Institutionen för teknik och naturvetenskap
Department of Science and Technology

Examensarbete

Digital Learning Designed for Entrepreneurial First-Time Smartphone Users

Examensarbete utfört i Medieteknik
vid Tekniska högskolan vid Linköpings universitet
av

Marcus Nygren

LiTH-ITN-EX--YY/NNNN--SE

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Linköpings universitet
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Todo list

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Design och utveckling av mobilinlärning för entreprenörskapscoacher i Uganda och Zambia
Digital Learning Designed for Entrepreneurial First-Time Smartphone Users

Författare
Author

Marcus Nygren

Sammanfattning
Abstract

If your thesis is written in English, the primary abstract would go here while the Swedish abstract would be optional.

Nyckelord
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problem, lösning

Sammanfattning

Svensk sammanfattning här.

Abstract

If your thesis is written in English, the primary abstract would go here while the Swedish abstract would be optional.

Acknowledgments

Due to a chain of lucky events, this master thesis took the approach of combining service design, thoughtful interaction design, technology, learning effectiveness research, and entrepreneurship.

For service design, I want to thank Peter Gahnström at LiU Innovation, who led me to Expedition Mondial, and I especially want to thank Susanna for being a great tutor.

Thoughtful interaction design was introduced thanks to a recommendation from Lena Tibell and Konrad Schönborn, to go to Jonas Löwgren's first test lecture about interaction design at Linköping University, which led me to looking deeper into his literature, and discovering the book Thoughtful Interaction Deisgn, which was a perfect fit into the world of interaction design for me, coming from an engineering perspective. It showed me what being a great designer really meant, and I was compelled.

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Thank you.

Linköping, Januari 2020
N N och M M

Contents

Notation

Några mängder

Notation	Betydelse
$\mathbb{N}$	Mängden av naturliga tal
$\mathbb{R}$	Mängden av reella tal
$\mathbb{C}$	Mängden av komplexa tal

Förkortningar

Förkortning	Betydelse
ARMA	Auto-regressive moving average
PID	Proportional, integral, differential (regulator)

1

Introduction

This chapter is the introduction to the master thesis report.

1.1 Purpose

In order for young ambitious entrepreneurs to build sustainable enterprises they need to have basic entrepreneurial skills. This is where a mobile learning platform comes into the picture.

1.1.1 Task

The entrepreneurship education YoungDrive is an initiative of Illiana Björling from YoungDrive, now collaboration with Plan International. Within the project A working future, they have educated, supported and inspired 12 000 Ugandan youth in the process of starting their own businesses. **?**

YoungDrive now requests two digital modules, to reach even better results and to be able to scale up the operations to more locations with confidence.

The overall aim of the master thesis is to do a Minimum Viable Product (MVP) of module 1, the Coach module.

The master thesis is about how to design an app for entrepreneurship education, including evaluating it's effectiveness towards the coaches.

The result is an app which the coaches use during and after the coach training.

1.1.2 Goal

By training coaches that can carry out the education in larger groups of entrepreneurs, the education reach many young people at the same time. The mobile learning platform will improve the effect even more.

The app has the following purposes:

- Validate the coaches' level of knowledge during their education
- Train the coaches on distance
- Certify all staff

Young Drive's experience goal for the app is "It should be easy to understand, pedagogical and enjoyable to use, and the coaches should think it is fun and meaningful to learn via the app".

1.2 Definitions

The following definitions of words will be used while reading:

Design situation

Entrepreneurship is the act of creating new businesses.

An *entrepreneur education* is when an entrepreneur goes trough training. (It can be defined according to Ruskovaara (2015) or Liñán, F. (2004) as well. The author talks about Intention-based models of entrepreneurship education. Piccolla Impresa/Small Business, 3(1), 11-35, contains a definition which may be useful as well.)

Training can be both physical and digital training, but always has the purpose to improve the skills or knowledge of the trained.

Effectiveness is about keeping the same quality with less means (economical, physical, time resources, etc).

Coaching is the activity in which a person is helped by being asked questions and support, often by a person.

Digital development

A *digital tool* is an electronic help for a person, designed to solve or assist a person in solving a task that otherwise would have been more cumbersome. A *digital education*, is an education which takes place on an electronic device, either partly or fully. An *app* or *application* is a kind of digital tool, and can often be downloaded from an app store, either on mobile or web.

Design process

Interaction design describes the creation of digital artefacts.

Learning

Formative assessment (given to you, for your own sake) instead of *summative assessment* (given to the employee, for the employee's sake). You have to secure that it's a process. You have to see that there is an effect! "Assessing for Learning" :) - much debated, has drawbacks. Feedback is one of the most effective ways for learning.

1.3 Theory

To understand how to reach the objectives of the project, this chapter presents background and relevant theories.

Part 1-2 deals with the design situation, part 3-4 gives introductions to relevant topics, and part 5 presents related work.

Part 1-2: Design situation

For design situation, the client context is described. This also includes a motivation for digital learning, and related work to the thesis.

The first section describes the opportunities for entrepreneurship in Uganda, followed by how Plan International and YoungDrive uses this to tackle child poverty by fostering and educating youth in starting their own businesses. This section concludes by how digital learning and digital tools becomes increasingly demanded, which is why this master thesis has emerged.

Part 3-4: Relevant topics

In this section, an introduction is given into entrepreneurship education, digital education, and hybrid app development.

Part 5: Related work

In this section, first examples within digital tools are named that have either considered a developing country context.

Secondly, two studies within digital learning are named, which have combined learning theory and a mobile or computer platform.

1.3.1 Social Innovation and Social Entrepreneurship in Uganda

This section will present background on working with mobile learning platforms, and understanding the society of entrepreneurs in Uganda.

Why Uganda is the world's most entrepreneurial country

Some facts about Uganda in terms of entrepreneurship are **?**:

- Uganda is the world's most entrepreneurial country. (28% av of the population are entrepreneurs)
- Uganda has the second youngest population in the world (77% of all Ugandans are below 30)
- Uganda has a very high unemployment rate (64 % of people between 18–30 are unemployed)

With a high unemployment rate and little or none social security, starting a business is for many young entrepreneurs simply a tool for survival.

But tough conditions can also lead to creativity, and there are as well many innovative entrepreneurs with great ideas and the aim to create positive social impact.

No matter the reason of starting a business, Uganda's many entrepreneurs are contributing to the national society by boosting the economy and creating new jobs.

Why mobile services is growing fast in Uganda

One of the reasons is that the country has invested heavily in communication networks, even connecting remote rural villages with fibre optic cables and thereby connecting them to a world of information.

As much as 65% of the adults in Uganda owns a cell phone, which has allowed many areas in the country to skip the landline stage of development and jump right to the digital age.

For those who hasn't electricity at home, there are plentiful of charging booths for mobiles all over the country.

Mobile services and social innovations

The wide use of mobile phones has lead the way for the development of several innovative mobile services and in many cases the mobile service are way ahead of us. In Sweden mobile banking services that allows us to transfer money through our mobile phones were made popular with Swish, introduced in 2012. In Kenya people have had similar services for the last 10 years.

1.3.2 The Client: YoungDrive

In this section, the project that the client YoungDrive is in is first described, and then how YoungDrive fit into the structure with its entrepreneurship education program. In the last part, future plans of YoungDrive and A working future is presented, giving relevancy to the field of digital education.

A working future

Plan International works towards eliminating child poverty, and their project A working future, supported by SIDA 2012-2016, tackles unemployment among youth in rural areas.

It runs for 12 000 youth in Kamuli and Tororo.

VSLA groups and CBT's

Because of high tuition fees, saving (financial literacy) and earning (practicing vocational skills) are central.

VSLA groups have existed for many years, where a group starts a village savings and loans group together. A democratic process makes the group independent of e.g. banks, which rates are in general high and which may not even borrow money, either because of long distances to the bank or of no previous financial history.

For Plan International, VSLA groups have been successful in several countries for a long time. However, while the groups were skilled with saving, they did not always spend the money in the most strategic way.

Plan's pilot with A working future, was to introduce trainings on top of the VSLA structure.

Where Community Based Trainers (CBTs) were previously only responsible for hosting the groups, not they were trained and tasked with carrying out different programs: like agriculture, financial literacy, and the most successful program to date, focusing on running own businessess, YoungDrive.

YoungDrive

YoungDrive is based on a Swedish concept, and had previously had a pilot in Botswana, when tasked with running the entrepreneurship module of A working future. The organization foster and educate young entrepreneurs in developing countries. They train the CBT's, provide training material, and support the CBT's via direction and direct support via co-project leaders and Youth Mentors (YMs).

YoungDrive moves an entrepreneur to location, becoming country manager. Then, she educates project leaders during four days, followed by educating CBT's, which then roll out the training to the youth groups during 10 sessions, 1 session per week in average. The CBT's also rolls out other trainings, often simultaneously.

Social entrepreneurship

The CBT's are often volunteers, receiving a small scholarship from Plan International. They are often business owners themselves.

Thus, the CBT's can be described as social entrepreneurs. As Mitchel says about entrepreneurship **?**, motivation does not need to be wealth accumulation anymore. The activity of entrepreneurship contributes to society, in a way that is not caputed by the commercial entrepreneurship literature.

Many of the YoungDrive participants are driven by that their business can have an impact on their community, as well as take them out of unemployment or increase their current livelihood.

Future plans

For the future of YoungDrive, they want to make the CBT's even better, and collect and take us of data (monitoring and evaluation). Another motivation is scaling and monetization, as Plan International wants to increase the project to more countries, with an increased digital focus, and YoungDrive wants to be independent of project funding (i.e. a social enterprise). This was a great time to introduce digital enablers, where there previously had been no technology-focus, especially towards CBT's and YM's.

1.3.3 Entrepreneurship education

According to Dickson **?**, there are few empirical studies available on entrepreneurship education.

Ruskovaara & Pihkala **?** concludes, that the teacher seems to be the main factor for entrepreneurship education, and that research agrees with them.

There seems to be no indication of difference between men and women, nor previous professional teaching experience.

Entrepreneurial activity seems to lead to better entrepreneurship education.

Recommendations for enhancing entrepreneurship education practices are mainly two things.

First, the playful side of teaching and learning is mentioned **?**.

Secondly, they encourage teacher training that develops the competences as a mentor, enabler or coach.

1.3.4 Digital Education

In recent time, e-learning has had a tremendous impact both outside and inside the classroom. With a growing teacher interest, research so far shows that digital education is hard, risky and possibly rewarding. Thus, digital education shows both great potential and great considerations.

Brining research into reality

Gates **?** has done a comprehensive study, which motivates why a digital tool or game is a good thing by showing a .33 standard deviations in intrapersonal learning outcomes, relative to non-game instructional conditions. They also conclude, that design rather than medium alone predicts learning outcomes.

Much of the research to date on digital games has focused on proof-of-concept studies and media comparisons. The study's comparison, is to focus on how theoretically-driven decisions influence learning outcomes: for the broad diversity of learners, within and beyond the classroom.

Caring for the context

Luckin **?** emphasises the need to care for the context. Stickdorn **?** exemplifies how the design process should be altered when the context is social innovation.

Service design in a social innovation context is called "social design", and is a new field. **?**. No longer is service design solely focused on creating and promoting consumer goods, but to offer services to society. The design process should be designed to tackle a social issue, or with the intent to improve human lives. The focus is on delivering positive impact.

E-assessment

There are numerous examples of developments in e-assessment using mobile environments, as well as immersive environments and social and collaborative environments.

Interest in formative e-assessment is increasing. A large amount of development has taken place on diagnostic testing environments, that allow teachers and learners to assess present performance against prior performance. **?**

Luckin says that further consideration should be given to how technology can be used to enable the assessment of knowledge and skills not usually distinguished within current curricula. **?** One such example would be entrepreneurship.

1.3.5 Hybrid App Development

The history of app and web development is rich and increasingly intertwined. First, websites were developed for desktop only, and when smartphones became popular, they were made responsive.

With today's possibilities of native mobile development or developing a native app using web technologies, there are numerous viable alternatives available if an app should work on several devices, depending on budget and preferences.

One of the main argument for developing an app in web technologies, is that the whole application, including the server, can be written in one programming language, JavaScript (full-stack).

Tools such as Apache Cordova can compile JavaScript applications into native apps. Thus, they can appear on Apple iOS and Android Play Store, as well as on the web, or installable offline on a smartphone from the computer.

JavaScript is developing rapidly as a language, as well as its ecosystem of frameworks and tools. Frameworks has emerged and matured, like Meteor.js, which makes building full-stack applications in JavaScript reliable and fast.

Previously, web hosting has been troublesome for JavaScript server applications. Today, tools as Meteor.js and Heroku have introduced free and paid hosting for such applications, with smart bindings to code platforms such as GitHub, which makes collaboration and version handling easy.

1.3.6 Related work

Caring for the context

One great example of a mobile banking service that is a true social innovation is Ledger Link, developed by Grameen Foundation in collaboration with Barclays Bank. This mobile banking service empowers saving groups in rural areas to save money. It is developed with human centered design methods and were lucky to meet up with Juliet, Julius and Joseph, three of the persons behind it, during our visit. **?**

One great example of an education service that is true social innovation is iSchool, developed by iSchool Zambia. Their app platform is designed to fit the Zambia school curriculum to the point, accessible as a home edition, pupil edition and teacher edition.

E-assessment / M-learning

Two studies within e-assessment have been done that this master thesis is inspired by. One uses deliberate practices on a mobile learning environement **?**. The other focused on and further validated the research of various experimental studies, that multiple-choice can be a viable auto-assessment method to improving student learning, especially for m-learning **?**.

1.4 Research questions

The overall aim of the study is to create and apply a design process of an application for entrepreneurial learning, to be implemented in a developing country context.

In response, the following specific research questions were raised:

1. How is the development affected by the technical possibilities?
   - Limitation

insert limitation here

2. How is the design affected by the contextual constraints, e.g. young entrepreneurs, entrepreneurship education, and culture?
   - The app will be a compliment to the physical YoungDrive training, not a replacement. This would be interesting continued work.
3. How can quiz questions be developed to support entrepreneurship learning?
   - Solely existing YoungDrive teaching material will tested using the app, not new material, or other entrepreneurship programs.
4. How can user's feedback be used to inform modifications of the app?
   - Limitation

insert limitation here

5. How does design affect usability and learning done via the app?

    - Ideally, the master thesis would include measuring how app usage affected their youth session quality, measured by the coach, the youth, and co-project leaders.

      If this would have been the case, there could have been three different control groups: A, using the app and the YoungDrive training, B, using only the YoungDrive training, and C, using only the app.

2

Methods and Implementation

This chapter presents the methodological framework, via presenting methods to design for learning and motivation.

Then, the setting and research context is described, together with a description of the participants.

Then, application implementation is described, followed by presenting the study design and data collection.

The final topic is data analysis theory.

2.1 Methodological Framework

2.1.1 Methods to Design for Learning

The following sections, are about how to design for effective learning, by designing for the mind, cognitive psychology.

Cognitive psychology deals with how our brain works in regards to our memory.

The section presents strategies and techniques to design learning for the mind, and what needs to be considered.

Two aspects are especially relevant when it comes to education: how humans learn (the first four sections), and how humans forget (the two last sections).

In how humans learn, the purpose is to find the most powerful strategies and techniques to design effective learning (mapping educational objectives, how to build skills, pattern-matching techniques, and the power of reflection and assessing).

In how people forget, UCLA Bjork's Learning and Forgetting Lab **?** researches how people forget, and how to design so that people do not forget (retrieval practice and spaced practice).

Learning the Right Things: Mapping educational objectives with Bloom's Revised Taxonomy

What to teach should be determined by the learning objectives of the activity.

Depending on the objective, it fits differently into the Knowledge dimension and Cognitive Process dimension of Bloom's Revised Taxonomy. **?**

The taxonomy provides a framework for determining and clarifying learning objectives. See figure 2.1 from **?**. Each colored block is an example of a learning objective matching with the two dimensions. The image also explains the different concepts.

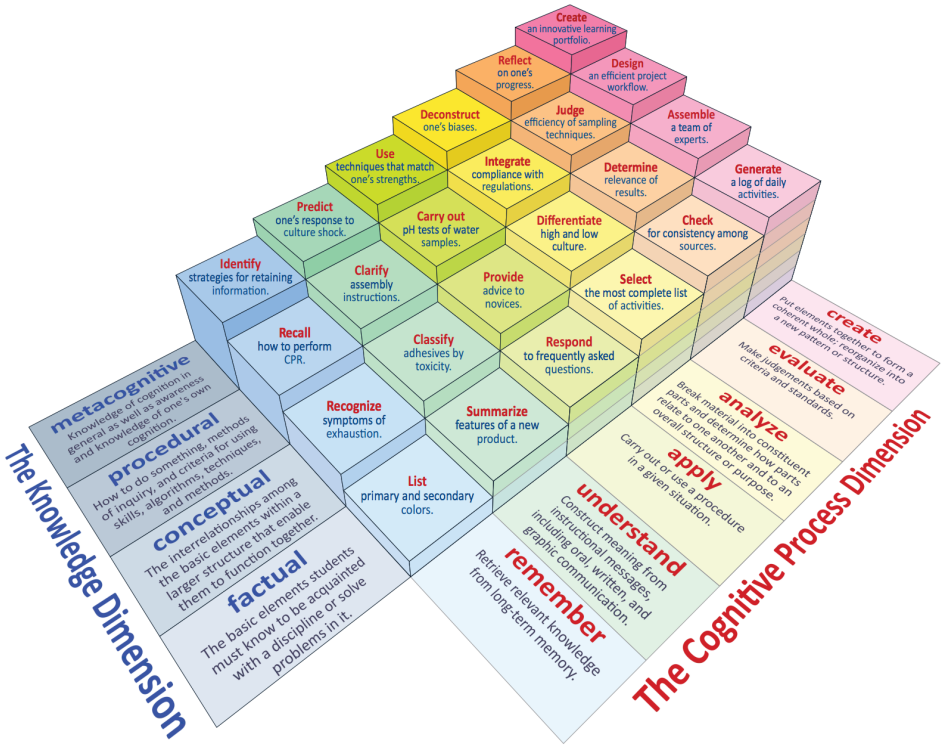

Figure 2.1: *Bloom's revised taxonomy visualised with examples of different learning objectives.*

Learning activities often involve both lower order and higher order thinking skills as well as a mix of concrete and abstract knowledge.

The taxonomy can provide usable insight into how to design, by the combination between lower or higher cognitive complexity, and concrete (factual or conceptual) or abstract knowledge (procedural or metacognitive). **?**

Building skills: by Spaced practice, Deliberate practice and Perceptual exposure

Spaced practice deals with spreading out learning, with the purpose of not forgetting. E.g. Gates **?** concludes that spaced learning versus massed learning did have a memory benefit in their study.

Designing for this, could mean making the user apparent on the person's meta-cognitive ability (personal insight into what you'll remember), and meta-memory (when you need to repeat information in order not to forget).

Moreover, dividing learning into 45-90-minute chunks, getting to 95% reliable within one to three sessions, has been proven highly effective. This is called deliberate practice. Gates **?** agrees, finding no evidence of consistent correlation between total duration and effects on learning outcomes in their study. Sierra says, if you can't get the user to 95% reliability within this time, stop trying; you need to redesign the sub-skill. **?**

Sierra presents a number of strategies, most notably research within deliberate practice **? ?**. Deliberate practice has been proven to be an effective way to build skills. It has also been tested before for mobile learning environments. **?**

Sierra **?** suggests skills to be divided into three buckets: can't do (but need to do), can do with effort, and mastered (reliable/automatic). The goal then is to move skills from can't do into mastered, in the best way possible. See figure **??** from Sierra **?**.

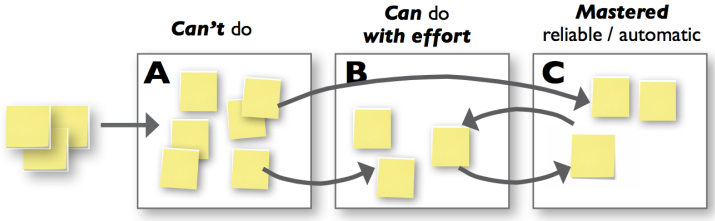

Figure 2.2: *Moving skills from A (Can't do) to B (Can do with effort) into C (Mastered) can move different ways, depending on how effective the learning is. Deliberate practices focuses on A-B-C, while perceptual expose enables A to C. Reflection allows knowledge to go backwards, to get better at the skill than previously possible.*

Desirable difficulties applies here, meaning that during deliberate practice, it may feel as if learning gets harder and harder, but in the long term the user is actually learning more. As a result, less people does true deliberate practice, but they do not get the same reward in return. This needs to be designed for, e.g. using social psychology.

A way to build skills quickly, is to utilize that the brain is brilliant at pattern-matching, by the method "perceptual exposure". **?**

Sierra shows how researchers have repeatedly, by well designed tests, been

able to quickly build expertise by trial-and-error feedback. A novice would hazard a guess and an expert would say yes or no. Eventually the novices became, like their mentors, masters of the expertise that could otherwise would have been intangible for long.

Whenever a skill relies on intuition, we could try exposing the user a well-designed trail and error test. This is done by exposing users to very high-quality samples during a very limited time. Perceptual knowledge includes teaching what we think of as expert intuition (like being a good entrepreneurship coach).

Learning from Assessment

Knowing what learners know, and don't know, is crucial to effective learning, Luckin **?** says.

Assessment can partly help to design for flow, matching challenge and ability **?**, which is effective for intrinsic motivation (see next chapter).

Moreover, it also has cognitive benefits. It can help to offer appropiate feedback, increase learners' awareness of their learning needs, and give accurate assessment and analysis, and allows learning to be tailored.

By recognizing differences of students, in their ability to understand what they know and how they can progress, it is possible to ensure that everyone achieves their full potential.

Effective assessment by a teacher or agent includes individual feedback (task-oriented and informal) and appropiate feed-forward advice.

Learning by Thinking: Reflection & Retrieval Practice

When reflecting, the student develops neccessary skills and self-awareness to refine their own learning activities. This surely applies to the teacher as well, Luckin says. **?**

Stefano **?** suggests that that reflection has been an overlooked area of research for a long time.

They found that individuals who are given time to reflect on a task, outperforms students who are given the same amount of time to practice with the same task.

His results suggests that reflection as an activity that can be more effective than additional learning.

Similar to deliberate practice, it is a desirable difficulty. Individuals in the test themselves, had a tendancy to allocate time to practice on the task rather than reflecting on it.

Bjork **?** shows that retrieval from memory is more effective than people who repeat reading the same thing to remember.

They also showed, that the more effective students, retrieves from memory.

E.g. "What was in that article?", instead of immediately reading the article, is an example of memory retrieval that is extremely effective for learning, their research shows.

One design method to encourage this, would be flip cards, where the question is on one side, the answer is on the other, versus giving the person a multiple-choice question.

2.1.2 Methods to Design for Motivation

Social psychology can guide the design, when there is a wish to make people behave differently. A big research area is motivational psychology.

With a compelling context, the users are already motivated. Their motivation, is to become better.

Sierra **?**, instead suggests the focus to be how to help users progress (see "Progress and payoffs"), and what pulls them off (see "Cognitive load theory").

Cognitive load theory

Sierra argues working on what stops people, matters more than working on what entices them. Thus, a focus needs to be identifying and removing blocks.

Sierra **?** describes how humans have scarce cognitive resources, and how to design for these.

Cognitive load theory research is divided into three areas: intrinsic CBT, extrinsic CBT, and germane CBT. Below, to design for these are described.

Intrinsic CBT, needs to be dealt with if the effort is too high. Sierra **?**describes two strategies. She first says that according to deliberate practice, if you can not get to 95% reliability within three 45-90 minute sessions, split skills that can be done with effort into sub-skills. The purpose is to reduce time spent practising being mediocre.

Extrinsic CBT, the way presented to a learner, should be handled via designing to support cognitive resources, Sierra says **?**.

Scaffolding is a technique to step by step remove the support wheels for the user, e.g. present information in different ways. Gates' **?** report shows that in their research, each category of scaffolding demonstrated significant effects on learning.

Also, reduce cognitive leaks by e.g. don't make them memorise, and make the thing you want the user to do, the most likely thing to do (affordances). Everything that takes willpower, reduces cognitive leaks.

Germane CBT, is the work put into creating a permanent store of knowledge. To support cognitive resources, escape the brain's spam filter by making the information essential. Either by designing for the compelling context, or desining for just-in-time learning versus just-in-case, Sierra says. **?**

Progress and payoffs

Sierra argues that to pull users forward, to stay motivated, progress and payoffs are essential. Both of these, are investigated in terms of motivational psychology.

The feeling of progress can be emphasised by a path with guidelines to help the user know where they are at each step, e.g. for a training. To create a path,

she encourages the designer to make a list of key skills ordered from beginner to expert. Then, these are sliced into groups of ranking or levels.

This way, it is possible to design a "belt" path for your context. The first level, should feel like a superpower for the user. The best payoff, is a intrinsically rewarding experiences, according to Sierra **?**.

For motivation, the earlier, lower levels should be achievable in far less time and effort than the later, advanced levels. One practice is to try to have each new level take roughly double the time and effort of the previous level. This highly relates to flow.

Caring for the compelling context, why the user wants to learn the skill, are helpful strategies. A sometimes critiqued way of progression is to give the user high pay-off tips, but if done in a fair way, it is a good way for both learning and motivation.

This kind of path map is suberb to simple gamification, says Sierra **?**. The statement is in-line with self-determination theory, where e.g. Pink **?** says that the surprising truth about what motivates us is that drive is fostered by autonomy, mastery and purpose. The most efficient way is therefore to design for having intrinsically rewarding experiences.

Gates **?** says that simple gamification as well as more sophisticated game mechanics can prove effective. However, they add that it should be investigated if "simple gamification" (e.g. contingent point and badges connected to learning activities) more frequently focus on lower-order learning outcomes, compared to studies with more sophisticated game mechanics.

2.1.3 Design Thinking

Interaction design talks about the creation of digital artefacts specifically. When it comes to the design process, it is influenced by related areas such as human-computer science, and more recently human-centered design.

However, various disciplines suggests different design processes. For example, agile development suggest how do develop software efficiently.

Whenever a project is multi-disciplinary, various design processes may need to be combined. Whenever this happens, *design thinking* becomes a skill essential to thoughtfully design the process.

Löwgren **?** writes about design thinking and useful techniques in general, from his interaction design perspective.

Service design thinking connects various fields of activity **?**, and it's methodology relies on being close to the users.

While interaction design talks about the creation of digital artefacts specifically, service design talks about the creation of services.

As some digital artefacts are used within a service, or can be thought of as both a product and service simultaneously, the combination of the two are very useful. Service design could help the designer be aware of how such a artefact would need to interplay with its physical environment.

Each discipline holds efficient methods and tools, that can be modified to suit the specific situation even better. From the field of graphic design, mental

models are usable. From interaction design, desirability, utility, usability and pleasurability are useful principles. While not naturally a part of service design, these have been useful in service design projects previously. **?**

In difficult situations, this places demands on the designer. This is where design thinking becomes relevant.

Here, relevant methods and tools are briefly described, and what it means to be a good designer.

A good designer

The result of a method can not be better than the people engaging in carrying out the process **?**.

With its user-centered and T-shaped focus **?**, service design can be said to equip the designer with tools both for reasoning and design ethnography.

This is neccesary, as a good designer can deal with the complexities of design: a satisfactory (and surprising) solution or design can be achieved while working in a highly restricted situation.

How to deal with relationships and roles

According to Löwgren, "real" design is about finding ways to design a project within the existing preconditions and limitations **?**.

While a researcher is interested in reality, a designer is interested in what reality could become. **?** Being thoughtful means conceptual clarity from the designer, caring for the vision, and being equipped with appropriate tools of reasoning.

There are three roles as interaction designer in particular can take: the computer expert, the socio-technical expert, and the political agent. The trend is increasingly towards socio-technical experts **?**, the middle ground.

This seems to be a perfect fit with service design, where interaction design is both technical skills and design, and service design can be both design and ethnography. Even more importantly, service design suggests making the whole process co-creative, involving all stakeholders. **?**

Thinking of a product as a service

Service design thinking is described as a process of designing, rather than to its outcome.

A service's intent is to meet customer needs. If it does, it will be used frequently, and recommended. **?**

As this is often not the case, service design can be applicable to fields including social design, product design, graphic design and interaction design.

The result can be a product service hybrid. When designed and considered well, service design shapes the value proposition and desirability of the product for the better.

Starting the project

Löwgren writes about the beginning of a project: This is where the designer gets involved in design work, establishes a preliminary understanding of the situation, navigates through available information, and initiates all neccessary relationships with clients, users, decision makers, and so forth. Based on all this, she creates a design proposal. **?**.

2.1.4 Service Design Methodology

Below, brief descriptions of the five principles of service design is described, together with how the work is divided into iterations, and examples of tools that can be applied.

Principles

Stickdorn **?** describes five principles that constitute service design thinking, and how to follow these.

The book describes how to follow these principles, by making the process user-centered (e.g. via design ethnography), co-creative (involve all stakeholders) and holistic (keep the big picture). Sequencing (visualize the service, and make iterations) evidencing (make the service tangible) are the two last important principles.

Sequencing

Sequencing the process means splitting the design process into iterations, which consists of a number of steps, which are repeated for each iteration. This is common also in the agile methodology SCRUM, which is often applied in software development.

While service design literature and practice refer to various frameworks, regardless of number of steps, every service design project includes: exploration, creation, reflection and implementation **?**.

Nissar **?** suggests a model where one iteration consists of insights, ideation, trigger material, and interactions. See figure 2.3.

1. Interactions, where you are listening, the *Explorative phase*.

2. Insights, which is where you use the Interactions in order to try to understand, the *Understanding phase*.

3. Ideation, where you find possible ideas and when creation of new version of the app is done, the *Design phase*.

4. Trigger material, where material is developed to test the outcome of our evaluation in the next round, the *Trigger development*.

Figure 2.3: *In Nissar's model, a iteration consists of Interactions, Insights, Ideation and Trigger material.*

The iterations should come closer and closer to a desired outcome. It is not always obvious what this outcome is. For each iteration, the process takes the project closer, from Why? to What? to How?, often with overlaps **?**. See figure 2.4.

Service design tools

There are a number of popular service design tools that follows the five principles, e.g. how to make it user-centered.

Explorative tools are e.g. Shadowing, Customer Journey Map, Contextual Interviews, The 5 Why's (same as "Why-why-why" within interaction design **?**), Cultural Probes, Mobile Ethnography and Personas.

Tools to create and reflect can be done via a certain work methodology, e.g. agile development, and structuring and inspiring brainstorms, e.g. via "What if...?" and Co-Creation, inviting stakeholders in the creation process.

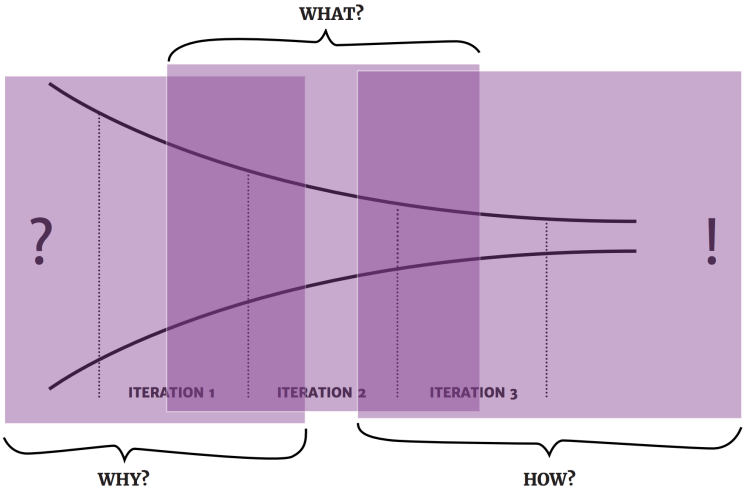

Figure 2.4: *The iteration process consists of a number of iterations with different focus, starting with broad strokes, and narrowing down into a concrete product. Between iterations, the overlap between "Why?" and "How?", "How?" and "What?", signals that there is a learning process which means conclusions may need to be quickly questioned as new insights emerge. This is especially important in projects where you work with an unfamiliar target group and there are several uncertainties and constraints.*

2.1.5 Digital Service Design

As there was a unfamiliar target group - mostly young Ugandians with little or no experience of smartphones - service design thinking would benefit true understanding of cultural context and in-depth empathy for the end users.

Tools and methodology in service design were chosen with the help of Expedition Mondial in Stockholm, who provided education and coaching.

At the same time, the end result would be a digital artefact, which is not common in service design. While the app could be though of as a service, the tools and methodology would need to take this in mind. More suitable approaches would be Agile methodology and Interaction design. These areas, were familiar to me as a computer expert.

This led to the joined development of a Digital Service Design method, created by me and Expedition Mondial. The method combines the benefits of Service Design, Agile Methodologies (namely SCRUM) and Interaction Design. Its purpose was to contribute a holistic approach to the design solution for the specific target group. **?**

A "Service Sprint"

In Digital Service Design, an iteration is called a "service sprint". Similar to service design, it includes four steps: insights, ideation, trigger material and interactions. It has added methodologies from both agile development and interaction design, making the process more suitable. For example, interactions can include mini-service sprints.

Insights: Analysis, Retrospective & Stakeholder feedback

Insights consists of analysis (service design), but also a retrospective (SCRUM) and stakeholder meeting (service design).

In the analysis, the app is evaluated (in terms of interaction design - pleasurability, usability, utility and desirability), and quantative data is processed (often by clustering data points) and compared with qualitative data (quiz results and questionnaires). This produces an analysis overview of the result.

In the retrospective, the design process is evaluated ("start doing, stop doing, continue doing"), and changes to the design process are suggested for the following iteration.

Both the result analysis and the design process analysis is then presented during two stakeholder meetings (service design), structured as "sprint demo's" (SCRUM), with the purpose of getting feedback.

The first "Expert meeting" informs the next iteration's design process (with Expedition Mondial), while the second "Partner meeting" informs the next iteration's delivery (with Linköping University and YougnDrive).

From the insights, a product backlog (SCRUM) is filled with needs and ideas informed by 1) user needs and 2) stakeholder needs.

Ideation: planning interactions and delivery

Ideation consists of a sprint planning (SCRUM). There is one technical planning part, where this sprint's most important user needs from the product backlog are reformulated into stories. There is one test planning part, where interactions are determined and booked.

Technical planning:

Ideas are formulated which would satisfy the user needs. This is often a iterative process, which happens in dialogue with chosen experts and entrepreneurs in technology, design and education.

To plan implementation of the ideas, every technical task are laid out, measured in time and prioritized. The least prioritized tasks can thus be cut or moved to the next iteration, in case it is necessary.

Interactions planning:

If the technical planning has been realistic, it is time to determine what this iteration's interactions should look like. How will this be tested?

The interactions activities are chosen (what, how, when), so that these are communicated to Plan International, who schedules the days I will visit, and solves the needs to the best of their ability.

Trigger material

Trigger material is about preparing the interactions (field visits, interviews, app tests, workshops) and creating the lo-fi (pen and paper) and hi-fi prototype (developed app) to be tested with the users.

To track the progress and plan effectively, each day starts by a daily standup, where today's targets are set, ending by reflecting if the targets were met. If they were not, either the design process needs to change, or something needs to be cut short.

Interactions: with "Service Mini-Sprints"

Interactions always consists of a sprint demo with the users with the lo-fi or hi-fi prototype. During the development process, these are formative tests, while for final app evaluation, this is a summative test.

Group tests are facilitated as workshops. Often, a scenario is presented, devices are given, results are submitted, followed by an open discussion.

Field tests are facilitated as naturally as possible (using the before, during, after technique). I observe how the coach does the job today, tests and observes if the app fits into the process, followed by an interview.

These tests always informs what steps to be taken next, both in terms of app development and interactions. Instead of waiting for the next iteration to do these changes, I do what I call a "Service Mini-Sprint".

Service Mini-Sprints

The insights gathered during the day allows for last-minute adjustments of coming pre-planned workshops (co-define, co-create or co-refine) or field visits (change of interview questions), that can sometimes happen the same day.

To take advantage of the precious time with the coaches, at the end of the day, app improvements are made and tomorrow's design process revisited.

This means, that already the next day, an improved version of the app can be tested. If I was not satisfied with a workshop format, it has been modified.

These mini-sprints allows for very fast iterations, which can sometimes accelerate the outcome of the visit.

2.1.6 Methods for Data Analysis

Visualizing Data

Here, each step of the visualization pipeline is presented, allowing analysis of data.

The Visualization Pipeline describes the process of generating an image from the data: **?**

1. Data acquisition (→ data are given)
2. Data enhancement (→ data are processed)

3. Visualization mapping (→ data are mapped to for example a geometry)
4. Rendering (→ images generated)

Data acquisition presents how data was acquired.
Data enhancement explains how the data was processed.
Visualization mapping is the process of mapping data to e.g. a geometry.
Finally, rendering allows images to be generated, presented in 2D.

Calculating Correlation

Calculate means, follow formula. Cumbersome to do with all of the axises against all the agises.

This can be done in Google Sheets as well as the R programming language. Psuedo-code in R would be:

```
x1 = c(1,2,3,1,5,6)
x2 = c(2,3,4,NA,6,7)
cor(x = x1, y = x2)
cor.test(x1,x2)
```

Visualizing Correlation

In Google Sheets, color scale can be used to give different column values different colors.

It is still hard to compare all of the axises towards all the axises, and it is not a scientific approach.

Include figure

In R programming language there are more powerful tools for visualizing correlation, e.g. using a "Correlation Heatmap".

Psuedo-code in R would be:

```
random_matrix <- matrix(rnorm(100), nrow = 10, ncol = 10)
random_matrix[1,1] <- NA
colnames(random_matrix) <- paste("V",1:10)
cor_mat <- cor(random_matrix)
heatmap(cor_mat, keep.dendro = FALSE)
```

The result would be:

Include figure

Calculating Logistic Regression

A limitation with correlation is that only two dimensions can be compared with each other.

With multiple-variable data, Logistic Regression is helpful if our response variable can be a logistical dimension (e.g. women or male, used manual or not),

while linear regression needs to be used if it is a linear or nominal scale (e.g. age and city respectively).

In either case, the first step is to determine a response variable: the variable I want to compare against, e.g. is there a difference between men and women? In my case, it needs to be a quantative measure of: "Have you learned anything?".

If I add more variable, e.g. also adding if a manual was used, this is called my "control". It is possible to add as many controls as possible.

If linear regression, then I need to determine a quantative measure of ("How much have you learned?").

In Google Sheets, this is not effective to do. R, however, is a very suitable tool.

First, the data is loaded, e.g. as a CSV file. Then, we tell R which the N/A values are, e.g. "N/A" or "Vet ej". We use this to filter the data.

Then, each column we want to use is converted into a factor.

When factors, a model can be created, e.g. using the General Linear Model. A different family can be selected, e.g. binomial.

Then it is possible for R to show this data, showing the coefficient, the Pr value, and others. See code below.

```
mydata <- read.csv("Development/R/quizResults.csv", na.strings = c("N/

mydata$y = ifelse(test = is.na(mydata$Quiz.9..y.n.1st),  yes = 0, no =

mydata$y <- as.factor(mydata$y)
mydata$Help <- as.factor(mydata$Help)
mydata$Sex <- as.factor(mydata$Sex)

mymodel <- glm(formula = y ~ Pre.test.score + Sex, data = mydata, fami

summary(mymodel)

plot()
```

For analysis, looking at the summary, coefficient (e.g. -1.0704) shows either a negative or positive correlation (in this case -7%) for what I compare with as a response variable.

To be significantly significant, a common measure is that the Pr value ("the p-value") needs to be higher than 0.05. If the p-value is higher than 0.05, meaning it is significant with a 95% probability.

2.2 Setting and research context

In setting, the people that are involved with the project is presented. In research context, the physical environment is described.

2.2.1 Setting

There are two groups, with me included in both of them, which gather at the end of each sprint for a check-up meeting.

The Expert group consisted of Expedition Mondial and LiU Innovation. Expedition Mondial could help with the design process, and LiU Innovation could offer input on social innovation. The meetings mostly lasted for one hour.

The Partner group consisted Iliana Björling from YoungDrive, and Lena Tibell and Konrad Schönborn from Linköping University. In Partner meetings, The Insighs from each iteration was presented and discussed. Then possible decisions were laid out, followed by discussing the alternatives.

Outside of these groups, these people can also give advice in certain situations. For specific areas, there are also some experts which have been beneficial during the proects. Below, the whole team is explained:

Supervisors

The supervisors are from YoungDrive and Linköping University.

The YoungDrive team consists of Iliana Björling, founder of YoungDrive, and Josefina Lönn, country manager in Zambia. They are both helpful in giving knowledge on the entreprenership education program, and giving support.

The Linköping University team consits of Lena Tibell, Professor, and Konrad Schönborn, Doctor, within the Department of Visual Learning and Communication.

Stakeholders

The stakeholders are YoungDrive, Plan International and Linköping University.

YoungDrive is the client of the work, and their needs should be satisfied. This person is mainly represented by Iliana Björling, who is part of the YoungDrive Strategic Management Team.

Using service design, the project leaders in Uganda and Zambia, are also considered stakeholders: Josefina Lönn in Zambia, and Patrick John Obbo and Christine Achom in Uganda.

Finally, the most important stakeholder of all according to service design, is the actual users: the coaches. They should be the main consideration of the work.

Plan International is the organization allowing for all the interactions with the end users in Uganda. A similar organization is operational in Zambia. They are the ones that are providing facilities, organizes transport, etcetera. They in turn, have the organization Community Vision, which organizes the coaches. If Plan International or Community Vision does not approve of my work, then the interactions with the coaches will not be possible.

Linköping University is a stakeholder, as the supervisor (Lena Tibell) and examinator (Camilla Forsell) determine if the work is a valid master thesis or not. Also, LiU Innovation is interested in supporting continued work with the project, and their representative Peter Gahnström gives advice on social innovation and how this project can continue in the future during expert meetings.

The designer and developer

I take on several roles in my project: most notably that of a designer, developer, but also product owner. It is me that needs to balance all different opinions and requirements, caring for the vision, like mentioned in the chapter "A good designer" . My motivation is three-fold: learn as much as possible, create a successful project, and finish the master thesis.

Add reference

Experts

Since the development country context is new to me, there are also experts involved in the project.

For design process, Susanna Nissar and Erik Widmark from Expedition Mondial has supported with all of their knowledge within service design.

For technical development for rural areas, Julien Tantege, Research Specialist at Grameen Foundation, has offered support before and during the work, sharing their insights from related work, and giving feedback during ideation.

For pedagogical development, Henrik Lundmark from edtech startup Knownly in Sweden has given support with regards to building skills within digital learning.

2.2.2 Research context

The biggest challenge with regards to time constraints and cultural differences is that it is difficult to understand the audience.

It led to me choosing to spend 3 months in Uganda, because the client and academy is there, and start the design process when I'm there. It also led me to wanting to apply service design.

By being in Uganda and applying service design, I will come closer to the client and coaches.

The internet is worse, especially outside Kampala (I will not be able to access 4G, and prices are high).

Working mainly from Kampala, because that is where YoungDrive is situated, means that there is still a long distance to the coaches in Tororo, which is located near the Kenyan border.

2.3 Subjects (Participants)

Participant manual and Coach guide

2.4 Study Design & Data Collection

Using novel methods like *service design* when developing the app according to research question #1 and *data-driven design* and interviews for understanding interaction according to research question #2.

I'm the computer expert kind of designer, but aspiring to be a socio-technical expert (which e.g. Expedition Modial are, as service design experts).

Expedition Mondial helped with a method for creating a MVP of the digital support for the coaches, so that the app was developed from the perspective of the end users and the education and a "learning by doing" mentality. The suggested design process was designed with them after a start-up meeting on Skype, and an Education day in Stockholm. During that day a crash course in service design was given, then creating a common plan for the future work based on my needs.

The result is that the design and development phase in Uganda is an iterative process with the human in focus. The process is built on top of service design process and methodology. There were four iterations.

Expedition Mondial gave support in each iteration, helping with the design of each iteration, and they were able to educate me during the different stages with methodologies. They also recommended service design literature.

Each Interactions phase consisted of a meeting with thought users, the entrepreneurship coaches.

Expedition Mondial's competence was valuable to me when formulating questionnaires.

How to frame the questions is an art. Therefore in preparation for meetings with the target group it was discussed exactly what was wanted to know and they helped to phrase the questions.

Finally, it was concluded if the master thesis work is going in the right direction. In most of the meeting, the next iteration was the biggest focus.

Before moving to Uganda, a time plan for the design and development phase was developed, see Appendix. . The four iterations are presented below:

Add appendix

The iterations

The time in Uganda is divided into four iterations. For each iteration, the result becomes more and more clear. In iteration 1, there was a very broad scope, without digital focus whatsoever, where iteration 2, 3 and 4 introduced a digital solution. This were the methods used in each iteration:

Iteration 1

Iteration 2

This time, the iteration has a more detailed scope, with a hypothesis on what needs the app should meet in the end, and create lo-fi and hi-fi trigger material to meet those needs.

A co-creation workshop started the interactions, followed by repeated app tests at minimum one session per day, followed by a feedback round. At the end of the week, there was a co-refinement workshop of the current hi-fi material, and also lo-fi material for the new version of the app.

The co-creation workshop was made to identify important functionality in the minds of the coaches.

After the week, there was again a summarizing meeting with experts and partners to determine the way forward. A second trigger material would be created

in iteration 3.

Iteration 3
Iteration 3 had an even more detailed scope. An app test was held, and also a co-creation workshop was held.

Before the workshop, the wished functionality and goals were well formulated. It was also discussed beforehand how to best design the workshop, together with Linköping University and Expedition Mondial.

Questionnaire 3 was created. In conjunction with the workshop the coaches tested with the app, then interviewed, divided into co-creation workshop groups, and their interactions studied.

In the end of iteration 3, an analysis was done, and a summarizing meeting with experts and partners determined the way forward.

Iteration 4
The focus of iteration 4 was a summative test.

2.4.1 Preparations in Sweden

The insights before going to Uganda were addressed in the initial work plan, see Appendix A.

Add appendix with Work plan

2.4.2 Iteration 1

The first iteration had a very broad scope. The focus was on the coaches' needs, motivations, and context. Creation of questions for questionnaire 1 was done. Interviews were done with coaches and other involved parties. Whenever coaches met in-group, open questions and dialogue was facilitated, using post-its and following up with specific questions. These sessions were all recorded.

Afterwards, a first analysis was done to summarize the coaches' needs, motivations, and expectations. Then, a summarizing meeting was held with the expert and the partner group to determine possible ways of going forward. These insights were the basis for iteration 2.

The goal of iteration 1 was to answer "From your perspective, what is it like being a coach?". A coach could have two meanings, a YoungDrive coach, or a Community Based Trainer (having responsibility for several trainings, one of them being YoungDrive).

Insights

Lowgren's though about how to start the project was used, meaning that the purpose was to get a preliminary understanding of all important aspects, and build relationships with all stakeholders.

Four interviews were held with stakeholders to answer "From your perspective, what is it like being a coach."

Two interviews were held with Plan International, to understand their needs. They recommended learning from previous work with Designers without Borders and Grameen Foundation.

Also, several interviews were done with Iliana Björling and Josefina Lönn from YoungDrive in Uganda and Zambia respectively, to learn more about the organization and its needs.

Ideation

An external workshop was visited at co-working space Outbox with Mango Tree.

Interviews were held with Designers without Borders and Grameen Foundation.

A questionnaire guide was created, with feedback from Expedition Mondial, Linköping University and YoungDrive. Expedition Mondial helped planning the interactions.

Trigger material

For the interactions, one co-creation workshop was created based on Customer Journey Map. Also, an app test was planned where the existing apps Quzical and Duolingo would be tested.

Interactions

As Plan International staff are not allowed to support visiting coaches in the field during local elections, the co-project leaders in Tororo are consulted to carry out the field trips, where it will be possible to attend youth group meetings.

Four days were spent in Tororo, with one day of travel. There were four face-to-face-interviews, one meeting with Plan, one meeting with the local partners.

Two workshops were conducted:

- Workshop #1: Customer Journey Map: A day as a coach
- Workshop #2: Quizical and Duolingo

Additionally, there were two field visits to attend youth sessions by coaches. One of the nights were spent with one of the co-project leaders, which supported understanding the target group.

Back in Kampala, an Expert meeting was held with Expedition Mondial and LiU Innovation, and the following day the Partner meeting with Linköping University and YoungDrive, which led to the ultimate conclusion of findings.

2.4.3 Iteration 2

The interactions for this iteration were planned to be in Tororo. However, during a meeting during the first week with YoungDrive project leader Josefina, I was invited to participate in the coach training in Zambia. A new work plan was created, so that I could travel to Zambia and develop the app and participate in the YoungDrive coach training together with the coaches.

Insights

There were two main insights to consider from iteration #1:

- The aim is for the coach to feel self-confidence for its youth session
- The skill to be trained is having a youth session

During the evaluation meeting with Linköping University and YoungDrive, it was the determined that Iteration #1, is answering the research question #1, #2, and #3.

The iteration had provided a good basis for answering research question #5.

It was concluded during the partner meeting, that iteration #2 should:

- Allow to test the validity of the insights from iteration #1.
- Be carried out in a way that allows comparison of usability and learning done via the app, between iteration #2 and #3.

Ideation

This was the start of the quiz app. The focus was on assessment. For example, it was decided with Iliana, that no facts would be presented before the quiz. The app would solely ask questions, not give the information beforehand. For that purpose, previous knowledge or the physical manuals could be consulted, meaning, it was not a top priority.

It was discussed, how the correct information about YoungDrive would be presented:

It was determined that questions would be created by YoungDrive, using the thesis' relevant theory and recommendations on designing for learning.

Thus, the ideation started with me creating a guide how to write questions according to Bloom's revised taxonomy, which was shared to the YoungDrive team.

The initial plan was that the team would only produce questions for two sessions, not all 10.

Iliana Björling from YoungDrive did questions initially for the two sessions, mapping each question to the Bloom taxonomy using the guide. Then, it was decided that the app would be developed and used during an actual coach training in Zambia, for each day.

Trigger material

Project leader Josefina in Zambia refined the first question sets, prepared for my visit in Zambia. Josefina created question sets with Bloom at the back of her head, also taking into account the structure and the order of the coach manuals, what it means being a coach within the topic, and lastly scenarios.

A hi-fi trigger material was done, a very basic quiz app, keeping it as simple as possible (see Application Implementation, Iteration 2). All of the devices (tablets and smartphones) that I had available were brought to Zambia.

I added the questions to the app, and installed the app to all of the devices. This process was repeated for all the days, Sunday-Friday.

Interactions

Design workshop #1

The coach training started with me having a design workshop with the coaches, not showing them the app that I had created.

Since the knowledge about smartphones and apps were low, I started by introducing these topics.

All were familiar with Facebook, so thus I showed the Facebook app. Me wanting to know what the app would look like if the coaches would have designed the app, I first needed to train them how to design an app via drawing wireframes.

Using postits, they started with during limited time drawing the start view from the Facebook app.

Then, they were asked to draw what they thought happened on the friend icon click, drawing the view on another postit.

Then, the mission of the YoungDrive app was described. They were then divided into two teams, having limited time to draw the best imaginable YoungDrive coach quiz app they could. First, they designed the app from the top of their heads. They then pitched their results to each other.

On the next iteration, they were to suggest and design improvements how the app should be designed to improve learning, not only assessment. They then again pitched their results to each other.

The result was fantastic, in the sense that it gave me an unbiased look at what the coaches expected from the app, what functionality wasn't important, and into their technical preferences.

The designs and insights gained were used throughout the week to further improve the app I had actually started creating, and gave great insights to who the coaches were and their thinking.

Assessment via quiz

At the end of each day, the app was used to test the coaches' knowledge. Each coach got either a smartphone, tablet or computer. The coach first took the quiz for the most recent session, and could then choose what to do next.

As there were no back-end developed, Josefina by hand documented the scores of each coach, writing the name of the coach, the session, number of correct answers, and what questions had been answered wrong.

Josefina then, when planning the next day, looked at the statistics, looking for trends that would inform the sessions for the following day.

She also evaluated the quality of the questions, before creating the new question sets for the next day.

Experimenting with quiz before or after the session

Since the coaches appreciated the app so much, we felt tempted to try what would happen with fun and learning if we tried using the app *before* a session instead of

only after. During the rest of the week, we continued, finally finding preferences and tendencies from the coaches, via observation, interviews, and survey.

Experimenting with design of questions

During the week, extra tests were done to test the following:

- Number of questions per quiz
- Single-answer questions or multiple-answer questions
- Framing of questions
- Challenge level of questions
- Determining what made a question hard

Interviews with Josefina

At the end of each day, an evaluation interview was held with Josefina. At the end of the week, a final interview was held.

2.4.4 Iteration 4

Efter prat med Henrik: https://memorize.com/

Growht mindset vs Performance mindset Goal-mastery-mindset vill vi få dem hamna i

Flashcards vid Improve

Self-monitoring, vad du vill åstadkomma

Questions Used to Prompt Self-Monitoring and Self-Evaluation Self-Monitoring 1. Am I concentrating on learning the training material? 2. Do I have thoughts unrelated to training that interfere with my ability to focus on training? 3. Are the study tactics I have been using effective for learning the training material? 4. Am I setting learning goals to help me perform better on the final exam? 5. Am I setting learning goals to ensure that I will be ready to take the post test? 6. Have I developed a strategy for increasing my knowledge of the training material? 7. Am I setting learning goals to ensure I have a thorough understanding of the training material? 8. Are the study strategies I'm using helping me learn the training material? 9. Am I distracted during training? 10. Am I focusing my mental effort on the training material? Self-Evaluation 1. Do I know more about the training material than when training began? 2. Would I do better on the final exam if I studied more? 3. Do I know enough about the training material to answer at least 80correct on the post test? 4. Have I forgotten some of the terms introduced in previous training material? 5. Are there areas of training I am going to have a difficult time remembering for the final exam? 6. Do I understand all of the key points of the training material? 7. Have I spent enough time reviewing to remember the information for the final exam? 8. Have I reviewed the training material as much as necessary to perform the skills on the final exam? 9.

Do I need to continue to review before taking the final exam? 10. Am I making progress towards answering at least 80post test?

FÖRSLAG ITERATION 4

Designat för learning och självreflektion, och effektivitet Problemet nu, var att de tog certifikations-läget och inte fick 100%, vilket är mödosamt och väldigt tidsslösande, då coachen igen måste gå tillbaka till Träning och nå 100

Tränings-läget behöver alltså förbättras, och vara säker på att coachen verkligen är redo för Certification.

Ett problem är att "Improve" endast upprepade frågor som varit inkorrekta, och inte upprepade gissningar som varit rätt. Det gjorde att en coach kunde få fel på Certification quiz, för att kunskapen inte var befäst. Så vill vi inte ha det. Därför föreslår jag följande förbättringar i Träningsläge:

Förbättringar Träningsläge: ta ett quiz, med "Are you sure?". Baserat på svar, låt frågor hamna i tre olika lådor: "Can't do", "Can do with effort" och "Can do effortlessly".

Låt coachen välja vilken typ av frågor de vill upprepa.

Frågor i "Can't do", är frågor som coachen ej vet svar på ännu (t.ex. om svarat fel). Frågor i "Can do with effort", har coachen ett hum om (gissat rätt, eller gått från fel till rätt). Frågor i "Can do effortlessly", har coachen rätt och den vet att den har rätt

Genom att ta en hög med frågor igen, flyttas de om till andra högar. Om du har fel på en "Can do effortlessly"-fråga, flyttas den tilllbaka till "Can't do" eller "Can do with effort". Om coachen igen har rätt på en "Can do effortlessly", blir coachen certified i just den frågan.

Frågor i "Certified", är frågor som coachen befäst genom att upprepat korrekt från "Can do effortlessly". De behöver inte upprepas. Coachen kan bli Certified i ett helt quiz, när den tar alla frågor som ligger i Certified. Då är den klar, och 100% expert i ämnet! Men coachen kan också välja att lämna quizet när som helst, och komma tillbaka i ett senare tillfälle. Detta handlar om glädjen i att lära sig, bli en bättre coach, och att visuellt se hur man blir bättre hela tiden.

Målet är alltså att i coachens egna tempo, flytta över frågor från "Can't do" till "Can do effortlessly" till "Certified". Så planerar jag bygga expertis som YoungDrive-coach.

Förbättringar Certifikationsläge: om coachen klarar det, ska coachen bli enormt glad. Guld, silver och brons-medaljer ska vara tydliga, och ljud kan förstärka storheten i att ha klarat det. Det ska synas på startskärmen, att du har fått stjärnor och blivit certifierad i ett topic.

Service design-insikter

SERVICE DESIGN Detta kapitel visar vilka insikter som har guidat mitt arbete med iteration 1, 2, 3 och 4.

ITERATION 1 & 3: What's it like being a coach? I iteration 1 fanns ingen digital ansats alls. Jag var i Tororo för att besvara "What's it like being a coach?".

Upptäckte att vad det innebär att vara en bra YoungDrive-coach, är att kunna ha bra ungdoms-sessioner. För att ha bra ungdoms-sessioner, är din självkänsla och självförtroende enormt viktigt. Och det är inte alla coacher som har detta, och därför skiljer sig kvaliteten mycket, vilket Josefina upplever som en utmaning.

Jag började leta efter hur och var en coach-app kan underlätta. En aktivitet som alla coacher har gemensamt för lärande och avgörande för coachens framgång, är (1) coach-träningen (som jag redan visste var viktig), men framför allt (2) förberedelserna av en ungdomssession. Jag övertygade Josefina att vi skulle ha ett mycket fokus på (2) än hon tänkt. Medan Josefina kan vara inblandad i (1), kan en app vara extremt viktig i (2), upptäckte jag under mina fält-besök på ungdomssessioner och intervjuer med coacher och projektledare.

I Tororo iteration 1 kunde jag observera ungdomsbesöken, i Zambia iteration 2 kunde jag observera coach-träningen, och i iteration 3 i Tororo kunde jag observera förberedande av ungdoms-sessioner.

Därför fick app-utvecklingen för dessa iterationer ha dessa fokus. I iteration 1 fanns ingen digital ansats, men apparna Quizical och Duolingo testades för att få koll på coachernas tekniska förutsättningar. Resultatet blev att min app kan placera sig någonstans emellan i svårighetsgrad.

Iteration 2 gjordes en coach assessment quiz app, och iteration 3 utvecklades den till en coach learning quiz app. Dessa insikter guidade:

Iteration 1: Självförtroende = empowerment Enligt iteration 1 kom självförtroende ifrån att under ungdomstillfället kunna ha: Correct Information, Correct Structure, Time Management, och Fun Atmosphere. Det är alltså detta appen borde testa och träna.

Lösning: en coach-träningss-app hade störst behov av att fokusera på Correct Information, i andra hand Correct Structure och Time Management. Till iteration 2 kunde Josefina assessa Correct Information (lyckat), och till iteration 3 kunde coacherna lära sig CI (lyckat, men behöver göras mer effektivt). Till iteration 3 hade hon via ett "Are you ready?"-quiz även försökt använda multiple-choice-strukturen till att även assessa och träna Correct Structure och Time Management (ej särskilt effektivt sätt, testar Factual Remember, men ej högre Bloom).

Det finns en medvetenhet kring att CS, TM och Fun Atmosphere är lämpligast att testa efter en ungdomssession, men att vissa förberedelser kan göras i appen innan en session. Dessa är därför sekundära.

Iteration 2 och 3: Självkänsla = kunskap om dig själv, meta-kognition Under Iteration 2 i Zambia, passade jag på att fråga vad som byggde självkänsla. Följande kluster fanns: "I believe in myself" (3 personer), "I believe in God" (2 personer), men också "I am well prepared" (4 personer) och "I am certified" (1 person).

Till iteration 2, hade jag fokuserat på att assessa "I am well prepared" och då stärka självförtroende, med hänsyn till Correct Information.

I iteration 3 i Tororo, hade jag fokuserat på att bli "I am well prepared", och även byggt in "I am certified.". Det visar sig att de flesta inte bryr sig om "I am certified" (vilket ju undersökningen redan visade), men de bryr sig om lärande-resultaten.

Under iteration 3, lärde jag mig att det tog för lång tid för coacher att nå 100%

säkerhet. Detta blev tydligt särskilt på den svåraste quizen om Correct Structure och Time Management, "Week 9: Are you ready?", då det tog en coach 2.5 timme att nå 100% i ett försök. I iteration 2, då "Improve" inte fanns, hade detta nog tagit ännu längre tid.

Iteration 4: Effektivitet = en förutsättning för att coacherna ska ha nytta av appen Anledningen till misslyckandet i iteration 3: dels för att CS och TM tydligen inte lämpar sig för multiple-choice (gör sådana övningar drag-and-drop-istället), men framför allt för att feedback-systemet och tränings-läget behöver vara mer medvetet i när en coach verkligen kan sitt ämne och är redo för sin ungdomssession. Du vill inte testa 100% rätt utan fel på 13 frågor, förrän du är helt säker på att en coach är färdig med sin träning. Till iteration 4, vill jag göra appen effektiv.

2.5 Application Implementation

In this section, the prerequisites for the app is described, from the perspective of the user, stakeholders, and the developer.

2.5.1 User needs

The technical constraints for the project, would need to affect the technologies used, if the project would be user-centered.

On the client side, the app would need to be mobile and web based, consider non-access to internet, and not use a lot of battery, to work for the coaches of YoungDrive.

That the app should be simple to use in this cultural setting leaded to design constraints and needs for evaluation.

2.5.2 Stakeholder needs

As the project was only three months, and the first month would be without digital development, time constraints were massive. However, to be able to answer research question #2, evaluation needed to be done via data collection.

If no evaluation, there would be no need to write code, instead working with a lo-fi prototype using pure design tools. Now, a data-driven approach was needed to measure, and therefore an app needed to be developed.

On the server side, a database and API would be needed, to pull data from the database and push data from the client. Since internet was not always available, the client must be smart in its usage of pushing and pulling data. This would need to be investigated further into the project.

2.5.3 Implementation of Learning Methods

Compelling context

My compelling context is that I want to help you become an even better coach.

The better user point of view: don't just make a better coach training app - make a better user of coach training material.

For me, this means:

"Given a teaching situation among the youth group, a great coach can teach an entrepreneurship topic more consistent with what the coach material said."

"Given a question in the app, a great coach will get the right answer more often, and increasingly leverage the correct answer to their coach situation."

Deliberate practice

Help them practice right. Goal: design practice exercises that will take a fine-grained task from unreliable to 95% reliability, within one to three 45-90-minute sessions.

Considerations for Entrepreneurship Education

The scope of the app is to examine and strengthen the entrepreneurship the student already has. One important goal is to give good feedback.

The YoungDrive's entrepreneurship education methodology goes hand in hand with the presented theory. It's mottos are: "Dream big, start small", "Learning by doing" and "We have fun!" **?**.

Both in regards to designing for the users and for the above reason, the app should be a complement to YoundDrive's existing training material and the structure of the program.

A challenging part of the work is that YoungDrive consists of both the practical skills of the entrepreneur, theoretical material of running a business, and an entrepreneurial mindset. Therefore, both how to assess knowledge, and build habits, needs to be examined.

Learning from Assessment

Lorum ipsum

2.5.4 Iteration #1

Here, the work and result from iteration #1 is presented.

App/Web Development

Early in the project, it was thought that existing tools could be used, instead of building the app from scratch. E.g. using existing tools like Knowly or Typeform[1] during the first iterations for understanding users, and during development e.g. the Typeform API (http://typeform.io/). The Typeform API allows developers to create surveys from within their own applications or systems.

[1] examples include https://showroom.typeform.com/to/ggBJPd and https://showroom.typeform.com/report/njdbt5/dIzi

Choosing cross-platform framework

After choosing Meteor.js

2.5.5 Iteration #2

Here, the work and result from iteration #2 is presented.

Staging environment using Heroku

Needed when the Meteor free tier was removed. Connected to deploy from GitHub branches automatically. Could have benefitted from CI, passing tests before ready for production. Solved this by having a stage environment (since April 19th) where stage is YoungDrive-beta (branch Iteration 4), and YoungDrive is master.

2.5.6 Implementation of Motivation Methods

Created a path. For me, the user's first feeling of a superpower is a hint of becoming a Certified coach.

This can be commented in the Future work

2.5.7 Iteration 3

Appens datainsamling

Denna gång behövde appen samla in data av sig själv, istället för att Josefina manuellt skrev ner resultat-tavlan efter varje quiz.

Kravet kom dels från Josefina (det kommer inte gå om det är mer än 10 coacher, vi har oftast 20-30), dels från att jag i mina interaktioner i Tororo skulle testa på 2 olika kontrollgrupper med 10 personer vardera, och jag visste baserad på Interactions 1 att jag inte skulle ha tid att både skriva ner resultat och observera hur de beter sig med appen.

Inloggning Att samla in data för användare, skulle kräva inloggning. Men det är ett användbarhets-problem för de flesta. Om de skapar en användare med lösenord, hur ska de 1) tycka det är intutivt och 2) komma ihåg sina användarnamn och lösenord till Interactions 4 om 2 veckor?

Jag pratade med flera om detta, Expedition Mondial och Grameen. Från EM lärde jag mig att de trodde min idé med en färdiggjort lista med coachernas namn (vi vet ju vilka som är i Tororo) skulle fungera, och från Grameen fick jag höra om dera erfarenhet att de validerat använda samma approach, med en PIN (längre än 4 siffror dock), men att de inte nailat konceptet ännu, och att de också itererar på sin approach för nästa uppdatering av LedgerLink.

Tyvärr har också Meteor begränsningar med deras auto-login-modul. Den tvingar både användarnamn och lösenord, och har automatiskt registrering. Går det att stänga av? Jag kan skapa användare och lösenord åt alla, och funderade på hur jag skulle generera lösenord. Ett förslag blev att bara registrera deras förnamn, och sedan skapa lösenordet baserat på T9 med de 6 första bokstäverna utan att berätta det för dem. Sedan tänkte jag på det kulturella, att det kan vara

oartigt med förnamn, och bestämde mig för efternamn istället. Hela namnet skulle bli för långt och krångligt.

Helst skulle jag behöva gå runt Meteors standard-inloggning, och istället ha en enkel login-rullista som den ovan beskrivet, istället för att använda deras standard-lösning.

Meteor Collections En annan problematik var att om data ska skickas till en server, måste det finnas en server med Collections. I version 1 av appen sparades inga resultat i huvud taget.

Jag gjorde en exempel-app med Meteor Collections under veckan, och det är ganska coolt med DDP, och appen kändes snabb oavsett ej internet-connection. Det var däremot svårt simulera samma internet-problem som ute i fält. Det är en risk jag tar, att appen kanske inte kommer skicka in rätt resultat.

Därför ville jag även ha offline-databas, och då fanns det en plugin som hette GroundDB.

Detta var tidsödande, och vi får se om det fungerar bra på måndag.

Ett annat problem är, hur ska detta visualiseras pedagogiskt för Josefina och de andra utbildarna?

Educator Dashboard

Detta hanns inte med i Iteration 3 även om det var ett mål. Istället gjordes trigger-material och workshop-upplägg till Tororo, då Expedition Mondial ifrågasatte "Visst är väl även Christine och Patrick?" målgrupp för detta? Och vad har de för utrustning? Christine har mobil, Patrick ingen. Så detta talade för att Educator Dashboard skulle behöva fungera på mobil, och inte bara dator som jag tänkt, iom att Josefina har dator.

Då bestämdes med Expedition Mondial att jag skulle ha workshop med dem på onsdag. Med samtal med Josefina, sade hon att de garanterat borde utrustas med tablets då de samlar in data digitalt, så jag kan tänka mig att de får en tablet framöver. Skönt! Detta stämmer även med vad Stefan FalkBoman hade tänkt sig, och de iPads han köpt in till mig. Så då kunde jag ha dessa som tanke att utforma educator-app-dashboarden ifrån.

Tekniskt

HighCharts var påtänkt som verktyg för att visualisera datan. Tanken var att den vanliga appen skulle kunna ha super-användare som är admins, och kommer till ett särskilt gränssnitt där de ser data om användarna. Detta kunde göras direkt i Meteor.

Stefan frågade vad jag tänkt om detta, och frågade om jag funderat över integration med deras verktyg Podio, och om det var möjligt. Det sade jag att det var framöver. Podio har ett API som bl.a. stödjer JSON, vilket jag använder. Då frågade jag om Podio har bra visual dash-board -verktyg, vilket han skulle kolla upp. Inom exjobbet behöver jag än så länge inte bry mig om detta. Problemet är att Stefan ser ett värde i att lagra datan i Podio, men de har inte i sig själv bra visualiseringsverktyg.

9 april hade jag då ett möte med SolarSisters COO Dave, som är en social enterprise med 1 huvudansvarig (Dave), 70 field staff och 2000 entreprenörer, så

ganska likt YoungDrive i Uganda när Josefina var där.

Dave byggde 2013 upp deras backend i SalesForce för databas, och sedan TaroWorks för datainsamling. TaroWorks är en plugin till SalesForce, med offline-app anpassad för fält. De har sedan utrustat alla field staff med tablets, då det var för dyrt att ge till alla 2 000 entreprenörer. Field staff träffar entreprenörer varje dag, och hjälper entreprenörerna att knappa in t.ex. kvitton, utvärderingar och undersökningar (t.ex. från finansiärer) via appen.

Det tog 3 veckor att bara sätta upp systemet, och det var snabbt. För Dave har det varit en 100%-tjänst i början, och fortfarande 20%. Men fördelarna är att de nu är 100% datadrivna, och de kan följa exakt hur det går för field staff och entreprenörerna - detta guidar även vilka som får promotions och vilka som blir avskedade.

Det mest intressanta är kanske att SolarSister inte bara avnänder datan för internt bruk, utan även för dess partners. De gör undersökningar via TaroWorks som inte är direkt kopplade till SolarSister, för att få in pengar. Men framför allt, sticker de ut gentemot andra social enterprises, då de enkelt kan ge partners all data de önskar, och det gör dem väldigt framgångsrika med grants. De är sannerligen en datadriven organisation. Datan, ger SolarSisters story ett trovärdigt narrativ, vilket Dave beskriver som en extrem framgångsfaktor.

Idag står 2/3 av finaniseringen från grants (fördel med socail entrepriser, du kan få pengar både från finansiärer och kunder), 1/3 från entreprenörerna. De vill bli mer self-sustainable för varje år som går, och detta är storyn som datan måste berätta - vilket är varför de t.ex. avskedar människor som inte presenterar. Datan måste stämma med storyn de vill berätta, för den storyn är vad som avgör att de får in pengar.

Detta gav mig insikter på hur mycket min datainsamling från coacherna kan spela roll för organisationen. Det var något jag inte tänkt på innan, och som jag vill vara medveten kring. För om det är något jag lärt mig denna iteration, är det hur "kunskap är makt", och hur mycket vettig kunskap jag, coacherna och Josefina och YoungDrive kan få ut av att helt enkelt lägga till frågan "Är du säker?" till varje quiz-fråga.

Teknisk utveckling: från Meteor 1.2 till 1.3

Branchade ut projektet och uppdaterade till Meteor 1.3 från 1.2, vilket gav bättre utvecklarupplevelse och många sådana fördelar (till exempel kan använda NPM), men fanns inte längre bakåtkompatibilitet till mobilerna som coacherna använder, samt att buildpack för Meteor till Heroku inte hade uppdaterats, så vid en push (även om det fungerade på localhost) så krashade hemsidan youngdrive.herokuapp.com, vilket fick feedback från handledare Lena som behövt accessa sidan.

Detta är ett bra exempel på hur tekniska begränsningar påverkar projektet. I slutändan, tog det ganska mycket tid under veckan "i onödan", och jag fick ta igen tiden genom att jobba fredag kväll och lördag inför mina interaktioner.

2.5.8 Iteration #4

2.6 Data Analysis Theory

2.6.1 General

2.6.2 Iteration #1

2.6.3 Iteration #2

2.6.4 Iteration #3

2.6.5 Iteration #4

First, a pre-test was carried out in paper, including questions about the coach and an entrepreneurship quiz, based on a well-known study **?**.

During the test, this was the first time that the app could send data to the server. Data was sent whenever a quiz was started, and whenever a quiz was finished.

After the test, every coach was divided into one or three groups, on random. In these groups, they were asked:

1. Why do you think you were correct or incorrect?
2. Do they like the app?
3. Are you stimulated by the app?
4. What did you like?
5. What did you not like?
6. When do you want to use the app?
7. When are you not able to use the app?

Then, to analyse the data, all of this was combined first into a Google Spreadsheet, then doing statistical analysis in R, followed by a parallell coordinates visualization.

Add parallell coordinates visualization example

2.6.6 Iteration 4: Implementation of Data Collection

Here, conclusions are presented.

Data Acquisition from Server

The app pushes data to server when online (it saves quiz start, and quiz finish).

The server receives JSON data, stored in a MongoDB database.

Each data point is saved in a database called Results, with the signed in user (from the Users database).

It was desired to store the data in Google Sheets, thus it was necessary to convert the JSON format into a Google Sheets-readable format, like CSV.

Multiple approaches were tried, and the Google Chrome extension called Magic Json by agaze_dev_team (last updated October 29, 2015) was the one that worked without problems. **?**.

Data Acquisition from Pre-Study

The Pre-study data was done by manually recording the paper-submitted pre-study evaluation form from the coaches, into Google Sheets.

2.6.7 Data Enhancement

Data Enhancement of Server Results

This section presents how data from the server was processed, to enable visualization mapping.

To make the data easier to work with, the columns were reordered, and made sortable and filterable.

Some columns were given conditional formatting, so it would be easier to spot irregularities.

After this, some observations could be made. For example, there was a surprisingly low number of answers where the user answered the question without confidence. Also, more users had started a quiz without finishing it than anticipated. Finally, a lot of users had done quizes that were not Topic quiz 3 and Coach quiz 9, which might indicate high interest (if they did more than 2 quizes) or confusion (if they did not do 3 or 9, but they did do other quizes) during the app evaluation. This meant that on some aspects, there were less data than anticipated, (which was troublesome, as there were already few data points), and some aspects where there was more data than anticipated (that were overlooked)

Lägg till bild "results-colored.p (finns på skrivbor- det)

Summarizing the Server Results

To be able to compare the test results with the pre-test results, it was clear that it would not be viable to test every dimension against every dimension.

Instead, since goals of the app evaluation had been predefined in the following way, the quiz results were summarized so that the following could be derived:

- % correct 1st try
- number of tries until 100%

- number of tries until 100% in 1 try

These could be calculated by having columns for:

- Quiz 3
  - Start time training
  - % correct 1st try
  - number of tries until 100% in 1 try
  - Time difference start to end time certification
- Quiz 9
  - Start time training
  - % correct 1st try
  - Time difference start to end 1st try
  - Time difference start to passed training
  - Time difference 1st try to certified

Then, to see trends, I again added color scales. With ordinal values, a sequential color scheme is used (e.g. fastest time, from green to red), and with nominal values (like if they are female or male) where there is no right value, a qualitative color scheme is used. Now, it was easier to spot outliers and trends.

Date Enhancement of Pre-study Results

To see differences in answers more clearly, the data from the pre-study was made sortable and filterable. Then, the data was resampeled for each column that hade numerable (sortable) data in text instead of numbers, so e.g. "The day before" was changed to -1 and "The same day" to 0. In a similar way, school level was divided into four different groups, from 0 to 3, where 0 meant secondary, year unknown, 1 meant lower secondary, 2 meant upper secondary, and 3 meant tertiary.

After this, each column was given conditional formats using a color scale, using Google Sheets built-in functionality. This gave a visual way to quickly get a overview of the pre-test data.

Observations from the data was that a surprising number of cells were left blank. One user had not done the pre-test, where some had left questions unanswered (most commonly "Do you own a company?" (should have used the word "business"), plus "Hours of preperation" and "Occations for a youth session" (there is a tendency this might be because they were not proud of their answers, because of correlations with low quiz results).

Missing cells was not as obvious with the app results, were users could not progress in a quiz without answering both the question and the confidence. However, none of the passed quiz 9 certification answers had been submitted. Thus, it was needed to add these from the manual recordings, which had been used as a backup in case anything like this would happen.

Comparing the pre-test and results summary sheets

I joined the summary sheet and the pre-quiz sheet, meaning I had created a multiple-variate data set (serveral dimensions that I needed to compare with several dimensions).

I met with my university supervisors, so they could further support me in how to properly analyze the data.

It was clear that analysis in Google Sheets could only go so far. It was greatly helpful to sort by multiple columns (e.g. first by Manual?, then by School level, then by Quiz 3). However, it took a long time to filter the data on multiple parameters, and the work became tedious. It was not viable to discover the data using this approach.

Meeting with the supervisors, they started by comparing the means on the pre-quiz results with the two control groups. Since they showed similar results, the two control groups were comparable.

Then, we calculated the means from the other columns based on e.g. "Manual?", gender, school category, high app quiz result, etc.

A multivariate analyzation software or a visualization was suggested to discover the data in less time.

It was hard for us to determine a suitable multivariate analysis software suitable when having so few data points. Principle Component Analysis or Cohen's kappa would not be suitable, or to do Linear correlation on all dimensions.

After discussion with other Master thesis students working with large amounts of data (one from KTS and one from MT), parallel coordinates was suggested. It would allow me to very quickly filter the data, find correlations, and distinguish outliers and common characteristics.

To learn how to analyse the data, Une-terre (2012) was consulted. He writes "||-coords are a data visualisation which allow you to "read out" the relationships and trends between your dimensions. Positive relationship (correlation), negative relationship (invert), or no relationship (random)."

Add that I also did regression test in R

2.6.8 Visualization Mapping

The goal with visualization mapping is to generate renderable data.

Thus, I added a new spreadsheet, specific for visualizing the data.

I deleted columns that would serve no visual purpose (e.g. timestamps), gave all cells data values (even N/A when undefined), deleting users that did not have data, and shortened the column names so they would fit on the screen.

The data was then exported from the Google Sheet into CSV.

2.6.9 Rendering

For rendering, the JavaScript library D3.js was chosen. It supports data-driven documents for visualizing data with HTML, SVG and CSS. It supports both JSON and CSV data.

A visual framework for multidimensional detectives for D3.js was found, called "Parcoords.js", written by Chang Kai (2012).

The example code from "Linking with a Data Table" provided the basis for the rendering. It would be a great benefit to bee able to see both a parallel coordinates visualization, and to see the same values present in the Google Sheet.

I replaced the example CSV file with the exported Google Sheets data in CSV.

Eventually, I also changed the colors, and added to the example the toolkit's functionality to drag the axes titles around to reorder the dimensions, since the goal was to quickly compare and find correlations.

Lägg till bild på parallella koordinater-visualiseringen

3

Result

In this chapter, the results are presented, so that in the next chapter, these results are analysed.

3.1 Developed Application

Here the results from the app for iteration 2, 3 and 4 are shown. Iteration 1 is missing, as the app development had not started.

3.1.1 Iteration #1

There was no developed application at this point.

3.1.2 Iteration #2

Result

Quiz-flödet 1.0: standard multiple-choice, designat för assessment, men ej för learning Besvara multiple-choice-frågor Få resultat-tavla med Question 1: 0, Question 2: 1, samt "Total score: X/X" Gå tillbaka till startskärm

3.1.3 Iteration 3

Result

Quiz-flöde 2.0: designat för learning och självreflektion, men ej för effektivitet vid varje fråga besvarar du det alternativ du tror är rätt samt "Are you sure?" Yes/No vid färdigt quiz, få en resultattavla med personliserad feedback läsa igenom dina felaktiga svar och hur säker du varit på dem observerat de korrekta svaren

klicka "Improve" för att bara få dina felaktiga svar igen upprepa tills inga felaktiga svar var kvar (det står "quiz try: 3", om det är försök 3) vid 100innan dess, uppmuntrades du läsa igenom coach/deltagar-manualen om du då fick något fel, fick du gå tillbaka till träning igen om alla rätt på, blev du Certified coach. Om du klarade det på första försöket, fick du även en guldstjärna (andra försöket = silver, tredje försöket = brons) sedan kunde du ta ett annat quiz Kommentar, fördelar med feedback-läge: Genom att på varje fråga besvara "Are you sure?": Yes/No, så stärker vi inte bara coachens meta-kognitiva förmåga, utan vi kan vi även ge personliserad feedback i resultattavlan, istället för att bara visa Question 1: 1 point. Question 2: 0 points, som i Iteration 2.

Detta gör att coachen kan reflektera över sitt lärande på t.ex. följande sätt: - få en självförtroende-boost (via feedback "You were correct, and you were sure") - gå från gissning till självsäkerhet (via feedback "You guessed, but you were correct") - ändra uppfattning snabbare (via feedback "You were incorrect, but you were sure") - uppmuntra coachen att läsa i manualen (via feedback "You were incorrect, and you were not sure")

Fördelar med tränings-läge, och certifikations-läge: Jag gillar idén att när coachen har kunnat svara rätt på alla frågor, kunna befästa kunskapen med hjälp av certifikations-läget, då coachen ska kunna få 100% rätt på 1 försök.

3.1.4 Iteration #4

Show images of final app - on mobile, tablet and desktop?

3.2 Qualitative Data

Here the results from the qualitative data for iteration 1, 2, 3 and 4 are shown.

3.2.1 Iteration #1

3.2.2 Iteration #2

According to the final interview with Josefina, she does not wish the app to replace her. She enjoys teacher, thinks she has an important role, and suggests the app to be designed to support her and the coaches, not replace her.

3.2.3 Iteration #3

Bugs Simpler design than I thought (KISS)

Using the quiz before the session increases learning, slightly decreases fun of the session, according to coaches

Fun and encouraging

Josefina feedback

Acceptance criteria

If you have a high score, you are ready. If not, you need to redo the quiz.

If you are 8/10 or lower, you are in the red zone. If lower than 10/10, they are not ready, the motivation being that what they don't know, they will teach in an improper way: affecting hundreds of youth. This is why Josefina thinks they should need all of the answers correct.

3.2.4 Iteration #4

3.3 Quantitative Data

Here the results from the quantitative data for iteration 1, 2, 3 and 4 are shown.

3.3.1 Iteration #1

3.3.2 Iteration #2

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3.3.4 Iteration #4

3.4 Insights

3.4.1 Iteration #1

3.4.2 Iteration #2

Bonus results: Testing the app outside the YoungDrive context

Back in Uganda, a test was done with refugee innovators, at the Humanitarian Innovation Jam.

Also, the app was tested on a university student from Makarere University

The test with the refugee innovatiors were surprisingly intriguing and successful.

It was found that refugee innovators says they would have a great need for such an app.

The university student from Makarere University scored 100% correct, in spite of not having any entrepreneurship training. This showed that guessing was possible, or that the quizzes were too easy.

Findings

Test with university student scored 100% correct, means that common sense can go a long way, and that the results can't be 100% trustworthy, and that multiple-choice questions has serious issues - this, we already knew during and before the coach training - but it needs to be taken care of

The app would be great and could actually work outside the physical coach training - with revision, be stand-alone, even being able to distribute online.

Now there are observable evidence for what the interactions from Iteration 1 showed:

- The purpose of the coach training should be to prepare the coach in having great youth sessions
- Therefore, this is what the quizzess should assess
- What it really means being a good YoungDrive coach, is having good youth sessions
- Josefina would have liked to be able to stop coaches from having taught, if they do not have 90-100 % correct information on the subject
- Today, Josefina can not assess this. This means that some coaches, are teaching incorrect information to hundreds of youth.
- Here, the quiz has a very good need to fill.

With all of these findings in summary, it can be concluded that an app for coach training, and an app to use before a youth session, could be the same app, since the purpose of preparing the coach to be great with its youth session is the same.

From the interviews, it was learned that while it *may* be technically possible, the teacher desires the app support her, not replace her.

3.4.3 Iteration #3

The app works for assessment!

- The app works for assessment!
- Good for learning for the coaches
- A good indicator for Josefina
- A great way to scale the YoungDrive training in the future, both for online coach-training and the physical training

3.4.4 Iteration #4

4

Discussion

4.1 Discussion of method

4.1.1 Consequences of involving end users and stakeholders throughout the whole process

Product Benefit from involving users and stakeholders

Design thinking, human-centered design and service design, has been proven to be crucial for the success of this project. Service design thinking and methods, gave a framework to have all of these perspectives in balance and consideration, always with the end user as the most important person.

Support Benefit from inolving users and stakeholders

The fact that the end users and stakeholders has been involved from the start, made them feel ownership of the product. This has many benefits, among others that they *everyone* involved is satisfied with the *final* app, since they think that their opinions and expertise has been taken into consideration and implemented. This further increases trust, and the the likelihood of them supporting future work. Even more so, the end users are more likely to use the app, as they have been co-creators of the product.

Complications

I was not a designer. I was a computer expert with social skills, now needing to design and develop an app for a cultural and socio-economic context very different from my own.

In this regard, the technical aspect was but one. I *did* need to learn how to develop hybrid apps in JavaScript that worked offline, and had an online back-end. Those was the technical demands.

But more so, I needed to quickly become a good designer. Not mainly from a perspective of graphic design or interaction design, but *how* to explore, design, and implements what the user needs from the requirements "fun, user friendly, and good for learning". The approach to learn design from these perspective was to read extensive literature, consult a diverse set of experts, and be very humble and curious in interactions with the end-users and stakeholders.

This took me a long way, to the point where research, experiments, and constant improvements could lead to increasingly well-informed decisions.

I now have new-found skills in:

- etnologicy (getting to know and learn from people in a different culture)
- human-centered design
- design thinking
- service design thinking
- interaction design
- digital learning
- data analysis

It has placed high psychological pressure and leadership demands on me as a new designer, to:

- always be in charge of balancing all the different perspectives, with the end user's best in mind
- be able to change the planned process when new learnings or opportunities emerge (leading an agile design process)
- always implement new functionality from customer needs instead of designer or engineer bias
- continually design and run workshops and tests suitable for the target groups

The reason why this has been especially hard, is that simultaneously to learning design and technological skills, I have been in a different cultural setting than the designer is used to. This has also been extremely rewarding, at the same time exhausting.

4.2 Discussion of result

In three months time, an app was developed with precision to the needs and context of the end users. The design has been heavily influenced by the end users, from day 1 of the project, in conjunction with relevant research, and in balance to stakeholder goals and considerations, and supervisor advice.

The results shows that the ideal coach, according to the quiz app, would be a woman, since she has better knowledge in spite of having less formal education. She prepares more, is more aware of her own knowledge and has a better study technique, respecting the app feedback for meta-cognition and meta-memory. This can be seen by higher quiz results, faster learning, and more honesty in "Are you sure?".

It could be that first-time smartphone users have a disadvantage with the app, since they will not learn as fast as experienced users. The interactions shows however, that at the second session, almost all of the coaches felt intermediate instead of beginners, using the smartphone and the YoungDrive app. The quiz data verifies this, with no direct correlation between technical skills and quiz results.

The final version of the app shows users can get 100% on quiz results much faster that the previous version, where the score board had been improved. Since the target group in Zambia and Uganda was different, it is hard to say if it went faster getting 100% with the possibility of repeating only the wrong questions, asking "Are you sure?", and providing individual feedback. The qualitative study does show however, that 100% thought the feedback was good for learning, and that they appreciate the app.

4.3 Future work

Lorum ipsum.

4.3.1 Iteration 3

Self-reflection after a youth session Josefina talks about a different need: doing self-reflection after a youth session. She says that this is at least as important as the coach training, especially in cases where Josefina or other project leaders don't have the resources to visit the coaches physically.

It is determined that while physical follow-up meetings are essential, the app can be used to help the coach in a smart self-assessment and self-reflection. Also, on encounters with the teacher, it can guide the coach-teacher discussion.

This does not need to be a new app. Questions can be asked in a way that they are indeed meta-cognitive, encouraging learning by reflection.

Josefina mentions that when she is there to give feedback, it is very clear to the coach that he or she lacks knowledge and has not prepared enough.

An app with self-evaluation and monitoring, would help keep the coach thoughtful and give the coach important insights. They are described to sometimes overestimate their own knowledge.

Including coach guides in the app She also points out a problem with the training: it feels like some of the coaches forgets the coach guide, even if it has been improved and better integrated with the participant manual. Some of them, don't even use the coach guide.

This speaks for that the app should include quizzes for all coach guides as well. however, the test showed that coach guide should not be designed as a quiz, but better suggested as a drag-and-drop exercise.

When asked if the coach guide quiz are more important than the topic quizzes, she answers that the correct knowledge is more important, because that is the one that needs to be explained correctly to the youth.

Therefore, it should be moved into Future work.

She also says, that while it would be great if the training did prepare the youth more actively for holding youth session, it would not be something to implement in the first day. One idea would be to start with topic quizzes during the first days, and then introducing coach guide quizzes and similar themes. She mentions the challenge with time: Friday, the last day, should be dedicated to preparing a session. But the time has never been there.

5

Conclusion

In response to the research questions questions, the master thesis has:

Contributed to the domain entrepreneurship education

Lorum ipsum

Demonstrated how certain technical constraints and design constraints can be overcome in a developing world context

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Provided methods of investigating usability and learnings with a digital training tool in the real-world training context

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Created new methods in service design, when co-designing digital artefacts in a developing country context

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Appendix

A

Appendix 1

Detta är ett appendix-kapitel. Jämför med appendixet i kapitel 3.

A.1 Original Time Plan

A.1.1 Before Uganda

Week	Focus
2	Workshop with Lena Tibell and Konrad Schönborn on Research questions & Proposal of method.
3	Start writing "Planeringsrapport". Study interaction design via guest lecture Jonas Löwgren, and reading the book "Thoughtful Interaction Design".
4	Interview with Take Aanstoot, Social entrepreneur in Kenya. Submission "Planeringsrapport". Education day in Service design in Stockholm (by Expedition Mondial). Meet Joachim Svärdh about Entrepreneurship research.
5	Approval "Planeringsrapport" with Camilla Forsell. Meeting with Lena Tibell and Konrad Schönborn (2016-02-02). Travel to Uganda.

A.1.2 In Uganda

Times specified are in local time to where I am. Uganda time (EAT - Eastern Africa Time) is 2 hours forward of Swedish time (CET - Central European Time). Meetings with Swedish partners are generally done via Skype, where Uganda meetings are preferrably done in person.

Note that during all of this time, writing the master thesis will progress. After the time in Uganda, the report will be a 100% focus.

1 day per week will be spent on report writing, including Analysis work for the meetings.

Week	Focus
6	**Cultural adaption**. Land, set up wifi, set up my apartment, learn about the YoungDrive organization, meet people. Be prepared for stomach disease. Get familiar with the transportation system in Kampala. Get familiar with the city. **Iteration 1**. Prepare Iteration 1 with Iliana. Start-up meeting with partners. Start report writing: analyze, collect material, sort, structure and plan.
7	**Iteration 1**. Prepare Interactions. Analyze Start-up meeting with partners. Write on report. in order to create *Questionairee guide*. Understand technical tools, without working on an app solution - the goal is to get familiar with the tools.
8	**Iteration 1**. Travel for Interactions. Do 8 face-to-face interviews, with no digital focus, hypotethical situations. Do minimum 2 field visits to understand the coach's situation, ideally living in Kamuli or Tororo a couple of days. This is a good opportunity to learn coaches how the tables and smartphones work.
9	**Iteration 1**. Analysis & Compilation. Thursday: Expert meeting (March 3rd, 6-7 PM). Friday: Partner meeting (March 4th, 11-12 AM). **Iteration 2**. Determine Needs. Ideation. Create low-fi Trigger material (pen and paper) and determine what the hi-fi (digital app) material should be.
10	**Iteration 2**. Design and Develop the hi-fi trigger material. *Half-time check-up with examinator.*
11	**Iteration 2**. Interactions, control group #1 & #2.
12	**Iteration 2**. Interactions, control group #1 & #2.
13	**Vacation** with fiancee.
14	**Iteration 2**. *Analysis #2* (What choices needs to be made? What path should be taken? Start formulate Customer path. If needed, document how people see apps, document limitations, document experience needs, document risks.) & Compilation. Thursday: Expert meeting (April 7th, 4 PM). Friday: Partner meeting (April 8th, 11-12 AM). Continued Development Creative Brief. Determine what actions needs to be taken outside of the development of the app. Create Behovsgrupper.
15	**Iteration 3**. Develop and Modifications phase.
16	**Iteration 3**. Develop and Modifications phase. Interactions: App Tests with Interviews & Measurements (with time allocated for late arrivals and missing participants).
17	**Iteration 3**. Interactions: App Tests with Interviews & Measurements. Analysis & Compilation. Friday: Partner meeting (April 29th, 11 AM) & Expert meeting (April 29th, 4 PM).
18	**Final analysis**. Finalize the app. Travel back to Sweden.

A.1.3 After Uganda

Week	Focus
19	Write on Master thesis report. Attend Auscultations.
20	Write on Master thesis report. Attend Auscultations.
21	Write on Master thesis report. Attend Auscultations. Find opponent for Master thesis.
22	Submission of report to examinator, after approval by supervisor. Examinator decides on date and time for presentation. Send report to opponent, and get the opponent's report.

A.1.4 After Semester

Week	Focus
35	Presentation of my Master thesis, with supervisor, examinator and opponent. Hand over publication approval to the administrator.
36	Opposition of another person's Master thesis.
37	Do changes to report if requested. Upload report to X-sys for approval (within 10 days). Write Reflections document and submit on X-sys within the 10 days. Publish master thesis in X-sys.

A.2 Half-Time Evaluation Time Plan

Bibliography

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