensarbetare från Chalmers.

Inom projektet kommer följande tidsramar att eftersträvas:

- Svar på mejl: inom 3 dagar
- Svar på SMS eller motsvarande: inom 5 timmar
- Telefonsamtal görs och SMS skickas mellan 8:00 och 21:00
- 5-10 minuters paus per timme arbete för att hålla effektiviteten uppe

7.2 Material

Projektet har från början inte tillgång till något specifikt material, utan det tillhandahålls allteftersom av Ericsson efter behov.

7.3 Lokaler

Vi sitter i Ericsson Academys lokaler i Mölndal. I december 2012 kommer avdelningen att flytta inom byggnaden, och då får vi egna arbetsplatser.

7.4 Ekonomi

Vi har ingen formell budget tillägnad projektet. De ekonomiska resurser som eventuellt behövs äskas vid behov från Ericsson.

8 Kvalitetsplan

För att säkerställa kvaliteten på både skriftlig dokumentation och källkod för vi kontinuerliga dialoger med både handledare på Chalmers och Ericsson. Om möjligt konsulterar vi en mjukvaruutvecklare på Ericsson som kan granska den kod vi skriver.

8.1 Granskningar

Linus kommer att vid några tillfällen granska hur projektet fortskrider. Planen är att ha minst en mittredovisning under projektets gång där vi redovisar våra framsteg. Ett rimligt tillfälle för detta är när vi presenterar ett förslag på prototyp men innan den implementeras.

9 Riskanalys

Vi har identifierat två typer av risker i detta projekt. Först har vi de risker som finns i själva projektet:

- Det kan vara svårt att få till tider för intervjuer eftersom många medarbetare är på resande fot titt som tätt. I så fall får vi helt enkelt hålla till godo med de intervjuer vi lyckas få ihop.
- Det kan saknas passande kurser där deltagarna kan fylla i enkäter, men grundkravet är att lyckas få ihop svar från åtminstone en klass.
- Den parallella kurs vi ska läsa kan göra planering av tid krångligt och ta mycket tid.

Sedan finns det några risker med själva prototypen:

- Det kan visa sig att vissa funktioner inte går att implementera på surfplattor. I så fall blir detta en eller flera nya begränsningar och något som istället tas upp i den slutgiltiga rapporten till Ericsson.
- I och med att prototypen introducerar mer teknik uppstår flera nya orosmoment i kurserna: fungerar alla surfplattor?, finns det internetuppkoppling?, hinner deltagarna med lika mycket när de måste lära sig ett nytt gränssnitt också?, har alla använt surfplattor innan?, krävs det mer tid till förberedelse för den som skapar kursen?

Alla dessa prototyprisker försöker vi utplåna så långt det går under utvecklingen.

10 Prioriteringar

Högsta prioritet är att få fram en rapport till Ericsson som berättar hur en färdig produkt bör fungera samt vilka eventuella hinder som finns innan det går att ta fram denna produkt till surfplattor. Prioritet två är att få ihop en lyckad prototyp som visar hur produkten skulle kunna se ut. Här är det viktigast att den visuellt ser korrekt ut snarare än att den använder riktig data. I sammanhanget är det viktigare att prototypen fungerar väl för kunden än att den från början är smidig för kursledare att använda.

11 Projektavslut

Planen är att redovisa och slutrapportera examensarbetet den första eller andra veckan i juni.

Appendix C

| Product specification

Table C.1 shows the product specification that worked as the contract between Ericsson and us as to what we would deliver at the end of the thesis project.

Till Ericsson ska vi leverera följande två produkter:

- En säljande rapport som beskriver fördelar och begränsningar med prototypen samt vad som behöver åtgärdas inom Ericsson för att en produkt baserad på prototypen ska kunna lanseras i organisationen. Rapporten innehåller också en plan för hur utvecklingsarbetet bör fortsätta i framtiden.
- En prototyp, som körs på en surfplatta, som visar hur en digital plattform kan användas dels för att ersätta anteckningar och information på papper under och efter kurser och dels för att berika dessa kursers upplägg. Det är inte säkert att prototypen kommer ha tillgång till skarp data och vara integrerad med Ericssons övriga system. Kanske innehåller den inte heller alla de funktioner den färdiga produkten förväntas innehålla. Prototypens syfte är att gestalta ett koncept för hur en digital plattform kan utformas och hur gränssnittet mot kursdeltagaren kan se ut.

Table C.1: *Product specification, dated November 2012*

Appendix D

| Company survey

This appendix contains the survey that was sent out to eleven companies in the education business. Seven companies responded, and their responses can be found in section D.2. Note that the original survey was sent in Swedish to some companies and English to some. The companies who responded did so in Swedish.

D.1 Survey sent by e-mail

This is the e-mail that was sent to representatives at each of the eleven companies.

We are two thesis workers at Ericsson Academy in Mölndal, Gothenburg, Sweden, who are investigating how the course material used in Ericsson's classroom training can be improved. Learning Tree is one of Ericsson's preferred suppliers, so we are curious how you work in this matter and would be very grateful if you could answer a few questions.

1. Do you hand out printed binders, compendia or similar (hereafter referred to as course material) in all courses, or only some? Are they printed in colour? How many pages on average are they? At most?
2. What type of material do they contain, is it mainly slides identical to those the teacher presents, exercises, or text written specifically for the compendium? Do they also contain answers to the exercises at the end or somewhere else, or are there no answers?
3. How much of the total time it takes to develop a new course can be used to produce course material?
4. Do you regularly give some thoughts about, and develop, the appearance, structure and how you distribute your course material?
5. Have you considered to instead of/in addition to the printed format also supply the course material in some digital form? Why, why not? How do you then distribute it?

Thank you for your time!

D.2 Answers

1. Har ni utskrivna kompendier i alla kurser eller endast i vissa kurser? Är de i färg? Hur omfattande är de i genomsnitt (antal sidor)? Som mest?

Ja, vi har kursmaterial/kompendier till alla våra kurser. De flesta skrivs ut i färg, några utbildningar får inget mervärde med utskrift i färg och då skriver vi ut i S/V. Generellt om vi använder termen powerpointslides så har vi kring 18 slides per utbildningstimme. I vårt kursmaterial kan det vara mer text än slides och då blir det mer omfattande kursmaterial än antal slides. Ibland ligger även bra whitepapers mm som bilaga till kursmaterialet.

Vi har utskrivna kompendier i färg. Snittet ligger på 80 – 100 sidor tror jag. Som mest 258 sidor. Sedan har vi handouts också. De är för det mesta inte i färg och de används i olika övningar.

Vi har mindmaps i färg uttryckta till alla kurser men vi skickar själva kompendiet - text/illustrationer etc som en digital fil på mellan 40 till 90 sidor Vår metod går ut på att ingenjörerna tillsammans med läraren bygger upp/ ritar de tekniska system som ska läras ut. De eleverna är mycket aktiva går det enklare att förstå och minnas hur det fungerar. Det kan tyckas underligt att en lite extern leverantör kan lära Ericsson något med det är dels vårt fokus - vi talar bara om den neutrala tekniska standarden och dels vår interaktiva metod som gör att vi är preferred supplier. Våra utbildningar är till för de som måste läsa specifikationer för att göra sitt jobb. Dessa måste läsa originalspecifikationer om 200 - 400 sidor med mycket svår teknisk "prosa". Vi översätter dessa 200-400 sidor till 20-30 mindmaps och 40-80 sidor med förklarande text så Ericsson ingenjören sparar Mycket tid och kraft genom att använda oss. En annan målgrupp är de ingenjörer som bygger och integrerar nät - kommer man till en kund där det står burkar från en konkurrent är det en stor fördel att veta vad som är standard. Om man endast behöver förstå Ericsson produkter så är vi nog "overkill" när det gäller 3GPP området. Vi går mycket djup ner i tekniken medan Ericsson's egna utbildningar (enligt ingenjörer vi talat med) mer fokuserar på de egna produkterna och bara nämner 3GPP standarder på en högre nivå. Vi levererar ett komplement snarare än konkurrerar och med vår nya digitala tjänst kan varje enskild ingenjör spara 3-4 dagars arbete. Utslaget på hela Ericsson är det då en otroligt stor besparing. Det kanske kan vara kul för er att veta att vi är det enda företaget i världen som finns på 3GPP's hemsida med våra utbildningar - vi har en unik metod, vi har mycket god kompetens och vår e-lösning är unik

Ungefär 100 sidor i form av spiralbundet kompendium i färg.

JA, deltagarna får alltid någon form av utskrivet läromedel. Läromedlen är i nästan samtliga våra kurser tryckta i svart-vitt. Antal sidor varierar väldigt kraftigt från 50 (enkla användarkurser som t.ex. "Office 2013 uppgradering) till ca 700 sidor för våra tekniska utbildningar (systemutveckling, Windows Server m.m.)

Nej, vissa av våra kurser har materialet upplagt på USB-sticka istället. Vissa är i färg men de flesta är svartvita, en del 100 sidor vissa är betydligt större.

2. Vad innehåller kompendierna? Är det främst slides identiska med en eventuell presentation (t.ex. Powerpoint) som läraren har, övningar eller speciellt skriven kompendietext? Innehåller kompendierna svar på övningarna längst bak eller någon annanstans?

De innehåller som regel (finns undantag) det du beskriver. Utöver det som du beskriver innehåller de allra flesta kurserna textavsnitt som beskriver bilder och ger deltagare information även efter kursen. Mao är vårt mål att producera kursmaterial motsvarande böcker.

Kompendierna innehåller numera mest slides efter önskemål från Ericsson. (Tidigare hade vi böcker.) Handouts innehåller övningar. Inga svar på övningarna delas ut. Svaren ska deltagarna själva komma

fram till med hjälp av praktiska övningar.

Kompendierna innehåller texter som stödjer mindmapsen Inga övningar men väl en hög grad av interaktivitet genom mindmaps

Slides identiska med de som visas som presentation. Dessutom övningar i separat kapitel samt svar på dessa längst bak.

Om vi tar de läromedel vi skriver själva ("allt" inom Office-familjen) så har läromedlen inget med lärarens presentationsmaterial att göra. Läromedlen innehåller "hur du gör" t.ex. diagram i Excel, övningar kopplat till detta och sedan båda tips om hur du ska lösa uppgiften tillsammans med hela lösningsförslag.

Det är blandat, Powerpoint, övningar och "tips&tricks"

3. Hur stor del av tiden att utveckla en kurs får gå åt till att ta fram kursmaterial?

Det beror väldigt mycket på ämnen, labbintensitet och vem som gör materialet. I snitt så skulle jag säga att det tar cirka 60

Vi har ingen bestämd tid satt till hur lång tid ett utbildningsmaterial får ta. Det varierar väldigt beroende på längden på utbildningen, hur stort kompendiet är, hur många handouts samt hur många posters. En del av kursmaterialet är ju i form av att skriva på blädderblock under utbildningen. Det är också uttänkt innan. Jag vet faktiskt inte, men skulle tro att det i genomsnitt går åt ca 20

Vi lägger mycket stor tid på analys av 3GPP protokollen - vi talar om ca 125 timmar per protokoll men då ingår även utformningen av mindmaps och tillhörande text. Tanken med materialet är att vi grafiskt ska visa komplexa samband, hur signalering och procedurer sker. Både innehåll och sammanhang.

—

Svårt att säga, men ca. en tredjedel av tiden skulle jag tro.

Det är ofta våra kursledare som tar fram och utvecklar materialet. Vissa kurser äger de materialet till och till en del är materialet vårt eget.

4. Hur utvecklar och funderar ni kring den form kursmaterialet distribueras på?

Ja, vi ser större och större behov av onlinedragningar från våra kunder

Vi funderar och tittar ständigt på hur materialet kan utvecklas och distribueras, baserat på synpunkter från deltagarna samt utfall från övningarna och naturligtvis kostnader.

—

Vi kommer under våren med största börja distribuera de tekniska läromedlen i PDF-form istället för som idag i bokform.

Kursledarna bestämmer själva hur materialet ska se ut eller i vilken form det ska vara. Ex pärm/bok/USB

5. Har ni funderat över att göra kursmaterialet digitalt? Varför, varför inte? (På vilket sätt i så fall?)

Ja, alla kunder på Ericsson (som vi litar mycket på), får kursmaterial elektroniskt i PDF, om de önskar.

Vi har hittills inte haft för avsikt att göra materialet digitalt på våra öppna utbildningar, där deltagarna kommer till utbildningen. En del har inte laptops med sig och de flesta vill ha materialet utskrivet, så att de kan anteckna på kompendiet, övningen etc. Posters sitter uppe hela tiden på väggarna som en påminnelse om vad man gått igenom och vad man kommer att gå igenom. Lärarna pekar oftast på våra

posters när de repeterar under utbildningens gång. Däremot håller vi vissa utbildningar via dator och Lync och där blir ju eventuellt material självfallet digitalt. Oftast blir det i så fall i form av en fil via mail.

Digitalt - vi har levererat klassrumsutbildningar till Ericsson sedan 2009 och vi har 5,4 av 6 i kvalitet. Vi frågar alltid ingenjörerna vad som kan bli bättre och vi samtliga kurser har vi fått krav på djupare kunskap inom mycket smala områden...det går rent praktiskt inte att fixa det ...därför byggde vi ett reference tool där ingenjörerna kan gå in under det dagliga arbetet och få en microkurs på 5-10 minuter.

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Samma här, kursledarna avgör hur materialet ser ut.

Appendix E

| Interview material

The following pages contain the interview plan and template that was used when interviewing employees in the Ericsson Academy department. The document is in Swedish. After that comes the transcripts from each interview. The transcripts are provided as-is with the exception that they have been anonymized. One interviewee in the end decided to opt out from participation, which means that only eight transcripts are included here.

Intervjuplan

Syfte med denna första undersökning

Syftet är att skapa en bild av hur personalen idag upplever klassrumsundervisningen. Till exempel hur de tekniska hjälpmedel som finns hjälper undervisningen, om det finns frustrationsmoment i undervisningen samt vilka idéer som finns kring en eventuell teknisk lösning som ersätter de pärmar som varje kursdeltagare får i dagsläget.

Vår förförståelse

Det verkar som att pärmarna mest är ivägen. På den kurs vi deltagit i hittills verkade de inte använda den i någon större utsträckning (fick inte reda på något om den i början heller). Eftersom det mest är bilder från powerpoint verkar den ha mest nytta i nuet under kursen för till exempel anteckningar. Väl tillbaka på sin egen arbetsplats har kursdeltagaren ingen större glädje av pärmen(-arna). Det behövs samtidigt trots allt något att anteckna på, och det gäller att man på ett enkelt sätt kan få med sig sina anteckningar hem - även från dag till dag under utbildningen. De uppgifter som delas ut verkar vara till för att sättas i pärmen. Även här undrar jag om värdet i efterhand av det materialet är större än 0. Det används mer för stunden som ett sätt att delge information om uppgiften.

Databehandling

Efter att ha intervjuat färdigt kommer vi främst att samla de idéer som finns kring tekniska hjälpmedel och då mer specifikt surfplattor. Detta används sedan som underlag till en produktspecifikation av den prototyp vi ska ta fram.

Frågeställningar som vi vill ha svar på

Vilka tekniska hjälpmedel upplever lärarna på Ericsson Academy att de har användning av idag eller skulle vilja använda i framtiden och vad finns det för idéer om utveckling i området?

Om lärarna fick välja helt fritt, vad finns det då för visioner hur undervisningen skulle kunna bedrivas?

Vad är begränsande faktorer idag för undervisningen?

Vad är det i en digital miljö som eftersöks?

Mer specifikt:

Vilka begränsningar och möjligheter har papper och pärmar jämfört med digitala medier?

Vilket är att föredra på Ericsson Academy?

Intervjupapper

Beskrivning till den vi intervjuar

Intervjun tar ungefär en timme, och vi (jag) kommer att anteckna under tiden som vi samtalar. På slutet går vi (jag) igenom vad vi (jag) skrivit för att se om vi (jag) tolkat dig rätt. Det vi kommer fram till idag kommer att användas dels för att ge en översikt över vilka utvecklingsmöjligheter som finns i klassrumsundervisningen, dels till att skapa en produktspecifikation på vad vi ska utveckla i vårt examensarbete. Det är bara Rikard Ljungstrand och Edvin Linge som har tillgång till råmaterialet, men det kan också komma att delas med Linus Eriksson i anonymiserad form. Vi kommer att skicka ut resultatet via mail. Det går såklart bra att avbryta när som helst eftersom intervjun är helt frivillig.

Frågor

Kontext

- Vad är dina primära arbetsuppgifter på Ericsson Academy?
- Hur länge har du jobbat på Ericsson Academy?
- På vilket sätt är du inblandad i utbildning just nu?
- Arbetar du med utveckling av (befintliga eller nya) kurser för ILT?
 - Om ja, vilka verktyg använder du?
 - till exempel Powerpoint

Det befintliga

- Berätta om en riktigt lyckad kurs som du hållit
 - Vad tror du var den främsta orsaken till att kursen gick så bra?
- Berätta om en kurs som du tyckt gått mindre bra
 - Vad tror du var den främsta orsaken till att kursen inte gick så bra?

Kontextbeskrivning

Nu glömmet vi för en stund vilka vi två är - att vi gör ett exjobb här och det du hört att vi ska göra.

Tänk dig att du leder en kurs här nere på Ericsson Academy. Till exempel 10 deltagare med inslag av labb. Här är några frågor baserade på den situationen.

Fler frågor

Vilka pedagogiska verktyg har du möjlighet att använda i klassrumsundervisningen?

Hur stor kontroll har du över vilka verktyg du faktiskt använder?

Vilka verktyg fungerar bra och vilka fungerar mindre bra?

Vilka är de största orosmomenten i en kurs som skulle kunna leda till att den inte blir lyckad (enligt dig)? (Exempel: ingen kommer fram på grund av vädret)

Hur skulle du beskriva att en typisk kurs upplevs för en kursdeltagare idag? Från ankomst till avfärd.

Om du istället helt fritt skulle få välja upplägg på en kurs, det enda kravet är att den i någon mån innehåller klassrumsundervisning, kan du ge ett exempel på hur upplevelsen skulle se ut för en kursdeltagare? (Skulle kunna vara likadant som ovan)

Nu går vi tillbaka till vår kontext igen. Vi kommer att utveckla en prototyp eller ett koncept till ett digitalt hjälpmedel för handhållna enheter som surfplattor och telefoner. Meningen är att den ska hjälpa dig i undervisningen på ett eller annat sätt.

Vilka funktioner skulle du vilja se i ett sådant hjälpmedel? Finns det något den skulle kunna ersätta eller utöka?

- För dig som lärare
- För kursdeltagarna

Vilka fördelar och nackdelar finns det med de pärmar som kursdeltagarna får idag? Tror du att kursdeltagarna använder den information som de innehåller - under och/eller efter kursen?

Skulle de använda informationen i större eller mindre utsträckning om den fanns digitalt?

Vilka hinder tror du finns mot att distribuera materialet i till exempel en app?

(Till Linus: Hur utvärderas kurserna idag? Vad görs med de utvärderingsblanketter som fylls i? --Det är flera utvärderingar men främst är det en central som kommer från Oliver i Tyskland. Den andra är linus egen och den tar han själv hand om //rikard 22/1)

Avslutning

Är det något som du vill lyfta fram innan vi avslutar?

Då ska vi bara gå igenom vad vi (jag) antecknat så att det inte blivit något missförstånd.

Tack för visat intresse! :-)

Intervjupapper

Frågor

Kontext

- Vad är dina primära arbetsuppgifter på Ericsson Academy?

Kursutveckling eller uppdatering av befintliga kurser

- Hur länge har du jobbat på Ericsson Academy?

I ett år, men dessförinnan ca 10 år (med paus på annat håll)

- På vilket sätt är du inblandad i utbildning just nu?
- Har kursutvecklingshantverket förändrats?

Nej, inte särskilt mycket. I rätt många år har person 1 ägt kurser och gemensamt har man pratat sig fram till vad som behövs. Powerpoint sen tidernas begynnelse. På lång sikt har man kanske ändrat inställningen till det hela. För 10 år sen var detta en del av marknadsavdelningen och kurser sågs som del av marknadsföringen, så är det inte idag.

Arbetar du med utveckling av (befintliga eller nya) kurser för ILT?

- Om ja, vilka verktyg använder du?
 - powerpoint, word
 - verktyg som är knutna till produkterna
 - vi är styrda av beställaren, som ställer krav på hur det ska se ut, hur dokument ska skrivas osv. att det ska finnas en powerpoint, en lärarinstruktion, osv. I templatén sägs att övningar ska göras i word, men de görs ofta i ppt. det är ganska hårt mallat från beställaren.
 - det är dock ändå meningen att man som lärare ska kunna anpassa. i praktiken är det definitivt så.

Hur nära inpå beställs kurser?

Det kan variera. Det kan vara att man i samband med att man säljer ett system säljer kurser utan att tänka på vilka som kommer gå kursen eller vad de kan.

Fler frågor

Vilka pedagogiska verktyg har du möjlighet att använda i klassrumsundervisningen?

Hur stor kontroll har du över vilka verktyg du faktiskt använder?

Powerpoint funkar tillräckligt bra, är allmäntillgitt. Däremot tror person 7 inte att det skulle vara ett problem att tillföra annat om beställaren är med på det.

Powerpoint har den fördelen att en rutinerad lärare som kan produkten och kursen sisådär har ett väldigt stöd. Och den som kan ämnet har bara en bakgrund i slidesen.

Vilka verktyg fungerar bra och vilka fungerar mindre bra?

Vilka är de största orosmomenten i en kurs som skulle kunna leda till att den inte blir lyckad (enligt dig)? (Exempel: ingen kommer fram på grund av vädret)

Osäkerhetsmomentet inför vad de kan, vad de förväntar sig. När man åker ut tror man att man behöver hitta på nåt mer att säga. Men när man väl kommer fram så märker man att de inte kan nånting. Man kanske får någon kontaktperson på plats men det är inte lönt att fråga "kan ni IP" t.ex. för man får alltid svaret ja.

(Hur skulle du beskriva att en typisk kurs upplevs för en kursdeltagare idag? Från ankomst till avfärd.)

(Om du istället helt fritt skulle få välja upplägg på en kurs, det enda kravet är att den i någon mån innehåller klassrumsundervisning, kan du ge ett exempel på hur upplevelsen skulle se ut för en kursdeltagare? (Skulle kunna vara likadant som ovan). Med andra ord, vad hade du velat ändra?)

ang kursutveckling: det som traditionellt alltid varit svårt är att få ner kravspec på vad de ska kunna (målet) till något konkret. man borde varje gång börja med det. Vad som är rimligt att lära sig på tre dagar är ju svårt. Traditionellt har de utvecklats med åtanke på att man inte kan så mycket.

Var ska man börja med den här gruppen? Vilken nivå ska man lägga det på den här gången? Man får ta reda på det längs vägen.

Nu går vi tillbaka till vår kontext igen. Vi kommer att utveckla en prototyp eller ett koncept till ett digitalt hjälpmedel för handhållna enheter som surfplattor och telefoner. Meningen är att den ska hjälpa dig i undervisningen på ett eller annat sätt.

Vilka funktioner skulle du vilja se i ett sådant hjälpmedel? Finns det något den skulle kunna ersätta eller utöka?

- För dig som lärare

Stödverktyg som är intuitiva att använda (GUI). (Exact packager skapar för e-learning flash av powerpoint.)

Ibland vill man göra små instruktionsfilmer för hur man hanterar en mjukvara. Spela in under tiden man gör det för att dela sedan?

- För kursdeltagarna

Hur är det med anonyma frågor osv?

Ja kanske, men det ligger i lärarrollen lite att få folk att våga fråga och hålla koll på om folk hänger med.

Smartboard är ytterligare en teknisk grej som eventuellt inte fungerar som man vill.

Stor fördel med smartboard är att projektorn sitter där den sitter :)

Möjlighet att använda vårt verktyg även i VCT?

I Centra som idag används för VCT finns chat, handuppräknning, frågor med svarsalternativ, osv. Ska man använda det i klassrummet helt enkelt?

Finns mobil klient för centra? Det vi tittar på kanske redan finns?

VCT:n funkade bra när person 7 var med om det!

VCT:n var internt ericsson bara. Men ska kunna funka externt också!

Anledning till att inte få med en PDF: Oro att det blir svartkurser.

Vilka fördelar och nackdelar finns det med de pärmar som kursdeltagarna får idag?

Kostnadsfråga att skriva ut i svart-vitt, ofta klagomål. Person 7 har upplevt kravet på svart-vitt som en stor begränsning.

Tror du att kursdeltagarna använder den information som de innehåller - under och/eller efter kursen?

Person 7 tror inte att de använder materialet efteråt, däremot under.

Skulle de använda informationen i större eller mindre utsträckning om den fanns digitalt?

Ja, om det var sökbart.

Vilka hinder tror du finns mot att distribuera materialet i till exempel en app?

Oro för risk för svartkurser.

Det befintliga

- Berätta om en riktigt lyckad kurs som du hållit
 - Vad tror du var den främsta orsaken till att kursen gick så bra?
 - *Kontakten med studenterna! Om den är bra blir kursen riktigt bra!*
 - *Tekniska hjälpmedel kan bli ett hinder, om de inte löser ett specifikt problem, eller kanske förenklar kontakten med studenterna.*
 - *I Tyskland hade det ett program så man kunde se användarnas skärmar, man kunde även stänga av dem. Det var bra!*
- Berätta om en kurs som du tyckt gått mindre bra
 - Vad tror du var den främsta orsaken till att kursen inte gick så bra?
 -

Idéer

Att kunna se vad deltagarna har på sina skärmar. Kan stänga av skärmarna eller visa vad problemet är på någons skärm.

Organisering av material blir viktigt. Och att kunna navigera mellan olika bilder.

Avslutning

För intervjuaren: Är något väsentligt för frågeställningens besvarande glömt?

Är det något som du vill lyfta fram innan vi avslutar?

När man ska utveckla en kurs så har man alltid för lite tid. Så verktygen måste vara streamlinade!

Vad skulle fördelen med en app vara om man till exempel tittar på tidsbesparing från kurs till kurs?

Beträffande kursutveckling är man styrd av corporate branding. Man ska använda vissa ikoner osv. Även i en app som vår?

Tack för visat intresse! :-)



Intervjupapper

Frågor

Kontext

- Vad är dina primära arbetsuppgifter på Ericsson Academy?

Uppdaterar och skapar kurser. Person 1 ger uppdrag eller så tar person 6 eller 7 egna initiativ. Men alla tycker inte det är smidigt med elearning. Vad är det som gör att kunder ogillar elearning? Person 6 ser inte om det är Ericsson som tror att kunden vill ha på ett visst sätt eller om det är kunden själv. Person 6+7 tar till sin information av person 1 och av de andra lärare i världen som kör kursen. Materialet är ett verktyg att använda, men baserat på elevgruppen behöver man anpassa vilket material som används och hur det används. OBS: Därmed viktigt att ha kännedom om alla olika besläktade kurser och material. Person 6 och de andra här har därmed en jättenytta av all kringliggande kunskap, the big picture. Ganska ofta person 6 ändrar och ber dem skriva ut nytt. På kursen vi var med på t.ex. var det by-the-book eftersom eleverna är från så olika bakgrund. Så när man kör kurs är det mycket roligare att köra en sån kurs där eleverna får styra mer (oftast på plats i världen).

- Finns något feedbacksystem för lärare att koppla tillbaka till kursskapare?

Finns en instructor's guide till kursen. Det är jag som gjort kursen, har du frågor så maila mig! Finns inget som uppmuntrar till att höra av sig? Nej. På e-learning finns däremot evaluation. Henrik skulle kanske kunna skicka ut och efterfråga feedback?

- Hur länge har du jobbat på Ericsson Academy?

Sen 04. Från början verkligen powerpoint, powerpoint, powerpoint. Instructor's guide har alltid funnits med. Håller inte i någon egen kurs förrän kanske efter ett halvår. Finns ingen specifik instruction-for-dummies för nya med best practises. Istället har man en typ av mentor i början, går också någon presentationsteknikskurs.

- På vilket sätt är du inblandad i utbildning just nu?

Designa kurser, leda kurser.

- Har det ändrats hur kurser utvecklas sedan du började?

Förr var det bara powerpoint. Kan vara smidigt om man kan det bra. Men nu sen ett par år har det blivit mer e-learning. Då kan man ge basic-sakerna över e-learning.

- Arbetar du med utveckling av (befintliga eller nya) kurser för ILT?
 - Om ja, vilka verktyg använder du?
 - till exempel Powerpoint
 - gör kursen i powerpoint, word
 - exact packager - för att få upp i mylearning. lcms backend. den som ska ha materialet laddar också ner via lcms. men de som publicerar elearning gör det i mylearning. lcms är en webbportal för nedladdning. exact packager för uppladdning.
 - 109 tjuoettan, beskriver skillnader mellan olika releaser av en kurs.

- vid e-learning jobbar man också med pp+exact packager. person 6 har inte ännu jobbat med articulate, men person 14 har. och person 15 kollar ju på om de ska använda xyleme i framtiden.

Det enda som krävs för certifikat är att de varit med 75% av tiden. Det är allt som spelar roll. Det finns pre- och posttest. Operatören som köper kursen kan begära att det görs pre- och posttest.

Kontextbeskrivning

Nu glömmer vi för en stund vilka vi två är - att vi gör ett exjobb här och det du hört att vi ska göra.

Tänk dig att du leder en kurs här nere på Ericsson Academy. Till exempel 10 deltagare med inslag av labb. Här är några frågor baserade på den situationen.

Fler frågor

Vilka pedagogiska verktyg har du möjlighet att använda i klassrumsundervisningen?

Hur stor kontroll har du över vilka verktyg du faktiskt använder?

Man förutsätter att det finns projektor när man designar. Det är egentligen det. I övrigt är det upp till varje enskild lärare. Det förbereds för svart-vit utskrift. Person 6 använder inte smartboarden heller. Presentern funkade inte alltid. Whiteboarden används ganska mycket. Pärmarna används inte särskilt mycket efteråt...

Vilka verktyg fungerar bra och vilka fungerar mindre bra?

Vad finns som skulle göra att materialet användes mer?

Nästan alla har med datorn. Det vore lättare om det fanns i datorn.

CPI store - customer product information. Där finns all information om en produkt. Det är bara pdf. Person 6 skulle vilja hänvisa till den mer (men den är rätt dålig). Egentligen skulle man vilja hänvisa till den. Om man pratar om mer komplicerade grejer - sätta upp nån ethernetgrejs - så finns det "gör så här 1, 2, 3 osv" men det står oftast inte varför i CPI. det kan t.ex. stå "namn: skriv i namn" men det står inte varför eller vad för slags namn. spelar det roll om det är qy54ct eller morot? där försöker person 6 ge en bättre förklaring i materialet. **Därför kan kursmaterialet eventuellt vara användbart även i fält.**

Men svårt att veta om folk har fattat det till den grad att de inte behöver gå tillbaka till utbildningsmaterialet. Vad vill de ha för material i fält? CPI eller pärmar?

Det finns en tanke att mer i framtiden kunna hänvisa till CPI. Installationsmanualerna är väldigt tydliga och bra. Så att hålla en sån kurs känns lite meningslös. Där känner sig person 6 överflödig.

När kurser skräddarsys - nya slides läggs in beroende på elever - motsvarande behöver kunna stödjas av en digital lösning.

Är admin-gränssnitten bra i verktygsprogram? Alltså, ger programmen kontexthjälp?

Typiskt ja. Gränssnitten är ganska bra.

Vilka är de största orosmomenten i en kurs som skulle kunna leda till att den inte blir lyckad (enligt dig)? (Exempel: ingen kommer fram på grund av vädret)

De som går kursen är inte de som beställer kursen. Så de som kommer är "fel" personer.

Person 6 skulle köra en översiktscurs och sen en system planning-kurs. Hade han vetat innan om det var samma personer så hade han gjort X. Och hade det varit andra så hade han gjort Y. Några skulle gå alla fem dagar. Några andra skulle inte. Några hade redan gått operation-maintenance? Det var helt fel ordning. Detta är det jobbigaste. Försa kursdagen måste man ställa om.

(Hur skulle du beskriva att en typisk kurs upplevs för en kursdeltagare idag? Från ankomst till avfärd.)

(Om du istället helt fritt skulle få välja upplägg på en kurs, det enda kravet är att den i någon mån innehåller klassrumsundervisning, kan du ge ett exempel på hur upplevelsen skulle se ut för en kursdeltagare? (Skulle kunna vara likadant som ovan) Med andra ord, vilka delar skulle behöva förbättras.)

Nu går vi tillbaka till vår kontext igen. Vi kommer att utveckla en prototyp eller ett koncept till ett digitalt hjälpmedel för handhållna enheter som surfplattor och telefoner. Meningen är att den ska hjälpa dig i undervisningen på ett eller annat sätt.

Vilka funktioner skulle du vilja se i ett sådant hjälpmedel? Finns det något den skulle kunna ersätta eller utöka?

- För dig som lärare

- För kursdeltagarna

En app där kursmaterialet finns som pdf typ och där man enkelt kan lägga till nya funktioner.

Där de kan följa att om person 6 lägger in 10 slides till så finns det redan där. Den direkta interaktionen att person 6 gör något som de kan ta del av. Alla har med sig datorer. De skulle kunna få ut det direkt istället för att bläddra i pärmen. Ibland kan säkert pappret vara bra för snabba anteckningar. Kanske som komplement. Det som eftersöks är framför allt att uppdateringar ska kunna ske på typ 10minuters-intervall, snarare än sekundintervall.

Problemet med datorer är att det är lätt att göra något annat.

Vad mer?

Nu drömmer jag fritt. Om man själv kör appen - om man då kan köra pp eller pdf i plattan. Om jag kan connecta med de andra så kan man rita på skärmen och spara det man ritar och spara som extrafil t.ex.

Person 6 ser inte att det är långt bort att alla kan ha en dator med sig. Men risken finns att man gör annat istället. Distraktionsmomentet är kanske större än nyttan med datorer.

Men en tanke är att Ericsson har surfplattan.

Clicker-liknande. Hade det varit användbart?

Ja, kanske. Och möjlighet att ställa anonyma frågor.

Av dem som kört virtual classrooms har jag förstått att man vill ha interaktionen med varje elev. Vilka fördelar och nackdelar finns det med de pärmar som kursdeltagarna får idag? Kan anteckna vid sidan av, utomlands är det ibland svårt att lägga till saker om det till exempel blivit utskrivet med spiralbinding.

Tror du att kursdeltagarna använder den information som de innehåller - under och/eller efter kursen?

Skulle de använda informationen i större eller mindre utsträckning om den fanns digitalt?

Ja, eftersom man har det med sig mer.

Vilka hinder tror du finns mot att distribuera materialet i till exempel en app?

Praktiskt: Att alla ska ha samma plattform. T.ex. både Android och iOS.

Interaktionen mellan elev och lärare. WLAN osv. Det behöver vara väldigt enkelt.

Tanke: för att undvika att folk inte registrerats ordentligt eller fått tillgång till det material de ska ha i en kurs. Se till så att kursledaren ger deltagarna tillgång med en engångskod (t.ex. över QR) som scannas in. Den ger autentisering till kursmaterialet.

(Till Linus: Hur utvärderas kurserna idag? Vad görs med de utvärderingsblanketter som fylls i? - Det är flera utvärderingar men främst är det en central som kommer från person 16. Den andra är linus egen och den tar han själv hand om //rikard 22/1)

Det befintliga

- *Berätta om en riktigt lyckad kurs som du hållit*
 - *Vad tror du var den främsta orsaken till att kursen gick så bra?*
- *Berätta om en kurs som du tyckt gått mindre bra*
 - *Vad tror du var den främsta orsaken till att kursen inte gick så bra?*

Språkförbistring, kursdeltagare är inte samma som de som beställer kursen, kan vara väldigt olika bakgrund.

Avslutning

För intervjuaren: Är något väsentligt för frågeställningens besvarande glömt?

Är det något som du vill lyfta fram innan vi avslutar?

Ponera att folk har en app och att om 5 år så har alla surfplattor. Interaktionen mellan en instruktör och elever. Att pusha ut "reklam" eller info om nya kurser. Då finns mervärde för ericsson. Genererar leads (merförsäljning). Person 6 tror att utbildningsfrågan bör kunna komma nerifrån också, att tekniker ber sina chefer om att gå ny kurs.

App eller vad det nu blir ska vara ett komplement

Tack för visat intresse! :-)

Intervjupapper

Frågor

Kontext

- Vad är dina primära arbetsuppgifter på Ericsson Academy?

Tar hand, tillsammans med Kista, om academysweden-epostkorgen. Det kan komma allt från de som vet vad man vill ha till de som vill köpa en hel kurs i Mölndal eller på annat håll. Beroende på om det är här eller borta. Om det är här kan hon direkt kolla om de har önskemål om tid osv. Men om det är borta måste de lägga in en request i ett program. Är det single-site lämnas bara offert. Coor är behjälpliga med hotellbokning osv. Finns nåt att göra på helgen osv. Restauranger osv. Man är som en guest service. När kursen är färdig samlar vi in evaluations, görs på papper. Lite B.

*I USA är evaluations digitalt. Om de inte fyller i det får de ibland inte diplom. Person 12 printar Diplom. Det är person 12 som tar in utvärderingarna och för in dem i excel. **TODO: Kolla upp med USA hur de gör med utvärderingar digitalt där.** Tror inte man kan tvinga någon att fylla in evaluations.*

Prata med person 13 om vad för statistik han behöver ur MyLearning kontra vad person 5 behöver?

Har ett excelschema för lärare. Läger upp i MyLearning baserat på det.

Alla som går en kurs bör ha ett konto på MyLearning, inte helt garanterat dock.

- Hur länge har du jobbat på Ericsson Academy?

2½ år. Det har funkad likadant hela tiden men tidigare fanns extrafunktioner (betalda) i MyLearning.

- På vilket sätt är du inblandad i utbildning just nu?

Se ovan

- Vilka verktyg använder du i vardagen?

MyLearning, Excel, Mail, "More" (Ärendehantering för kursbokningar). "RT-Tool" för bokning av utrustning.

Fler frågor

Vilka är de största orosmomenten i ditt arbete till att en kurs inte blir lyckad (enligt dig)?

(Exempel: ingen kommer fram på grund av vädret)

Att access försvinner, teknik strular med andra ord. Ofta lång distans, till exempel Kina eller

USA. När man offererar utomlands försöker person 12 offerera utan material (pärmar).

Person 12 har aldrig kundkontakt. Hon har bara kontakt med lokala ericssonkontor.

Nu går vi tillbaka till vår kontext igen. Vi kommer att utveckla en prototyp eller ett koncept till ett digitalt hjälpmedel för handhållna enheter som surfplattor och telefoner. Meningen är att den ska hjälpa till i och runt om undervisningen på ett eller annat sätt.

Att kunna göra evaluations digitalt. Att pärmens innehåll är i svart-vitt är tråkigt.

Person 8 jobbade tidigare med projekt med soft-copies osv, men det lades ner helt.

*På Ericsson (Lindholmen) finns FMX-kurser där deltagarna får materialet på lånat USB-minne.
(Det går säkert att kopiera... egentligen inte tillåtet?)*

Vilka funktioner skulle du vilja se i ett sådant hjälpmedel? Finns det något den skulle kunna ersätta eller utöka?

- För dig som lärare
- För kursdeltagarna

Vilka fördelar och nackdelar finns det med de pärmar som kursdeltagarna får idag?

Tror du att kursdeltagarna använder den information som de innehåller - under och/eller efter kursen?

Skulle de använda informationen i större eller mindre utsträckning om den fanns digitalt?

Vilka hinder tror du finns mot att distribuera materialet i till exempel en app?

Det befintliga

- Berätta om en riktigt lyckad kurs som du hållit
 - Vad tror du var den främsta orsaken till att kursen gick så bra?
- Berätta om en kurs som du tyckt gått mindre bra
 - Vad tror du var den främsta orsaken till att kursen inte gick så bra?

Avslutning

Är det något som du vill lyfta fram innan vi avslutar?

Tack för visat intresse! :-)

Intervjupapper

Frågor

Kontext

- Vad är dina primära arbetsuppgifter på Ericsson Academy?

Lite av varje men projektledning för att ta fram kundkurser. Men även internkurser. Har också kört kurser, både wbl och ilt.

- Hur länge har du jobbat på Ericsson Academy?

På training sen 2007. Jobbade med en utredning om softcopies för något år sen. Det person 8 kollade på var att via ericoll (sharepoint) distribuera softcopies (krypto-pdf). Kund loggar in på business portal => fick länk till ericoll-sharepoint-sida => accessrättigheter satta så att man bara fick se de pdf som man skulle ha tillgång till. Krångligt sätt att göra det. Det var "student textbook" som var det material som skulle delas. Dels kan det vara en pdf:ad powerpoint, alternativt worddok med importerad ppt och textmassa. Utredningen var från LS. Det är managemntfolk på LS bestämmer och de bestämde att student textbook ska vara en asset (man ska betala. Då och då dyker de upp på scribd och man vidtar åtgärder.

Finns en ALEX-mjukvara som laddar ner en databas för den produkt man jobbar med.

Kursmaterialet kanske ska fokusera på den pedagogiska biten, snarare än referenskunskaper som CPI täcker.

En digital lösning behövs för student textbook.

Hur funkar det med WBL:er idag? Kan man komma åt material efter att man slutfört en kurs?

Osäker, prata med person 1.

Utredningen om soft-downloads kan vi få läsa. Av de presenterade alternativen var det bara krypto-läs-in-lösningen som var acceptabel.

Claes kan nog kolla upp gamla utredningen.

Prata med andra företag som gått före. Hur går det för dem?

- På vilket sätt är du inblandad i utbildning just nu?
- Arbetar du med utveckling av (befintliga eller nya) kurser för ILT?
 - Om ja, vilka verktyg använder du?
 - till exempel Powerpoint

Fler frågor

Vilka pedagogiska verktyg har du möjlighet att använda i klassrumsundervisningen?

Hur stor kontroll har du över vilka verktyg du faktiskt använder?

Vilka verktyg fungerar bra och vilka fungerar mindre bra?

Vilka är de största orosmomenten i en kurs som skulle kunna leda till att den inte blir lyckad (enligt dig)? (Exempel: ingen kommer fram på grund av vädret)

(Hur skulle du beskriva att en typisk kurs upplevs för en kursdeltagare idag? Från ankomst till avfärd.)

(Om du istället helt fritt skulle få välja upplägg på en kurs, det enda kravet är att den i någon mån innehåller klassrumsundervisning, kan du ge ett exempel på hur upplevelsen skulle se ut för en kursdeltagare? (Skulle kunna vara likadant som ovan). Med andra ord, vad hade du velat ändra?)

Nu går vi tillbaka till vår kontext igen. Vi kommer att utveckla en prototyp eller ett koncept till ett digitalt hjälpmedel för handhållna enheter som surfplattor och telefoner. Meningen är att den ska hjälpa dig i undervisningen på ett eller annat sätt.

Vilka funktioner skulle du vilja se i ett sådant hjälpmedel? Finns det något den skulle kunna ersätta eller utöka?

- För dig som lärare
- För kursdeltagarna

Vilka fördelar och nackdelar finns det med de pärmar som kursdeltagarna får idag? Tror du att kursdeltagarna använder den information som de innehåller - under och/eller efter kursen?

Skulle de använda informationen i större eller mindre utsträckning om den fanns digitalt?

Vilka hinder tror du finns mot att distribuera materialet i till exempel en app?

Det befintliga

- Berätta om en riktigt lyckad kurs som du hållit
 - Vad tror du var den främsta orsaken till att kursen gick så bra?
- Berätta om en kurs som du tyckt gått mindre bra
 - Vad tror du var den främsta orsaken till att kursen inte gick så bra?

Avslutning

För intervjuaren: Är något väsentligt för frågeställningens besvarande glömt?

Är det något som du vill lyfta fram innan vi avslutar?

Då ska vi bara gå igenom vad vi (jag) antecknat så att det inte blivit något missförstånd.

Tack för visat intresse! :-)

Intervjupapper

Frågor

Kontext

- Vad är dina primära arbetsuppgifter på Ericsson Academy?

Två delar. Började som instruktör under 1-2 år. Hållit kurser på service-on. Övervakning av minilink. Kom möjlighet att göra wbl-kurs på serviceon. Fick göra första wbl:en på hans avdelning. Huvudsyssla skapa wbl. Omvärldsanalys.

- Hur länge har du jobbat på Ericsson Academy?

2009

- På vilket sätt är du inblandad i utbildning just nu?
- Arbetar du med utveckling av (befintliga eller nya) kurser för ILT?
 - Om ja, vilka verktyg använder du?
 - till exempel Powerpoint
 - *Authoring tools. Använder alltid exact packager och lcms (externa kurser).*
 - *På IT: Person 17 PM för Xyleme-Swap-projektet. Person 11 är produktägaren.*

Fler frågor

Vilka pedagogiska verktyg har du möjlighet att använda i klassrumsundervisningen?

Hur stor kontroll har du över vilka verktyg du faktiskt använder?

Vilka verktyg fungerar bra och vilka fungerar mindre bra?

Vilka är de största orosmomenten i en kurs som skulle kunna leda till att den inte blir lyckad (enligt dig)? (Exempel: ingen kommer fram på grund av vädret)

(Hur skulle du beskriva att en typisk kurs upplevs för en kursdeltagare idag? Från ankomst till avfärd.)

(Om du istället helt fritt skulle få välja upplägg på en kurs, det enda kravet är att den i någon mån innehåller klassrumsundervisning, kan du ge ett exempel på hur upplevelsen skulle se ut för en kursdeltagare? (Skulle kunna vara likadant som ovan). Med andra ord, vad hade du velat ändra?)

Nu går vi tillbaka till vår kontext igen. Vi kommer att utveckla en prototyp eller ett koncept till ett digitalt hjälpmedel för handhållna enheter som surfplattor och telefoner. Meningen är att den ska hjälpa dig i undervisningen på ett eller annat sätt.

Vilka funktioner skulle du vilja se i ett sådant hjälpmedel? Finns det något den skulle kunna ersätta eller utöka?

- För dig som lärare
- För kursdeltagarna

Vilka fördelar och nackdelar finns det med de pärmar som kursdeltagarna får idag?
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Det befintliga

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Avslutning

För intervjuaren: Är något väsentligt för frågeställningens besvarande glömt?

Är det något som du vill lyfta fram innan vi avslutar?

Då ska vi bara gå igenom vad vi (jag) antecknat så att det inte blivit något missförstånd.

Tack för visat intresse! :-)

Intervjupapper

Frågor

Kontext

- Vad är dina primära arbetsuppgifter på Ericsson Academy?
(Det finns ett CPI-bibliotek på labbdatorerna.) Snarare nästan sälj nu.
- Hur länge har du jobbat på Ericsson Academy?

sen 00

- På vilket sätt är du inblandad i utbildning just nu?

För 1½ år sen blev person 10 utlånad i ett projekt "Go for 40!" (market share). Har nu varit ute under året och träffat många kunder. Man går mer och mer från att prata produktspecifikt till lösningsspecifikt.

Kunder hade önskat att få se materialet innan kursen börjar. Man hade velat se materialet eller göra en liten webbkurs innan.

I höstas halkade person 10 in på hela mobile backhaul för regionen Afrika.

Person 15 ska köra en centrasession mot ett afrikanskt land snart där han kombinerar två grejer.

Vi får alltid frågan om man kan få en soft copy? Under tolv års tid...

Dels bjuda in de till något innan så alla ligger på samma nivå.

Person 10 har hört från installationskurser att folk säger "vi kommer ut till site och skit jag har inte med pärmen tänk om jag hade materialet i datorn"

Fler frågor

Vilka är det största orosmomentet i en kurs som skulle kunna leda till att den inte blir lyckad (enligt dig)? (Exempel: ingen kommer fram på grund av vädret)

Oro att det är för stor variation bland kursdeltagarna. Utomlands: att utrustning inte funkar, till exempel ingen Internetuppkoppling.

Nu går vi tillbaka till vår kontext igen. Vi kommer att utveckla en prototyp eller ett koncept till ett digitalt hjälpmedel för handhållna enheter som surfplattor och telefoner. Meningen är att den ska hjälpa dig i undervisningen på ett eller annat sätt.

Vilka funktioner skulle du vilja se i ett sådant hjälpmedel? Finns det något den skulle kunna ersätta eller utöka?

- För dig som lärare

Man kan behöva anpassa vartefter man kör kursen. Person 10 tror på mycket Centra osv.

Kanske särskilt centra som förberedelse innan man kör ILT.

- För kursdeltagarna

Tillgång till hela materialet + CPI store. Du behöver ha hela CPI.

Behöver ha materialet lokalt. Lättare att ställa frågor till exempel innan kursen.

Alla har en dator.

Vilka fördelar och nackdelar finns det med de pärmar som kursdeltagarna får idag?
Tror du att kursdeltagarna använder den information som de innehåller - under och/eller efter kursen?
Skulle de använda informationen i större eller mindre utsträckning om den fanns digitalt? yu

Avslutning

För intervjuaren: Är något väsentligt för frågeställningens besvarande glömt?

Är det något som du vill lyfta fram innan vi avslutar?

Kan man låta typen av material vara ett alternativ när man skapar kurstillfället? Vissa får pärmar, de som hålls här på plats får det inte till exempel?

Tack för visat intresse! :-)

Intervjupapper

Frågor

Kontext

- Vad är dina primära arbetsuppgifter på Ericsson Academy?

Internutbildning. Mest kompetenser som inte finns internt, det vill säga inte egna produkter. Till viss del även kurser om egna produkter där det inte finns någon kurs idag.

Det finns 50-60 utbildningsföretag som man skrivit ramavtal med. Mycket processtyrt.

Finns ett tänk att man som nyanställd går in och kollar i det curriculum som passar med ens kompetensområde. Så finns det en head of competence. EA vill att kurserna ska skapas efter behov såklart. Finns till exempel 8 leverantörer (utbildningsföretag) inom R&D, programmering etc. Ramavtalen är väldigt olika skrivna. Med eller utan kursmaterial, vissa har uppstartskostnader etc. Försöker helt komma ifrån att chefer själv beställer kursen från leverantörerna. Fungerar bra i Göteborg. I Stockholm beställer man själv mer. De kanske inte skapar kursen i MyLearning, får inte utvärderingar, det får bara den lokala avdelningen. Den stora förtjänsten pengamässigt är att samla ihop, storskaligheten. En estimering är att man sparade 8 miljoner 2012. Från 2013 kommer systemet att stoppa köp från non-preferred suppliers. Jämförelse: Vi är som ett snabbköp, har det lokala utbudet som man efterfrågar i närheten.

Person 9 tycker att EA och även vissa leverantörer är överambitiösa när det gäller material. Det blir nästan att kurserna blir att vända slides. Till exempel: det blev 400 sidor på en tredagarskurs i kommunikation och feedback typ. Idé: Kan vi påverka hur material skapas också?

Har själv pärmar i hyllan, men vill att materialet istället ska vara användbart även efteråt.

Materialet är ibland undermåligt

Användbarheten efteråt är såklart mycket beroende på materialets kvalitet och typ.

Kan vi påverka själva kursutvecklingen? Till exempel kvalitet på bilder.

- Hur länge har du jobbat på Ericsson Academy?

Konsult sedan 95, blev anställd 05, på EA sedan 1,5 år tillbaka. Det finns ett siteråd med alla höga chefer för olika PDU:er.

Fler frågor

Hur länge ska kursmaterial kunna ge pengar egentligen?

Vi ska fråga person 6 hur han går till väga rent praktiskt när han skapar en kurs från start till slut.

Leverantörerna har mer sällan material som är slides.

Webbsidor

Ericsson Academy är mer ett koncept, regioniserat, för stort? Internutbildning Göteborg har en egen sida, var?

Skicka till person 9: kontakt till några utbildningsleverantörer, länkar till bra sidor att titta på, till exempel Internutbildning Göteborg-sidan. Den grafiska designen är förvånansvärt viktig.

Fråga person 5: Kan vi få skicka mail till folk som gått kurs i höstas och fråga om de använt sitt material sedan dess. Var ett test på en Erlangkurs med en bok. Person 18 internt, person 12 externt.

Nu går vi tillbaka till vår kontext igen. Vi kommer att utveckla en prototyp eller ett koncept till ett digitalt hjälpmedel för handhållna enheter som surfplattor och telefoner. Meningen är att den ska hjälpa dig i undervisningen på ett eller annat sätt.

Viktigt för pappersmaterial:

Väl uppbyggt, bra design, användbart efteråt, arbetsbok ("interaktiv"), om det är slides måste det ju vara något man kan förstå i efterhand. Endast en fråga är ju värdelös till exempel... även om läraren under lektionen svarat på den.

Vilka funktioner skulle du vilja se i ett sådant hjälpmedel? Finns det något den skulle kunna ersätta eller utöka?

Person 9 tror inte att man använder materialet efteråt. Många skriver för att komma ihåg. Under kursen finns den poängen. Sedan efteråt blir inte kursmaterialet så användbart längre. Då är det istället någon typ av sökning (databas, referens) som är viktig.

- För dig som lärare
- För kursdeltagarna

*Angående mobilapp: Att man kan få tips, idéer etc från en databas som innehåller saker från kursen. Till exempel att ställa en fråga "hur gör jag det här?", också kan man få ett svar, en kommandorad kanske. **Sökbarhet.** Alexdatabasen finns på Ericsson. Kan söka bland alla möjliga dokument. Cross referencing.*

IML = Internal Managed Learning

Göteborg, Stockholm, Karlskoga, Linköping

Ska själv gå någon kurs, som kursen om skillnader mellan git och clearcase.

Avslutning

Är det något som du vill lyfta fram innan vi avslutar?

Tack för visat intresse! :-)

Intervjupapper

Frågor

Kontext

- Vad är dina primära arbetsuppgifter på Ericsson Academy?

Började i oktober, har varit här i tre månader. Framför allt att producera e-learning. Hjälpte person 10 komma in i det. Har pysslat med video och foto innan så har gjort sånt nu med. Anställd som konsult. Person 2 och 3 är på samma företag. Utveckla/producera e-learning. Enda egna projekt har varit hardware services - en introduktionskurs till hardware services delivery. Första modulen i ett kurspaket. Väldigt övergripande. Som person 2 förstått det är service ett område som Ericsson försöker bli större inom.

- Hur länge har du jobbat på Ericsson Academy?

Tre månader.

- På vilket sätt är du inblandad i utbildning just nu?

Klippa film, filma, klippa ljud, spela in ljud, reviewa kurser.

- Arbetar du med utveckling av (befintliga eller nya) kurser för ILT?

- Om ja, vilka verktyg använder du?

- till exempel Powerpoint

Powerpoint, Articulate (plugin till powerpoint) (paketera ljud+video) => SCORM? Eller flash?, Storyline. (Storyline och Articulate är från samma tillverkare). Storyline nyare, fler features. I Articulate synkar man ljud till slidesen. I Articulate kan man göra quiz osv. Finns fler interaktiva grejer.

- De har pratat lite om gamifications.

Fler frågor

Vilka pedagogiska verktyg har du möjlighet att använda i klassrumsundervisningen?

Extremt stor potential med t.ex. VCT.

Hur stor kontroll har du över vilka verktyg du faktiskt använder?

Vilka verktyg fungerar bra och vilka fungerar mindre bra?

Person 2 läste distans med inspelad lärare. Hade inte skadat att ha dubbelt, dvs både live och inspelat.

Vilka är de största orsaken i en kurs som skulle kunna leda till att den inte blir lyckad (enligt dig)? (Exempel: ingen kommer fram på grund av vädret)

(Hur skulle du beskriva att en typisk kurs upplevs för en kursdeltagare idag? Från ankomst till avfärd.)

Ganska lite erfarenhet. Själv tycker jag inte att de är revolutionerande direkt. Vi jobbar mycket med rapid e-learning (konvertera tidigare föreläsning till rullande slideshow). Det är en utmaning

ibland. Inte alltid jättekvalitet. Ericsson var väldigt nöjda med hardware services-kursen.

(Om du istället helt fritt skulle få välja upplägg på en kurs, det enda kravet är att den i någon mån innehåller klassrumsundervisning, kan du ge ett exempel på hur upplevelsen skulle se ut för en kursdeltagare? (Skulle kunna vara likadant som ovan). Med andra ord, vad hade du velat ändra?)

Nu går vi tillbaka till vår kontext igen. Vi kommer att utveckla en prototyp eller ett koncept till ett digitalt hjälpmedel för handhållna enheter som surfplattor och telefoner. Meningen är att den ska hjälpa dig i undervisningen på ett eller annat sätt.

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Vilka hinder tror du finns mot att distribuera materialet i till exempel en app?

Det befintliga

- Berätta om en riktigt lyckad kurs som du hållit
 - Vad tror du var den främsta orsaken till att kursen gick så bra?
- Berätta om en kurs som du tyckt gått mindre bra
 - Vad tror du var den främsta orsaken till att kursen inte gick så bra?

Avslutning

För intervjuaren: Är något väsentligt för frågeställningens besvarande glömt?

Är det något som du vill lyfta fram innan vi avslutar?

Tycker du att du får fria händer i utvecklingen?

Det var snarare tidsbrist och att person 2 var ny som var begränsande. Tycker ändå att han fick gehör. Vill få mer tid för kreativitet framöver.

Då ska vi bara gå igenom vad vi (jag) antecknat så att det inte blivit något missförstånd.

Tack för visat intresse! :-)

Appendix F

| Customer survey - courses

This appendix contains the customer survey that was conducted as a part of course evaluations at the end of a few courses held by Ericsson Academy employees. After the actual survey comes a compilation of the results of this survey from the three courses we got responses from. First we summarize all responses from each question in a spreadsheet. Where respondents have made a comment there is a number within brackets (e.g. [4]), which refers to the list of comments after the actual sheet.

We at Ericsson Academy and Learning always want to improve to help you maximize your learning with us and to help your company increase their knowledge in order to maximize your competitiveness. Therefore we would like to collect some information from you regarding your views on our delivery methods and materials to better adapt future courses to your needs. Thank you for your valuable input!

1. Your country? _____

2. Your company? _____

3. I have, during work, access to

a smart phone

a tablet

4. What is your general impression of the handout materials used in this course?

5. Do you think you will use the handouts from this course in your work in the future?

a. If **yes**, how often and in what situations?

b. If **no**, why not?

6. What other materials/information would you have liked to receive that would assist you

a. during the course?

b. in your future work?

c. If applicable, what format(s) would you prefer? You can mark several choices.

- Paper handouts Binder PDF
- MS-Word document Smartphone or tablet app Desktop program
- Web page Web portal Other: _____

7. Do you feel that Ericsson provides good alternative delivery methods to instructor led training that suits your learning needs? If not, what methods would you like us to provide?

8. If we would offer a personalized training portal for you where you could access course materials, look at short training videos, find information, take e-learnings and get learning updates...

... would this be of value to you? Yes No

... do you think you would use it? Yes No

... is there anything else you would want added to such a portal?

9. Finally, please write down your personal thoughts on how we could improve the way we deliver our training towards you and your company.

Thank you for your participation to help us to better serve you in the future. If your company would like to have a more in-depth discussion regarding how we could better help you by building learning with different delivery methods to meet your learning strategies please send me an e-mail or ask your management to contact me.

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APPENDIX F. CUSTOMER SURVEY - COURSES

Completion of results from the evaluation forms handed out in the end of courses									
1 Your country?									
2 Your company?	No answer 0	Cameroon 19	Not relevant	Singapore 8	Slovenia 4				
3 I have, during work, access to									
	Course 1	A smart phone	3	A tablet	Both	None			
	Course 2		7		1	15			
	Course 3		3		1	0			
4 What is your general impression of the handout materials used in this course?	No answer 0	Positive 11(11)	Acceptable 7(2)	Negative 2(5)	0	0			
	Course 1	1(3)	4(4)	3(7)	0	0			
	Course 2	0	3(7)	0	0	0			
	Course 3	No answer	Yes 19(9)	Unsure 4(10)	No 2(12)	0			
5a Do you think you will use the handouts from this course in your work in the future?	Course 1	1	4(10)	1(11)	2(12)	0			
	Course 2		4(13)						
	Course 3	No answer	Not applicable 0	Maintenance 8(14)	Regularly 7(15)	Rollout 4(16)			
	Course 1		0		3	1(18)			
	Course 2		3						
	Course 3	No answer	Not applicable 19	Last resort 4(19)	Useless 1(4)	Wrong format 1(22)			
5b If no, why not?	Course 1								
	Course 2								
	Course 3	No answer	Local lab 7(23)	Soft-copies 3(24)	CPI 3(25)	Other 3(26)			
	Course 1	No answer	3	3(28)	1(30)	2(29)			
	Course 2		2		0	1(31)			
	Course 3	No answer	-	Soft-copies 3(32)	CPI 7(33)	Other 6(34)	Product updates 3(37)		
	Course 1		2		2(8)	2(36)			
	Course 2		3		1(35)	2(38)			
	Course 3	Paper hand	Binder	PDF	MS-Word	Smartphone/tablet	Desktop program	Web page	Web portal
	Course 1	3	1	18	2	5	4	8	6
	Course 2	2	1	6	3	3	1	4	4
	Course 3			3	0	2	1	1	1
6a What other materials/information would you have liked to receive that would assist you... during the course?	Course 1	No answer	Yes 14(42)	No 1(43)	Partly 1(44)	Misunderstood? 2(45)			
	Course 2		8						
	Course 3	No answer	Yes 18	No 1					
	Course 1		8						
	Course 2		3						
	Course 3	No answer	Yes 19	No 2(49)					
	Course 1		8						
	Course 2		1						
	Course 3	No answer	Knowledge base 2(47)	Software, documentation 2(49)	Labs 1	Level evaluation 1	Support 2(49)		
	Course 1		4						
	Course 2		8						
	Course 3	No answer	Customized training 2(51)	Prolong course 5(52)	More labs 3(53)	More preparation 1(54)	More examination 1(55)	Availability online 1(59)	Other 5(56)
	Course 1		3		2(58)				
	Course 2		3		3(61)				
	Course 3	No answer	1(57)						
9 Finally, please write down your personal thoughts on how we could improve the way we deliver our training towards you and your company.	Course 1								
	Course 2								
	Course 3								

1. Globally good

Handouts were very practical and easy to read/use

Very interesting

Good even though after explanation some slide were not given (We are waiting as promised)

Very good impression

Very nice

Very good (adapt for training)

My impression of the handout materials used in this course is good, but the time was too short to explain it

Good. I liked the handout because I was in need.

The lab was really usefull but XXX was not easy

The one available was well prepare but I need more documents to really handle This technology

2. - Explicit, focussed on essentials

- Acceptable, satisfactory

- Good. Printed document would be better in color

- Appropriate for a 4-day training but lacking in XXXXX

- The handout materials was good but is improvable we will like it to be in color (XXX documents). No problem for XXX.

- Good, but needed to be well secured instead of photocopying and binding

- Good, but internet connection was too slow

3. -The normal training handout hardcopy-state

4. -Systematic & easy to refer to according to topics.

-Easy to understand. The contents are well covered on IPNMS.

-Excellent. Although the course materials were a bit outdated, the instructor quickly updated it and print it out.

-It is useful.

5. -Detail but black and white no colour

-Traditional teaching method

6. -Should have at least some form of exercises so that trainees can practice.

7. -Satisfied with handout materials

-Ok

-It was easy to follow during presentations, the explanations below were quite good.

8. -Looks detailed. More practical work would be nice.

9. Yes, especially the exercises

Yes I will keep it as support document for future use

Some/sure(?) because I working to operation and maintenance

Yes

Yes

Yes I will

Actually yes

Yes, I'll

Yes. The exercises will help with revision

Yes, we can use it. If we want to remember to some notions

Yes

Yes

Of course. It will help me for the future job

Yes, I think

Yes

Yes

Yes

The duration of the course was very short but some of the parties(?) has been master(?) and can be applied

Yes, it can help

10. -Yes

-Some useful SOEM and some slides on IPT-NMS

-Yes

-Yup

11. -Maybe.

12. -Less likely

-Very seldom

13. -Yes, of course

-Yes

-Yes

-Yes

14. When similar situations as the examples in the training
Troubleshooting. When configuring my first node
On site maintenance, and site implementation, or modification
When adding a new terminal to a node. When planning a configuration change.
For more and easily monitored transmission network
Anytime that I will have to install or maintain this equipment
Reading the handout before an intervention or configuring a link
For XXX work monitoring (alarm), making loop

15. Daily job
Regularly. During planning of transmission backbone
While doing my daily task as commissioning, maintaining task or during curative works
Regularly. Anytime I'll need information related to exposed topics.
Regularly. If I want to remember to some notions study during the course
Anytime when I want to refresh my knowledge or work on the equipment
Very often

16. During the implementation of Traffic Node in our network
I'll often use during the link design and planning
Configuration of the radio link and design of the DCN
During the implementation of the system and troubleshooting

17. -If in situation when problem arise, can refer to it for troubleshooting purpose.
-Quite often, for implementation and troubleshooting.
-When working on the SOEM and NMS.
-Yes. Frequency of usage will be low as we use it for checking alarms & route of trails for troubleshooting as we are on field mostly.

18. -Trail creation

19. -In the beginning all the time! Commissioning troubleshooting
-In cases when I face the real problems, an try to find the real solution.
-Often, commissioning, configuration
-At least once a week at the office and every time I will be on field working on Ericsson LH.

20. -Only need it if really want to go thru the info when can't get help at that moment.

21. -My job scope is maintaining & operating the minilink system. IPNMS mainly for us to check the alarms and performance monitoring.

22. -If there is a softcopy, would prefer to use it.

23. Local lab with hardware units
Hardware and module
Connecting physical equipment, powering them and doing configuration and other activities we had
Install platform (transmission link). Connect direct to equipment and XX. Install software to our laptop and XX.
To have the connection module during the course – not remote connection for lab
The practical exercise was supposed to be done in the classroom but connecting to Sweden
I think we should have installed link on which we will be able to practice instead of connecting remotely to Sweden

24. Soft document
Software document
pdf XXXX

25. User manual of Traffic Node
Documentations related to Network design, installation, and detailed O&M user guide
DCN manual(?)

26. More graphical pictures of plug-in unit
More available laptop connection for practical exercise

Notebook

27. -Existing materials are good enough for our learning.

28. -Something like Electronic Documentation where include training materials & videos
-Softcopy of the training material.
-Softcopy of the materials

29. -Video example of how configuration is done
-A video clip (screen video) documenting the step-by-step service and trail creation.

30. -Technical Data (PDF). LMT User Manuals

31. -More pictures of hardware and some application for LMT Configuration (to configure MDRS)

32. More detailed softcopies withg printscreens for future reference on field
Software document and e-mail and phone contact from the support
Software version of all presentations, documentations, free available softwares related to the course

33. User manual for SOEM and Mink-Link
User manual/How to configure equipment
MiniLink TN product roadmap. Access to R&D release. User manual, installation guide.
In my future work, I will enjoy to have more details about the AMM; more details about the choice. AMM2op, AMM 6.
p.
Full documentation of the system
Detailed documentation of the solution
For my work I will need more information like the different slot on the MMU where each board can be inserted

34. ALEX library
The synchronisation flow in Ethernet pipe
High NMS system to be more efficient in remote management
Software to manag the Nes already installed
Minilink Craft software. Detailed product documentation.
The basic laptops that have the craft terminals versions.

35. -Maybe training material can come in App (Android/Apple) since most people have tablet.
-The latest update of Ericsson product.

36. -Video screen capture of process & steps of creating & provisioning the various services.
-Files or notes of just the main point or example to help in future work problem

37. -New or improved feature on Nms.
-The latest update of Ericsson product.
-Updated Materials if there is any

38. -LMT User Manuals
-Manuals: Installation, commisioning

39. -Some graphical interface, for LMT (Animated configuration, user friendly)
-Some "gadgets" with easy access to something which I would need to find quickly, when working somewhere outside, and would not be able to have the book with me.

40. ALEX
CD
CD

41. -A video of a screen capture

42. Yes
I appreciate this method with connection to lab
Yes
Yes!
Yes
Yes. The online method is really good.
Yes. The method used for this course is very good.
Yes, I feeling Ericsson provide good alternative methods
I feel that Ericsson provides good alternative delivery methods to instructor led training

Yes
Yes
Yes, quite good
Yes
Yes

43. No, I would prefer everybody to make its own labs instead of making team

44. Ericsson should continue in the same light but lay more emphasis on practical configuration methods

45. For a 2 days training it is acceptable
More time for training

46. No.
Nothing else.

47. A database of several configurations and database of issues encountered by different customers/users and solutions applied to those issues
Practical examples

48. Software, documentation
Terminal/hvp configuration guides. Product roadmaps.

49. Whiteboards and remote desktop assistance
Yes, remote assistance from experts.

50. It is presently quite good.

51. Take expected configurations from customer before the training and adapt the content/presentation accordingly
You should think on how to extend the duration of the training to match the level of the attendee.

52. By adding number of trainings day, we can improve the way we deliver the training.
Make sure the time frame is enough to help trainee improve their level.
Consider the normal course duration (the session was too short). Use color documentation (student book).
Have a normal classroom. XXXX (Grow?) the duration of the course.
Dividing the course in terms of the number of days, i.e. increased number of days.

53. We should include intensive lab to master use of Ericsson equipments
To deploy a mini-lab to easy the workshop.
The main missing for me in this training was a life link on wich we can practice.

54. Any program before training for me to have ideas.

55. Every trainee should go through the exercises. There should be an evaluation at the end.

56. Every training should be go throught Ericsson
XX the training with few persons in the course
It will be good to have e-learning an also presential training
In the coming day, it is better to do training out of the office, in order to be free in the head. No way to work and do the training simulataneously.
More material like laptop and to ensure a good internet service.

57. -Ericsson can arange customised training that suits the specific requirement of the company.

58. -More field equipment to simulate a live network so that we can have more options & changes to create & troubleshoot services.

-Training lab should at least set up based on customer's network as close as possible. EIII should provide test XXXX during the course of training.

59. -Some references and other examples can be put on the web portal. However, instructor led training is still necessary.

60. -A good instructor and a good set of test equipments are crucial in delivering a good course and practice.

61. -More practical work
-More praactical training
-More practical work on equipment

62. -It would be better if the materials are available also in electronical form.

Appendix G

| Customer survey - e-mail

Figure G.1 shows the customer survey that was sent to all learners who participated in a course at Ericsson Academy during 2012. We sent the survey to 502 people and received a total of 111 responses. The rest of the appendix holds a compilation of the results of this e-mail survey. Note that this includes non-technical courses such as Scrum and Project Management.

Hello,

According to our records, you recently attended the Ericsson course *course name*.

We are constantly working to improve your learning experience at our courses and we are currently looking into how we can improve the student materials and make them more useful for you.

We would much appreciate if you would help us improve by answering these short questions:

1. Have you used the provided course materials in your work after having completed the course?
2. If yes, to what extent?
3. If no, why not?

Figure G.1: *The survey which was sent to past course participants*

APPENDIX G. CUSTOMER SURVEY - E-MAIL

Compilation of mail responses										
1	Have you used the provided course materials in your work after having completed the	No answer		Yes	No	% yes:				
				64[1]	47[2]	58%				
2	If yes, to what extent?	No answer	Not applicable	Daily work	Significantly	Regularly	Seldomly	Use as reference	As a course recap	
		3[3]	46		8[4]	18[5]	24[6]	10[7]	2[8]	
3	If no, why not?	No answer	Not applicable	Not had chance yet	Incomplete	Not useful to me	Missing	No need		
		3	62[9]	19[10]	1[11]	21[12]	1[13]	4[14]		
	Total number of e-mails sent:	502								
	Responses:	111								
	Response frequency:	22.11%								

1. -I mean that I find it 20% useful in my work
 2. -No, Actually there should be 2 different training for the purpose of complete learning. [...] Materials are quite (more than quite) basic. Not even a table showing improvements and corrections (delta)
 3. -Well, rhetoric skills is used daily in my function so the answer yes to question 1 and 2.
 4. -I work mainly on pre sales and used significantly some material from the training in this context
 - Large extent part of my job (service sales within EP MBB)
 - 1.On first line fault management process in NOC(Network Operations Centre) by reconfiguring failed links as a result of lost NPU configurations on some nodes, greatly reducing service downtime. 2.Switching traffic to alternative channels(where working channel has failed) on redundant medium to high capacity links(both as preventive and corrective measures). 3.Verifying bandwidth allocation to different service classes on our transmission domain e.g. 2G,3G&WiMAX for optimization purposes. We have an ongoing ML TN/LH project under implementation on a number of hops & upcoming ones to offer us protection on identified backbone links. I expect to practice the skills acquired in the training academy during and after traffic loading (hybrid traffic: Ethernet &SDH).
 - I do maintenance of Minilikn TN on daily basis. Even though we are still on R4. We have installed Marconi equipment in the company, though not in my region so it will be a while before I put on that training to use.
 - To great extent as I'm working in Transmission operation.
 - I am frequently using page 28 (version 2.5.2), and now and then page 6, 40, 73, 74, 105.
 - Since I am in planning department, so I use most of the course in daily work, in dimension AMM configuration, link configuration to support project roll out, in Boq creation to support account team. So it is very valuable.
 5. -For estimating optimization workload and cost for the Optimization Service offer to customer.
 - Yes I have used the course material from time to time and as we speak I am configuring a MINILINK TN with the aid of the notes.
 - Regularly, to some extent, to look up details regarding different products
 - Each time I need to review service channel capacities for different MMUS, and to review OSPF for some cases and to read the notes I wrote down during my class attendance and when I feel it is necessary to read it.
 - I have used the course materials many times when I needed to refresh some principles implemented into this technology. So the depth information acquired wasn't big. I only wanted to understand/refresh key principles or main features of the technology. When I needed more detailed informations about subracks, units, ports, etc., I used official electronic documentation.
 - Loaned it to colleagues that have not attended the course. Used as reference and example when setting our own working agreements and ways of working.
 - I have looked into the material a few times
 1. To recap the objective of the different meetings suc as sprint review, sprint planning meeting, daily scrum, retrospective, backing grooming.
 2. to recap the different scrum roles
 3. to recap the scrum artifacts and how they should be used.
 3. to reflect on team dynamics.
 - Yes, I have used the handouts, which were pretty good, with one exception – the index was incorrect, so I had to generate my own.
 - Yes I have used the material a couple of times, but the documentation was very light and lack details, so I only used it as an input to know what to search for on-line. It is difficult to find the right information on the web in this area so I would liked to have much better course documentation.
 - Actually the contents became part of my work, as I am working in pre-sale, accordingly preparing product packages and offerings among my core responsibilities. Worth to mention that the slides of Long-haul design were very valuable.
 - I would say that a medium extent because some of the given material was too specific and I was working on a more general level at that moment.
 - I was good as I used it During the tender with account I work for
 - Probably about 6 to 10 times during the year
 - 2)When preparing and giving presentations. I don't give presentations daily, but when I do I try to use what I learned in the course.
 - I used the materials along with the project installation phase to guide me through installing it. the materials are rich and useful.
- One important thing is that we should have a soft copy of the materials, we only had hard copies.
- It was very usefull to configure IPTNMS services for demo presented in BBWF and another one for Talk Talk customer.
 - It is helping on configuring transmission node for ongoing 3G/HSPA network roll out, the MLTN R5 is the release we are using. This training is helpful also on providing interconnection Transport service to some Local enterprises.
6. -Once for rehearsal and once before a presentation
 - The course material was a mix of old and new stuff mixed as a deck of cards. This cause some confusion and reduces the readability. I have only used the newer materials and examples.

-I've used it to check some definitions and to read through afterwards.
-Yes, the transformerprogram MIDAP.
-To remember and understand how Scrum teams work.
-To a moderate degree. Have had tasks involving the tool
-Quite useful but for detailed configuration examples the resolution of the printed manuals is not good.
-To minor extend, the project I have worked with has so far not been into that technical details
-Both Yes and No. Since I am working in the Lab I used to get the understanding of what I have to do but I couldn't find what I needed to do. I think if you would like to improve the course material, it would be very fruitful to include all the steps for setting up Layer 1 and 2 in the craft, and the reason of using different functions in different situations for example when shall we use policing and what does the function help with in the system. My feeling was these things are not well ordered documented in a proper order for further use after the course.
-I am not working directly with the product.
-Just a little, some parts of our systems are written in Python, but mostly in Perl
-I used the documentation and the example exercises. I used it to design rules and to train other colleagues to develop on FMX.
-About 4 hours of browsing, checking python concepts while programming python.
-Yes, I have made use of this in later presentations at customer meetings in Singapore etc.
I have not reviewed the CD with my presentations during the course. Why? This is due to Ericsson ESOE PC no longer feature DVD readers (for cost saving purpose). Proposal: Store the student presentations on a 64 Gb USB stick.
-Changed position to line manager.
-For a very specific detail (don't remember which one). I didn't use it a lot of time because it's a big folder to catch somewhere on a desk
-Very limited. The material is more or less useless. Small pictures hardly readable. More examples and more explanations to picture in some cases is needed.
-Once only for checking regexp patterns
-2) Somewhat, however, Python is so widespread so I prefer to use google to find answers. It's so much faster than using books/handout material.
-I am not working as a scrum master at the moment but I have used some of the course content in different situations.
-Two or maybe three times during a year.
-Only a few times (4-5 times maybe)
-a few days
-

7. -Twice to check up things regarding products I heard about and to check again about a feature.
-To check what capabilities different softwares have and also to check reference cases for projects
-I referred back to the course material at work a couple of times exactly
My problem was : though it's a big material, it lacks important details and gives details in topics that are no longer used so that was kind of frustrating.
-I used to study for the ETCP Certification of Microwave Transmission (I passed), and also to consult on some equipment (apostilles and presentations) in my work.
-I've referenced rule editor thing from the course material.
-använt det som snabb uppslagsbok, men jag tycker att det saknas mycket i kursen som ändå heter TN Advanced...
-I have used the course material as input to change work implementing agile/scrum in my organization. Both as source of inspiration and as input to the actual communication and creation of my own presentation material.

It was now some time since I went to this training session but I remember the content of the material was different in the student pack compared to what was shown by the teacher. That was not so good. Also, what the teacher said sometimes had very little to do with the material or the material was not relevant. This could be OK, but it seemed to me that the content did not really stick together.

Overall the training session went between average and a bit above average wrt quality, content etc.
-Yes I still use the course material from time to time to recap on some of the functionalities. I think one of the major improvements for the course material would be to add page numbers to the glossary.

Often for my work I encounter something that I know was explained in the course material so it would be easy if I could find it back with just looking up the name in the glossary and not have to go through all the chapters to find it back.

-I have used the material for reference with ongoing job activities and for use with mentoring other Ericsson staff moving into the sales support area.

8. I have done all exercises once more by myself, just to remember it better. I started working at the FMX group at GCH Lindholmen in January and the training was a good and quick start for me.

-Yes, as repetition when I have discussions in the area with suppliers.

9. -Not really, because we are looking for this solution and we have begun a trial. But I have already verified the

functionality available with this solution.

10. -We are planning to start around summer this year, then I am sure I will sneak look into the course materials
-I have not been in the situation of making a presentation needing that kind of preparation after the course. I think the course was very good and very practical.
-I used what I remembered, especially for definition of done and retrospectives, but I did not use the material (yet).
-I have made no presentations.
-Honestly I don't think I have. I still have to review the course. Probably because I attended a course in Malaga 2 years ago and have been scoping services for a while now.
-The course was good but there was a change in plans related to my work assignment and because of this change I am no longer assigned to radio part of telecom (initially I was assigned as backup for Andreas Dahlin).
-I am just involved in implementation activities. I will use it when I have to do design activities for sure.
-Solution still not implemented in VF-EG with Ericsson equipments
-So far , I don't use the material of IPTNMS – P in my work , in my network IPTNMS – P server installed but not activated yet
-Not yet used the course material till now, but there is some opportunity in the coming business for using it.
-I have not explicitly been working with IPT-NMS since the course. It was more as a general orientation of the tool.
(*2)
-Har inte jobbat enligt SCRUM. Inget omedelbart behov av kunskapen.
-I haven't been programming any C++ code the last year.
-I have not been working with this type pf questions
-Not needed to, haven't had a reason to yet.
-Don't use that product
-We didn't install the SoEM yet on our network
-I have not used Python yet.

11. -Would have used it more if we were given handout of all the material that was presented during the course. The provided course material was just a small fraction of the material that was used during the course.

12. -The material had no practical use. Also the material was not tailored for remote delivery or in this case delivery online.
-If you call course material = thick folder with printed slides - I don't. I prefer ppt vesion.
-The provided material was really bad and contained a number of printed out slides. Content was maybe useful during training but mostly for notes
-I have not used the provided course materials, but I have used the knowledge I gained from the course.
-Too theoretical for application in my present work
-Because my main responsibility fall under network rollout with Implementation responsibility only.
-EDOS-based services and EDOS tools are not currently a part of design/optimization service delivery solutions to our customer
-I don't like to start looking into "slide packs". I rather read books and search the web for info. A good book as course material would have been better.
-The course was a completely disaster
-A real book would be usable, powerpoint handouts are not
-The material were printed out in a non friendly reading way. Every other slide was "upside down" to the one before.
-No, I have note used the course material. It was to hard to find information in it so it was not god for using as an encyclopedia. The printing was also done in the wrong way. It was printed in landscape shape but we had to turn over the book all the time while we was reading it since every other page was upside down.
-Using google
-I normally look up the language specifics on the web.
-What I can remember, it was just a compendium, OH pictures etc. It was not so good.
-3)I was already familiar with most of the material in the documentation, and since they mostly consisted of pictures, they didn't give you much more to read about afterwards. If there had bben extra material, which we didn't have the time to go through during the course, then I might have looked at the student material afterwards.
I think the discussions that we had during the course was the most valuable part.
-3)I don't find the material so suited for reference, a book would have been more valuable in that regard.
-The course wasn't very useful. The content was interesting but the presentation wasn't very good. It is easier to get the information I need from other sources.
-There was almost nothing i didn't already knew.
-Lots of better stuff on Internet. You can find more variant stuff that is more suited for you.
I would have used the course material if it was more like a referens book and with with different tips and trix for common situations, like retrospective guides etc.

13. -There was not relevant course material. Slides that were presented were not collected and given to the attendees. I took notes during the course and sometimes use those ones instead. I think the course material should be properly done and distributed.

14. -My role is product manager for MNI-LINK. My goal with the course was to get a general understanding of the

product to be better prepared to handle O&M issues for MINI-LINK.

-Changed work assignment

-Now I will be using it more since I have a customer with 50 Marconi LH nodes. Normally I refer to the class materials in preparation for customer meetings and pre sales presentations.

-Because in my work either in the solution or the integration, what I needed is Alex for installation & integration procedures, & knowledge base for communicating to other colleagues if external help or advice is needed. I was working with different EMA versions & CPs, so for each project, I get the latest Alex documentation for the same CP I'm working on, which is also having detailed information for the product features & capabilities.

Appendix H

| Tablet trial evaluation form

This appendix contains the tablet trial evaluation form that was handed to the two learners we tested our prototype app on during a course. It was created through Google Drive as an online form, and after the course they got a link to go to. Since they did one response together their responses are included inline in the actual form below.

Tablet Trial Evaluation

Hello Ramy and Ahmed!

We would really appreciate if you would take the time to answer the following questions about the Android application that you have had access to during this course. We want to stress that we would like your honest feedback rather than "nice" and polite answers. :)

Note that each time we refer to "the application" in the evaluation form we refer to a future stable version of our application where at the very least the "follow instructor mode" has been properly implemented, you can search, and you can bookmark pages.

Thank you for your valuable help with our thesis work!

* Required

Did you use the Ericsson Academy application? If so, what did you use it for? *

The documentation and presentation for the E/// IPTNMS TDM course

Do you prefer the binder or the application as the distribution medium for course materials? *

Assume that you after the course are able to log in on your own phone/tablet to access the materials and your own notes and drawings.

The tablet has its positives which is high availability and coloured bright documentation; but for taken notes I would still prefer the binders :(

Do you think the application could successfully replace binders as the sole means for viewing course materials and taking notes? *

Sooner or later it should be :) but we need to find a reliable way to take the notes (more accurate and responsive stylus)

What feature, if any, did you find most useful in the application?

Follow up instructor Coloured and bright presentation

Are there, in your opinion, any specific features the application is lacking?

May be it can include reference to specific documents or other links to other materials in case mentioned within the course.

Three days is not much time to learn a new tool. How feature-packed do you think the application can be before it steals too much attention from the actual course?

Possible features include browsing course materials, sharing notes (these two were available to you), receiving new material from the instructor, doing exercises, reordering pages and choosing among various shapes when drawing.

-

As a measure of usefulness, how much more would you (your boss) be willing to pay for the course to get to borrow a tablet and use the application instead of getting a binder? *

Again, assume that after finishing a course you can download the app to your own tablet or phone (Android and iOS etc) to access all documentation and notes.

I believe bosses will not pay so far for this :)

Is there anything else you would like to add with regards to your experiences?

It begin with us! :)

Appendix I

| Report to Ericsson Academy

This is the final report that was handed over to Ericsson as the overall result of our master's thesis.

Modern Classroom Training with OnCourse

Edvin Linge & Rikard Ljungstrand

June 19, 2013

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1 Executive summary

To continue to evolve and modernize classroom training a study how to incorporate tablets in the training in Mölndal was made during spring 2013, partly to find something which could replace the binders that today contain all course materials. The conclusion of the study is that tablets could very well be used in classroom training, and though one tablet is quite a bit more expensive than a binder they quickly save up that cost. This document describes benefits and obstacles to do a transition towards tablet usage. Major benefits include much easier sharing and creation of user- and instructor-created content, materials in color, possibility to access materials before and after a course, and that Ericsson can push ads about e.g. new courses to past course participants. To achieve this resources will need to be allocated to create the actual solution (an app called *OnCourse*), a server backend infrastructure and then to maintain it once implemented. The most important effort for success, however, is to allow the staff at Ericsson Academy to get accustomed to using tablets and to allow time to develop courses with tablet availability in mind. The document introduces four *levels of commitment* for Ericsson Academy to choose from depending on how much resources can be allocated and ends with a recommendation how to proceed and which level of commitment to go for.

2 Introduction

In fall 2012 we were for our thesis project invited to study Ericsson's training at Mölndal, Sweden, namely the prospect of introducing new technical teaching aids and to give our recommendations for action. In our work, we have both studied what other companies and organizations are doing in the field of electronic strategies in training and developed our own concept based on the specific needs of Ericsson Academy and its customers. Our master's thesis, *OnCourse at Ericsson Academy: Using Android tablets to enrich classroom training*, details the project in its entirety while this document summarizes our main results which we deem most important to Ericsson Academy.

This document describes possible directions for Ericsson to take in order to make use of tablets in their classroom training. First we present what we call *the concept* for the future mobile app OnCourse for tablets, which describes which features the app should contain, and what it could look like. We begin by outlining the envisioned usage of OnCourse and continue by detailing its specifics. This concept has a number of features that we hope will enrich the training sessions for participating learners. It is hoped to enable new ways of teaching and to help to reduce costs by eliminating the need for printing course materials. We then outline four *levels of commitment* on behalf of Ericsson Academy for implementing these ideas. Each level of commitment to the concept allows for greater benefits while at the same time requiring more resource commitment. Finally we state *our recommendation* on how Ericsson should move forward in this matter.

3 A story of two technicians

Before we delve into technical specifications of OnCourse, we present a usage scenario which highlights the benefits of the tablet solution over traditional classroom training without tablets. This chapter can be skipped without missing out on any raw data.

Now, picture SweTel, a large albeit completely fictional telecommunications provider in Sweden.

Daniel Svensson is a network architect working for SweTel since a few years back. Things are busy as SweTel is in the process of rolling out their network in northern rural Sweden which is sparsely populated. SweTel have opted to make heavy use of MINI-LINK microwave links in their network and Daniel and his colleagues are scheduled for a course in MINI-LINK equipment together with SweTel employees from other territories. Arriving at Ericsson's training center in Mölndal by taxi Daniel and his colleagues find their way into the classroom and quickly find their seats. On the desk in front of them there are tablets with a stylus, a pad of paper and a pen. Next to Daniel sits a junior technician from another territory.

- My name is Daniel, Daniel says as he turns to Jesper.

- Jesper, the man replies. Jesper Persson. Nice to meet you! curiously powers on the tablet and Daniel can tell what he is thinking.

- Oh, that's just for the course materials. You'll see in a minute, Daniel says and unpacks his own tablet from his bag.

- You see, I've taken courses here before so I know that they give out all materials electronically. It's quite handy really. Personally, I won't be using Ericsson's tablet during this course since I have brought my own device. But it really doesn't matter what device you are using. You can always access the materials and your notes, no matter what device you end up using.

- Neat, Jesper replies.

He is busy investigating the ins and outs of the tablet in front of him.

The class is about to start and the instructor introduces herself and gives a brief introduction to the tablets and their use. The class listens with anticipation.

- And as I mentioned before, your tablets will automatically follow along my presentation so you won't have to switch pages manually. You can fully concentrate on the topic, still when necessary stop on a page to examine it more closely, and then follow my lead again on the click of a button. The tablets are yours to borrow for this course but we will be wanting them back before you leave, so no trickery! If there aren't any further questions, let us begin on today's topic.

During the lecture, Daniel shows Jesper how he can use the stylus or his fingertip to make freehand drawings and highlights in the course materials and how he can take textual notes. Jesper interrupts him.

- This is all good and well, but if I take all my notes in this tablet, how do I get them out after the course has finished?

- Didn't you listen? Daniel replies. You just download the app to your own device afterwards and it will sync all your content automatically. Simple. You can even run it on your phone if you want to.

After lunch, the class has reassembled and it's time for lab exercises. The participants work in pairs with Ericsson's network tools to set up MINI-LINK connections on the lab equipment. On their tablets, they have quick access to the relevant CPI (Customer Product Information, i.e. technical manuals) and can take additional notes and make annotations within the manuals.

- I'd advise you to set a bookmark on the section with the error codes in the manual, Daniel says to Jesper in a low voice. I've found that section to be invaluable in the past!

An hour later, all links have been set up and configured and the instructor guides the class into the hardware room where the kit is set up. She points to one of the modem units sitting in a rack and puts on a serious face.

- Here, she says, is a very important indicator light. Make note of it. If you find yourself in the field with a downed link and see no immediate explanations, it might be because the transmitter

fuse has failed. In that case, you will find that this indicator is turned on. To remedy the situation, use a flat screwdriver to open this door right here and replace the faulty fuse. Do we have any volunteers who would like to try it out?

Jesper is the quickest to raise his hand and gets to replace the faulty fuse. Meanwhile, Daniel uses his tablet to snap a picture of the replacement procedure and of the small indicator light on the panel. He makes a circle around the light in the picture with his stylus and scribbles down some notes on the replacement procedure.



Figure 1: *Jesper fiddling with the equipment.*

The following day the class is once again assembled for the morning lecture. The instructor has left the classroom for a few minutes and Jesper takes the opportunity to turn to Daniel: - You know, it's been only a day, but I've already forgotten which light it was that indicated the broken fuse, there were so many lights! How embarrassing is that! Especially since I was the one to actually replace it. Do you remember which one it was?

- No worries, Daniel replies in a soft voice. Take a look here.

Daniel browses to the CPI in his tablet and searches for the term 'broken fuse'. He quickly finds the section of the documentation where he inserted his picture earlier and shows it to Jesper.

- Cool, I didn't know you could take pictures!

- You can, and you can share them too, just like you can share your notes and drawings. Here, let me send that over to you.

Daniel clicks to share the page and selects Jesper in the list of recipients. Within a second, Jesper has a copy of the annotated picture in his tablet.

- Now that you have your own copy, you can add additional notes and drawings on your own if you want. You can even hide or delete my scribbles if they are getting in the way!

Jesper takes a sigh of relief in that he has saved his face as the instructor enters the classroom. Today's class is on network topologies and the instructor opens up a blank slide in the

presentation. As she begins to draw network nodes and interconnecting links on the smartboard, Jesper picks up his stylus and looks down on his tablet to jot down a copy of the diagram. Imagine his surprise as he sees the instructor's drawings appear in real time on his tablet.
 - It's cool, isn't it? whispers Daniel. You don't have to copy it over by hand but can focus on understanding the concepts. If you want, you can draw your own amendments though. Or if you are the kind of person who prefers to write and draw to aid in your learning, just hide the instructor's layer and draw on your own!



Figure 2: Jesper and Daniel in the classroom.

The following day is the final day of the course. After the last lecture, the instructor asks the attendees to fill out the course evaluation form to help improve future courses. The evaluation is filled in through a web form which is accessed on the tablet. A gentle silence fills the room, only interrupted by the rapid tapping of fingers.

The course attendees say their goodbyes as they leave the training center one after another at the appearance of their taxis.

As Jesper returns the borrowed tablet he turns to Daniel and asks.

- I really should get one of those tablets. What did I have to do, again, to be able to access my notes and materials back at work?

- Just download the app and log in with your email address and password, just like you did on the borrowed tablet. Why don't you try it on your smartphone in the meantime? And if you figure you want to have the documents on your PC, they can be exported as PDF documents. A taxi pulls up on the driveway, the driver opens the window and exclaims "Jesper Persson?"

- Gotta rush, Jesper says. Thanks for all your help! Maybe we'll meet again. Perhaps in a follow-up course, given how much SweTel are investing in this.

- Perhaps so.

Jesper heads off to his taxi.

- One more thing, Daniel says. If you do attend more courses, you will have access to all materials from the same place in the app, for both past and present courses. You can even get

a head start on the course materials if you wish, they are available to you as soon as you are enrolled for a course. Might be something for a long train journey, don't you think? - Good thinking, says Jesper as the taxi drives off.

* * *

Six months later Jesper has acquired a tablet and is out in the field troubleshooting a faulty MINI-LINK modem unit. Browsing the CPI in the tablet app, he stumbles across the photo Daniel took during the course.

- Perfect, he exclaims, just as a notification arrives telling him that an updated MINI-LINK course is available. When he comes back to his office he notifies his boss that he would like to attend that course.

4 Introducing OnCourse

In recent years there has been an enormous interest in app development with the rise of popularity of mobile platforms such as Android and iOS, especially in the western world. Sayings such as "there's an app for that" are testament to the large supply of highly specialized apps which try to do only one (or a few) things but do them well. The saying is also symptomatic of modern user expectations. Given the supply of useful apps for most of life's problems, we have come to expect there to be tailored apps for all sorts of situations. Companies are urged to develop a mobile strategy to reach their customers and to stay relevant in the stiff competition.

In the context of training and education, embracing computing devices is beneficial because it enables instructors to present a richer and more dynamic learning experience. In "traditional" training where the instructor is using Powerpoint slides and learners are taking notes on sheets of paper, the course content is very much limited by the means of presentation. If each learner has a device the instructor can more easily encourage a more active and collaborative environment during lectures.

Having users install and use an Ericsson app on a mobile device however has a number of substantial benefits over using other types of computing devices such as laptop computers or simply providing soft copies of documents. Mobile devices are easier to carry around, and an app can be tailored to suit specific needs of even individual courses at Ericsson.

This section details all features of the concept and illustrates them using screenshots from the prototype app described in section 5. The screenshots were taken on an ASUS Transformer Pad TF300T. First of all there are a few key features we believe that a fully fledged app needs to have in order to fully utilize the possibilities of tablets as they are today.

- OnCourse should make use of the higher precision and additional functionality provided if the user is using a stylus instead of her fingertip to draw on a digitizer-enabled device, such as one from the Galaxy Note series of Samsung devices.
- A substantial effort needs to be put into making the app as self-explanatory and easy to comprehend for first-time users as possible since many course participants will arrive without any prior knowledge of it.
- Except for cloud storage of user-created content and initial authentication the app should not require an active Internet connection to be usable. The instructor should in the absence of Internet connectivity be able to create a local WiFi hotspot if needed and temporarily act as a local provider of course materials. Sharing documents among peers should only require a functioning Local Area Network. In summary, the app should be robust to shifting Internet and network connectivity¹.

4.1 Ability to download the app to the learner's own device

The learners should have the option to install OnCourse on their own devices. Should a learner enrolled in a course choose to install OnCourse before arriving at the course, she should have the option to view course materials and other information before the course begins. There may also be additional information available including (but not limited to) a list of enrolled learners, suggestions for preparatory WBL courses or suggestions for other relevant courses. After the

¹Ericsson frequently gives courses at foreign sites where Internet access is unreliable and using tablets must not reduce the instructor's ability to give courses

course has finished the learner should be able to access all materials for future reference.

4.2 Prerequisites

Presently, all learners are being registered in the *MyLearning* database at Ericsson, though currently only by their e-mail address. To be able to fully use the app's functions each learner needs a full login, and the server needs to be able to communicate with the app and store user-created content. Ericsson needs to investigate how the course materials could be distributed to tablets, especially when it comes to DRM and how to release documents which are considered company assets.

4.3 App specification

This section further specifies how we envision the tablet app and the features it supports.

Login view

The user is initially greeted with a login view where she logs in to the system (which is integrated with e.g. MyLearning, Ericsson's learning management system) using credentials supplied by Ericsson. Figure 3 shows this screen.

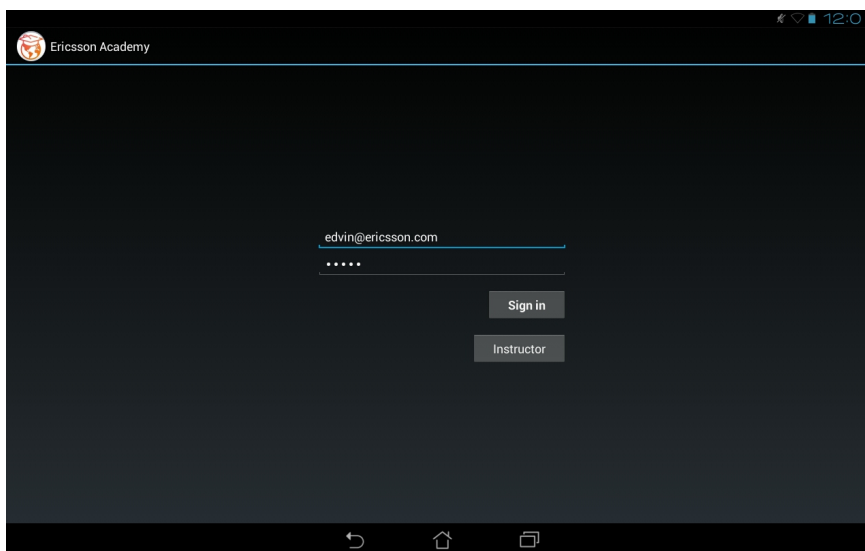


Figure 3: *The very first screen presented to the user is a login form.*

Course list view

When logged in, the user is shown a list of accessible courses, i.e. past, present and enrolled courses. By tapping on a course, the user is shown a list of resources associated with the course.

Course resources overview

When a course has been selected this view shows course resources available for that particular course, which includes

- Documents, e.g. the Student coursebook
- Interactive exercises

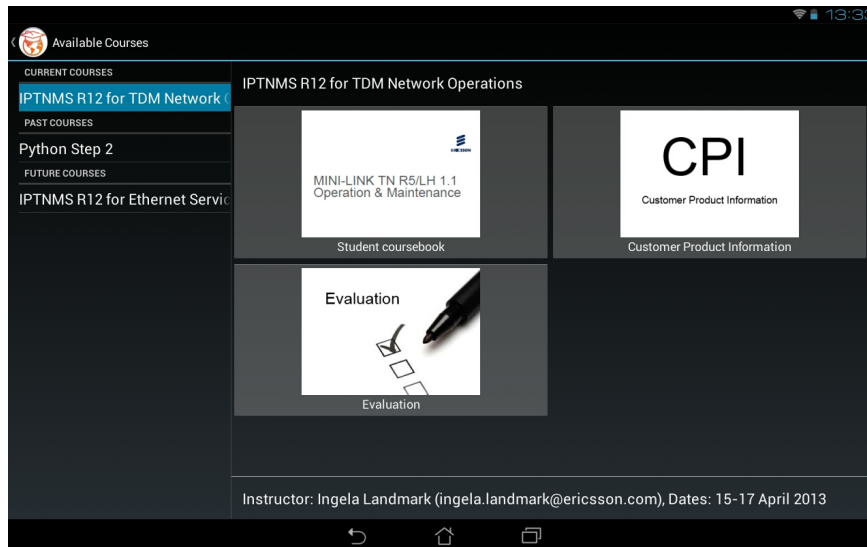


Figure 4: The overview screen that the user first meets after she has logged in. It shows available courses to the left and resources for the chosen course to the right.

- Links to relevant CPI documentation
- Links to external resources such as videos and articles
- The course evaluation form

The overview also contains some basic information about the course, for example the instructor's name and e-mail address, and key course dates. Figure 4 shows the course list to the left, available resources in the selected course to the right and some basic information at the bottom of the screen.

Document view

When selected in the course resource view, documents open inside the app. In this view the user can take notes, set bookmarks and make freehand drawings on each page of the document. The interface allows for zooming and panning, and the freehand drawings are vectorized to stay smooth when zooming in. Available navigation tools in this view are a document outline (table of contents), search feature and a list of set bookmarks. Figure 5 shows what the document view looks like in the prototype app.

The learner can choose to *follow* the instructor, which means that the learner's app always shows the same page as the instructor's. This saves the learner from the tedious flicking through pages when the instructor progresses through her presentation. Additionally, any notes or drawings that the instructor makes are immediately streamed to all connected participants. The instructor can on demand add additional pages if needed and this is reflected on all enrolled learners' tablets. Note that an Internet connection is optional if all participants are connected to the same Local Area Network connection. The learner can also add new blank pages anywhere in the document or create a new page based on a just taken photo as shown in figure 6. The instructor can use the mouse (or hovering stylus pen if she is using a tablet) to highlight specific areas on the current page with a dot.

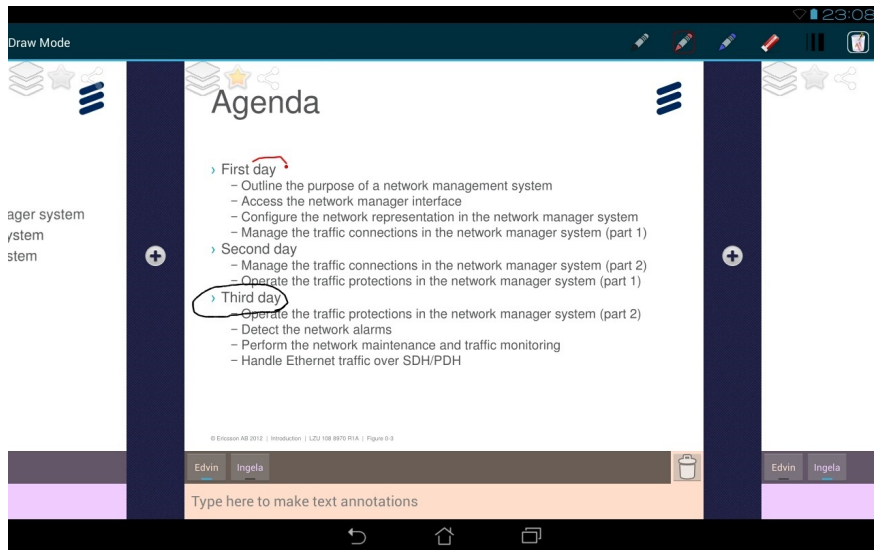


Figure 5: The document view when the user is circling some headings.

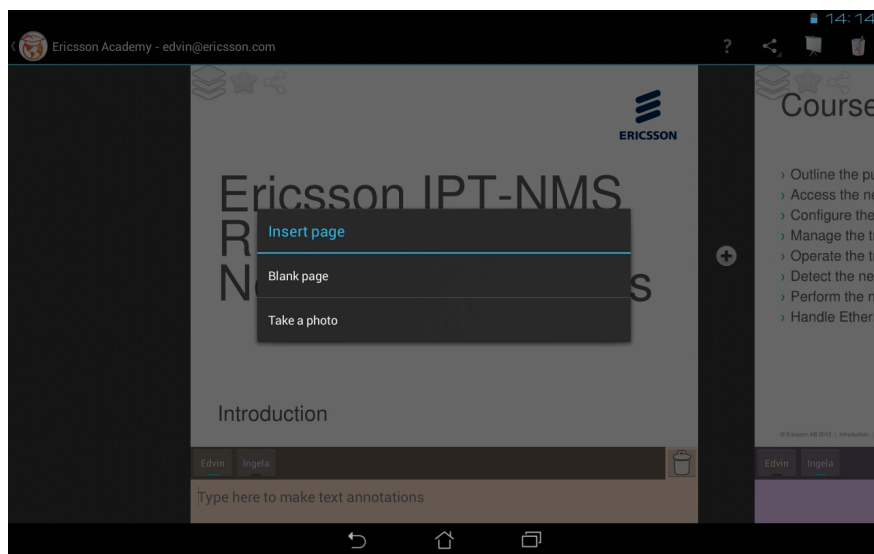


Figure 6: A user about to insert a new custom page gets two choices

In figure 7 the user has started to make a note at the bottom of the page. The notepad automatically increases in size as more lines are added. There is one tab for the local user's notes, in this case the user is called Edvin, and one tab for the instructor's notes (Ingela). If yet another user shares her notes with Edvin, another tab will pop up on his device.

Interactive exercises

During class, after the instructor enables an exercise the learner can open it from the course resource view (similarly to how she opens a document). A new view is opened, which presents

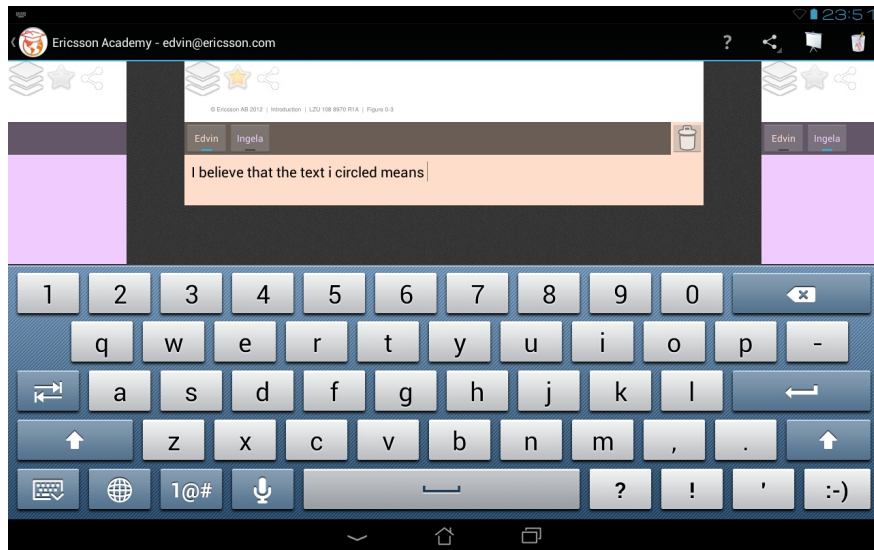


Figure 7: Writing notes associated with a single page.

one exercise instruction at a time. Having finished the current task, the learner taps a button to proceed to the next. The instructor can then at any time see a summary of progress for all learners. The instructor may also, as a quick check, have added a question to answer on some pages. The questions do not stop the learner from moving on though, it is merely a way for the instructor to gather statistics that can be used to later on emphasize those questions many people failed to answer correctly.

External links

The resource list may also contain external links to e.g. Youtube videos or other interesting web pages such as the CPI portal. Note that an Internet connection is required to access links. When tapped the default web browser is invoked to open the web page.

Course evaluations

At the end of the course the instructor can enable a course evaluation that the users can answer directly on the tablet by choosing the corresponding resource in the resource view. Optionally, the instructor may remotely push the course evaluation to the front of the screen on all learners' tablets. After the course the instructor then simply taps a button to create a summary of the results for future reference.

Page sharing

All learners continuously get any drawings the instructor makes on the SMART Board in the classroom (or her tablet) streamed out to their tablets. They may also share their own page content (this includes notes, drawings and photos) with each other. When sharing such content, the receiving user gets a snapshot copy of the content through the network. Each person's notes are presented in individual tabs at the bottom of each page while drawings are presented as layers whose visibility can be toggled (see figure 8). That way every learner can choose any combination of layers to show.

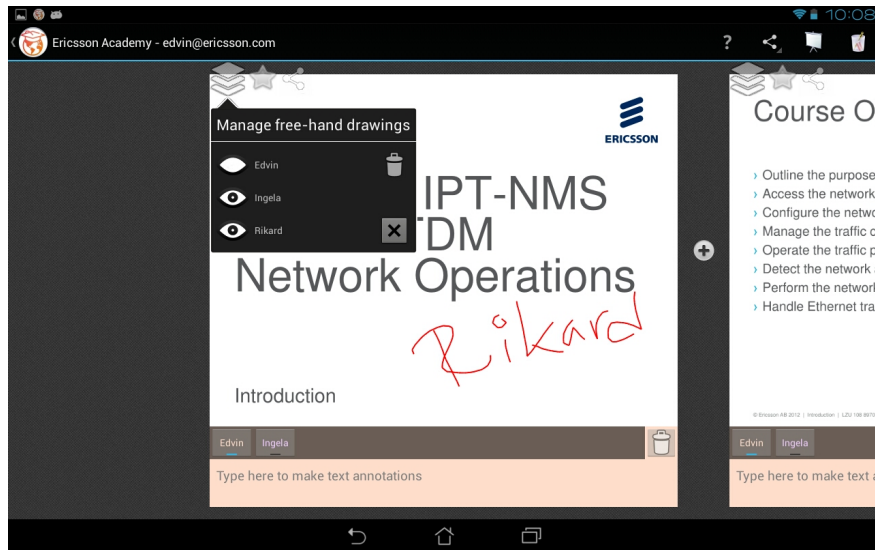


Figure 8: The layer toolbox

Figure 9 shows a user in the middle of sharing some created content. The user has pinch-zoomed out to get an overview of a few pages at the same time. She has taken a picture, made some notes about it and is now just about to share all her pages with a fellow learner. Note that on the second visible page from the right where Ingela's (the instructor's) notes are shown, the notes can not be deleted (there is neither a trash icon nor a cross icon in the tab bar).

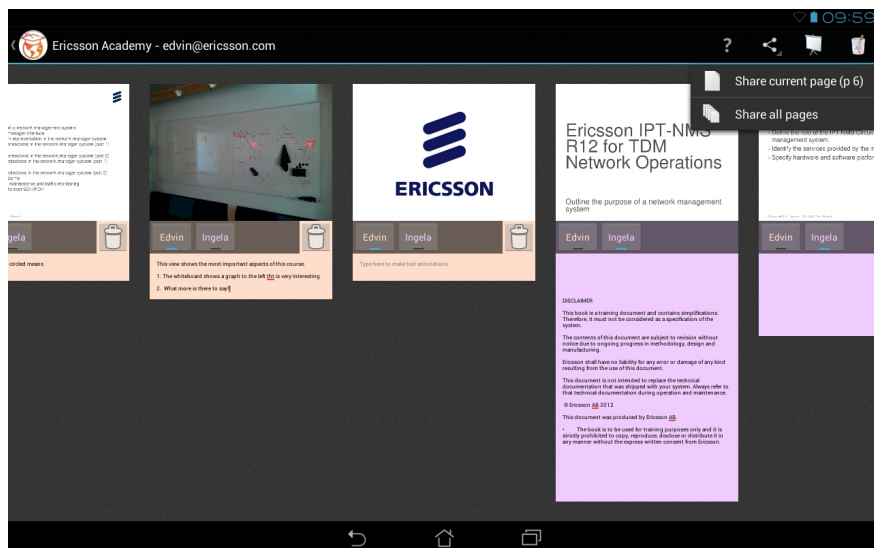


Figure 9: A zoomed out view of a few pages in the document

Spontaneous questions

The instructor can choose to ask a question with e.g. four possible answers. Each learner then

receives the answers as a new page. The instructor could also ask an open question to gather data from each learner for easy sharing to everyone. Then everyone do not have to manually copy interesting thoughts from each other's notes.

Links to the CPI (customer product information)

The course resources may, if applicable, contain links to specific sections of the target equipment's manual (CPI). When tapped, these links go directly to the correct section of the CPI in a web browser, with the possibility to easily return to the same place in the local course materials again.

Search

Throughout the app the user can do full text searches for anything she wants to find. The search is done in both resource names, document content, user notes and the CPI. Android requires compliant devices to have a dedicated back button (either physical or on-screen) and tapping this button allows the user to always go back to the previous view after looking something up by searching.

Export of all course materials created during the course

Documents, typically supplemented with the learner's content, can be exported as PDF-files for viewing on other devices.

Information about new relevant courses

If the learner has the app installed on her own device Ericsson can push notifications about new or updated relevant courses.

5 The prototype

As a proof of concept and to be able to test the concept for OnCourse in real courses we created a prototype app. It implements a subset of the features presented in the concept in section 4. The user can login, browse a few courses and access external links and course materials (documents or presentations). The document view is feature complete except for the left slide-in panel with search, bookmarks and document outline. Sharing of user-created content works over the network, and the prototype features letting instructors have additional privileges such as streaming page changes and new content to all users visible on the network. It is however not possible to use a PC and draw directly on a SMART Board. Other parts of the concept that have not been implemented include searching and browsing bookmarked pages. Perhaps most notably the prototype does *not* integrate with any of Ericsson's existing IT infrastructure. Therefore user-created content is only stored locally on the user's device (and on peers' devices with which the user has shared content) and this hinders seamless device migration. For instance, this implies that if a device crashes or is lost, the user has no way to recover the content. If content was instead stored on a server, as proposed in the concept, a user could log in on any device and have instant access. There is also no dedicated exercise functionality in the prototype. Exercises are presently distributed on paper though, so it is possible to simply present these as ordinary documents inside the app.

6 Levels of commitment

While the app concept itself is designed to envision a great deal of things that could be done to enhance training at Ericsson through the use of tablets we recognize that there might be constraints that limit how much can realistically be implemented. Aside from aspects of cost

and implementation time, there might be other factors that limit what is possible. Therefore, we have chosen to offer these four separate recommendations based on the level of commitment to the overall idea. They are arranged in numerical order from low to high commitment, and for each level more benefits to learning and user experience are available at the possible expense of higher risk and greater resource cost. After each level's definition we also state requirements for that level. *Note that a higher level requires everything from all lower levels in addition to what is stated for that particular level.* Table 1 shows a comparison of the four levels of commitment for easy reference.

6.1 Level 0: Minimal commitment

The minimal commitment level simply makes tablets available for all learners and instructors during ILT courses at Mölndal. It is up to the instructor how to use the tablet during the course, for instance finding useful apps, since OnCourse is not available. In this approach, we acknowledge that we do not fully know how tablets are best utilized in Ericsson's classroom setting but expect the users to find good uses when given the option.

Requirements: Class sets of tablets will need to be purchased. Each instructor will then need to book a set in some booking system, make sure that they are charged before the first course day and prepare each tablet to the extent she deems fit for that particular course.

6.2 Level 1: Minor commitment

At this level, OnCourse is regarded as a supplement to the traditional ILT teaching given. The tablets are used by learners to view course materials and to answer evaluations. Each learner can choose between a binder or a tablet, but when the course is finished only the binder can be taken home. Therefore an option to print a binder with the learner's own notes is required. The instructor uses either the app on a tablet or a special program on her PC to show slides so that learners' apps can follow along and get any content she creates. On completion of the course each participant fills in the evaluation form on the tablet. Learners cannot use their own tablets; they must borrow one from Ericsson.

Requirements: For each concurrent course a full class set of tablets is needed. As a rough estimate, if four courses are held at the same time this means at least 60 tablets. Maintenance will be required either as preparation work from the instructor or from a dedicated employee. Maintenance includes app installations, fixing faulty devices and making sure that loading cabinets are available on course day end. The issue of battery charging is not to be underestimated. The OnCourse app also needs to be developed according to the concept specification, though some parts such as exercises and individual account logins are not needed. Some training of instructors is needed too.

6.3 Level 2: Major commitment

On this level OnCourse is also available for download to your own device. The learner can view all course materials both before, during and after the course, but no content can be extracted outside the app. Instructors may to some extent adapt their course materials to this new platform, for instance by creating an interactive exercise.

Requirements: This level requires that a backend exists to log in to, both for user authentication and for storage of user created data. A fully functioning app as specified by the concept needs

to be implemented and maintained. Instructors and course developers also need more extensive training how to use the tablets and the app.

6.4 Level 3: Full commitment

At this level the full potential of the concept is used. The learner can extract all content from the app to a PDF, which possibly has DRM.

Requirements: The final level requires asset policies to change so that non-Ericsson devices are allowed to store PDF-files - with or without DRM.

Functionality	0	1	2	3
Tablet available during course span	✓	✓	✓	✓
Printed binder provided to participants	✓	✓*		
View course materials on tablet	✓**	✓	✓	✓
Draw, make notes and take photos stored in the app		✓	✓	✓
Follow instructor page changes		✓	✓	✓
Stream instructor drawings and notes		✓	✓	✓
Digital evaluation form		✓	✓	✓
Possibility to use the app before and after the course			✓	✓
Participants can use their own device during the course			✓	✓
Ericsson can push notifications about e.g. new courses			✓	✓
PDF export functionality available				✓
PDFs with DRM				✓•

* Since course participants cannot access their created content anywhere it will have to be printed after the course.

** The instructor may decide to prepare the tablets by putting parts of the course materials on each tablet. Then course participants will be able to view it in a suitable PDF viewer app.

- May be required depending on current policy regarding course materials.

Table 1: A comparison of the four levels of commitment and which features they enable.

7 Our Recommendation

Out of the four levels of commitment described in section 6 (levels 0-3) we recommend Ericsson to aim for level 3. Level 2 is also a reasonably good way to go, but customers will most likely dislike that they cannot view the materials on any device they have at their disposal, for example a PC. An alternative though, would be to also develop a web page where the user can log in and view the materials, but then there would be two systems to maintain.

Level 0 may very well increase the tech- and wow-factor for courses and create a modern appeal to it, but it does not enhance the learning experience at all. It will probably even lower it since a new distraction is introduced in the form of tablets that poke for attention. It also requires maintenance, so all in all this level is not worth the cost.

Level 1 does allow for improved learning, but the main issue is how to distribute user-created content to the respective participants after the course. If Ericsson chooses this level of commitment more investigation is needed in this area. The advantage is that there is no need to change any existing systems.

All levels require instructors to embrace and explore new ways of performing training, so in order to succeed training and time is needed for them too. Especially levels 2 and 3 mean an organizational change both for those who create courses and those who deliver them. This cannot be stressed too much. To really enrich the training *it is not sufficient* to develop an app and then leave it at that. Conscious structural change is also required to be able to utilize the app as intended.

7.1 Next steps

Before more resources are put into a fully functioning app we recommend Ericsson to do more testing with our prototype on live courses to get more feedback. Classes of about ten people would be perfect, but more tablets will need to be bought to do this. At least four courses should be tested with the same instructor to also get feedback from an instructor that during those four courses has become accustomed to the app. In order to really take advantage of using tablets pedagogically we also recommend some research into how the structure of courses can change when tablets are available.