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Tech education opportunities through Xes

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Abstract

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Technology education is the new computer literacy and a key component in the success of modern society. Despite the growing opportunities, there are significant challenges in learning. The study aims to discover the best practices for delivering tech education to non-technical students. The research is mainly conducted for the non-profit organisation Xes, founded initially as Helsinki Entrepreneurship Society in Haaga-Helia in 2018.

Qualitative methods are selected for collecting and analysing the data. The methods are case study, action research and content analysis. Also, there is a justification for the choice of methods. After reducing, classifying and displaying the information gathered from semi-structured interviews, a concept is derived for the organisation.

The concept is Xes CodeCamp based on the adopted pedagogical models from HundrED and 42 Schools. CC is a platform for peer to peer project-based learning powered by the Xes mentors. There is a recommendation to integrate the platform with the school.

Keywords

Tech Skills, Programming, Pairing, Mentorship, Project-based learning

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Thank you, mummy, papa and Silja for your love and light.

I would like to express the deepest appreciation to Haaga-Helia and Xes for giving me the opportunity to learn, experiment and graduate. I dropped out of India after the sudden demise of my father, and experiencing a lack of support, empathy in the education system. Thank you, Finland, for funding my education and opening the doors to future careers.

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In addition, love and happiness to all my well-wishers in India, Finland and Universe.

Akshay Sharma
Helsinki, August 2020

Terms and abbreviations

PBL	Project-based learning
ML	Machine Learning
DPBL	Design Project-based learning
P2PL	Peer to Peer Learning
HTML	Hypertext Markup Language
CSS	Cascading Style Sheets
COVID-19	Coronavirus Disease of 2019
MOOCs	Massive Open Online Courses
IDE	Integrated Development Environment
UX	User Experience
CC	CodeCamp
SIGs	Special Interest Groups

1 Introduction

It is widely accepted that tech education is the digital literacy of the 21st century. Furthermore, during the last decade, the rise of tech giants has substantiated this claim that the jobs of the future will be reinvented with technology. The formal education system is outdated and struggling to keep pace with rapid advancements in digitalisation and the continuous need of updating curriculum to match the employer needs. Nobody imagined COVID-19 would be the leading factor of digitalisation within organisations and sectors at scale.

The thesis aims to address the significant problems of skilling people in tech education with a non-technical background. Finland is a pioneer in adopting and inventing new ways to impart education with a proactive Government and institutions at the forefront.

1.1 Research organisation

The organisation selected for this thesis is Xes, an international entrepreneurship society based in Haaga-Helia University of Applied Sciences, which I and others founded in 2018 originally as Helsinki Entrepreneurship Society (Xes Helsinki 2018). The entrepreneurship society is supported by Startup School and funded by The City of Helsinki and Helsinki Chamber of Commerce. Xes has currently over 250 members in the organisation, mostly students from non-technical backgrounds. I currently serve as the advisor, board member on the non-profit organisation, and I recently joined hands with other mentors in the community to support the members of the organisation.

Xes is located in one of the world's hotspots for entrepreneurship. Finnish startups attract the most venture capital in Europe, and the startup scene in Helsinki is ranked as #1 in the world for local connectedness by the Global Startup Ecosystem (Business Finland 2018). Xes has organised 70 events since its inception in 2018. The nature of events is mainly workshop and challenges. Personal growth, along with diversity, inclusiveness is a key component of the core value of Xes. The organisation activities and services are based on these values.

The practical benefits of the outcomes of the thesis are in exploring the opportunities Xes can offer to its members in the form of coding bootcamps, hackathon and workshops.

1.2 Goals of the thesis

The main objective of the thesis is addressing the following question:
Why, how, and what kind of tech education can be offered through Xes?

The following three sub-objectives are set for the thesis:

1) Designing a curriculum of tech education for students with a non-technical background
2) Selecting the tools to learn
3) Evaluating the mode of delivering tech education to Xes members

1.3 Significance of the study

The thesis has a significance in creating new knowledge relating to the main objective. I aim to learn during the thesis process various methods for discovering the needs of the end-user and, develop academic writing and publishing using scientific methods. I have signed up for mentoring students in technology through the Xes network and working to improve the diversity of skills within Xes members. Also, the study opens opportunities in paid mentoring services in tech education.

1.4 Delimitation

The thesis will not cover non-technical education offerings like marketing and business. In technical education, the scope is limited to programming and development tools.

1.5 Structure of the thesis

The thesis comprises of 7 chapters, including this being the introductory chapter.

Chapter 2 of the thesis compiles the theoretical framework by highlighting the challenges in learning, presents the pedagogical practices and establish a link in various academic studies on coding as literacy.

Chapter 3 details the research method used for this thesis and the case. The chapter also justifies the choice of the selected methods while mentioning the other qualitative methods of research.

Chapter 4 presents the research and analysis of qualitative data. Various tools are used to compile the empirical part, consequently leading to the final concept.

Chapter 5 compiles the results from the empirical research and thereafter validate the goals of the thesis and answer the research problems.

Chapter 6 discusses the key findings from all the previous chapters, establishes the reliability, validity of the study and concludes the thesis. I have also listed a few ideas on future research.

Chapter 7 presents a single page summary of the thesis.

2 Theoretical framework

This chapter compiles a knowledge-based for supporting the research and analysis of the thesis. Several academic sources, along with informative articles from the net, are used to create the dialogue. Sources like HundrED and 42 are adapted to create a framework for adult education and Eurostat is used to highlight the prevalent challenges in the tech industry.

Technology is pervasive and everyday part of our life without us even knowing, yet most people are only experiencing it as end-users. It is possible to learn tech education for anyone and design the way it works. There is a need for institutes to develop the necessary infrastructure like 3D-Printers, laser cutters and promote maker culture. The best way to impart tech education to anyone is by introducing it as a multidisciplinary topic and cross-curricular among different streams. To get the best results, it is important for the curriculum to personalised, flexible while giving autonomy to teachers. The University of Helsinki offers 60 credits of study in technology education. (Uotinen 2019.)

2.1 Fundamentals of tech education

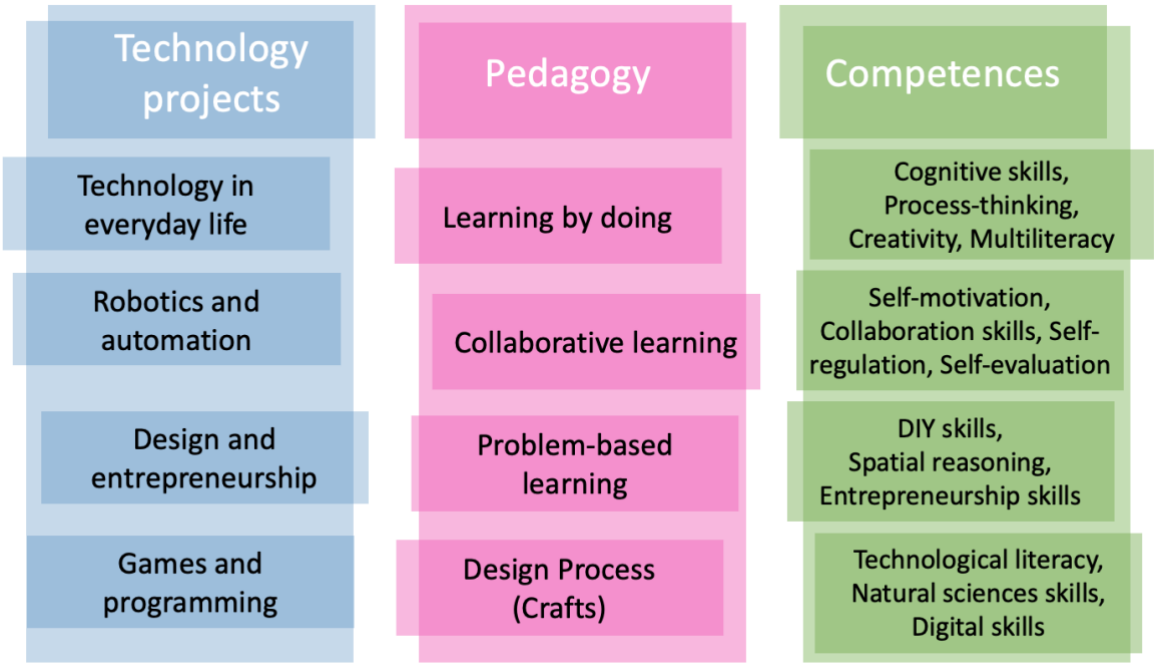

Figure 1. Technology Education Building Blocks (adapted from HundrED)

The basic building blocks of technology education is a learning unit of technology projects, pedagogy and competences. The module is comprising of three modules, with each having four blocks. The first module gives the holistic view of different kinds of technology projects in everyday life like robotics and automation, design and entrepreneurship,

games and programming. The second module emphasises on the pedagogical models of learning by doing, collaborative learning, problem-based learning and Design Process Crafts. The third module measures the competences like cognitive skills, process-thinking, creativity, self-motivation, collaboration skills, self-regulation, self-evaluation, spatial reasoning, entrepreneurship skills, technological literacy and digital skills. The adapted framework is capable of laying the foundation of a tech education not just in children but adults. (HundrED 2020; figure 1.)

Learning to code or developing the understanding of technology requires a similar mindset as learning entrepreneurship. Entrepreneurship can be learned by experimenting, problem-solving and creating new knowledge in projects. The threshold of becoming an entrepreneur or learning to code has reduced drastically since the last decade. Entrepreneurship societies play a crucial role in filling the gaps of the community-based support in institutions, and one does not have to be an entrepreneur to join the community (Bako 2020).

2.2 Challenges in learning

To educate ourselves in the fourth industrial revolution, there is a need for reforms. Massive Open Online Courses (MOOCs) made education more accessible, yet it is unable to solve the education crisis. The fault lines lie in human behaviour and lack of discipline, although MOOCs might be the solution, the key to be able to learn efficiently is being surrounded by peers or in a community. The formal education system needs to be revamped with more interaction between student and the learning facilitators. Coding bootcamps like 42 Schools, Hive Helsinki (2020) are now trying to solve the learning puzzle by introducing peer to peer based learning and interactive problem-solving. (Kalache 2018.)

On the one hand, there is a surge in the number of coding bootcamp while on the other hand women make up only a quarter of the scientists and engineers in Finland. Despite Finland revamping the educational model, the overall ranking of women in science and technology is dismissal and at the bottom in Europe. (Eurostat 2018.)

The barriers to entry in tech are low, yet the challenges remain in producing the tech architects, senior c-suite executives. The challenges can be classified under three categories formal boundaries (finance), informal boundaries (gender, stereotypes) and personal obstacles (age, temporarily lost income, lack of social support). Among all challenges, stereotypes on who is ‘real’ programmer, ‘natural’ ability to learn can greatly

disrupt an individual's personal growth, sense of belonging and confidence levels. (Thayer and Ko 2017).

2.2.1 Pedagogical approaches

Project-based learning (PBL) is an approach where students learn through apprenticeships on the job training. Tech companies actively hire people and train them in the latest frameworks and methodologies.

Design project-based learning (DPBL) is where a student learns with the customer. This method of learning also imparts complementary skills like pitching, project management which are desired by the employers. Learning multidisciplinary problem-solving skills improves employability prospects.

Peer to Peer learning (P2PL) The peer to peer-based education model fills the void of the community support and enhance constructive feedback resulting in continuous development with a low peer or examiner pressure. The regular way to impart education is delivery teaching and assessment at the end of the curriculum. The 42 Education Model solely focus on project-based peer learning where students can start and end at their own pace. It enables the students to develop creative problem-solving skills and applying their topic understanding in teams. (42 School.)

Figure 2. The 42 Education Model (42 Schools)

Figure 2 is the pedagogical approach used by 42 schools in designing the curriculum. It shows creating is the highest form of learning followed by evaluating and analysing.

Conversely, the current education model is highlighted at the bottom of the pyramid where emphasise is on applying, understanding and remembering. (42 School; figure 2.)

2.3 Coding as literacy

Skills in computational thinking are necessary for the 21st century (Microsoft 2016). A large of number intitatives have spurned over the years to include programming at the elementary level in schools. There is an increase in the penetration of the internet around the world making interconnected tools an everyday part of our lives and, making the remote work possible seamlessly. Progressive countries like Finland are introducing coding as digital literacy in schools and make it an essential component of transformed education. There is a surge in the number of jobs where coding is seen as a method of problem-solving, increasing productivity and innovating new jobs. (Tuomi, Saarikoski, Multisilta, Suominen 2016.)

Figure 3. Why we should learn coding (Microsoft 2016)

The foremost question comes to anyone willing to be a developer or trying hands-on programming is in which programming language to start first. A natural progression is starting with HTML a markup language and CSS, writing a few lines of code and testing it on an internet browser. The real challenges of learning to program begin after HTML where the student has to dive in the logical operations, and that is where basic mathematical skills and abstraction capabilities are tested.

2.3.1 Top skills to learn

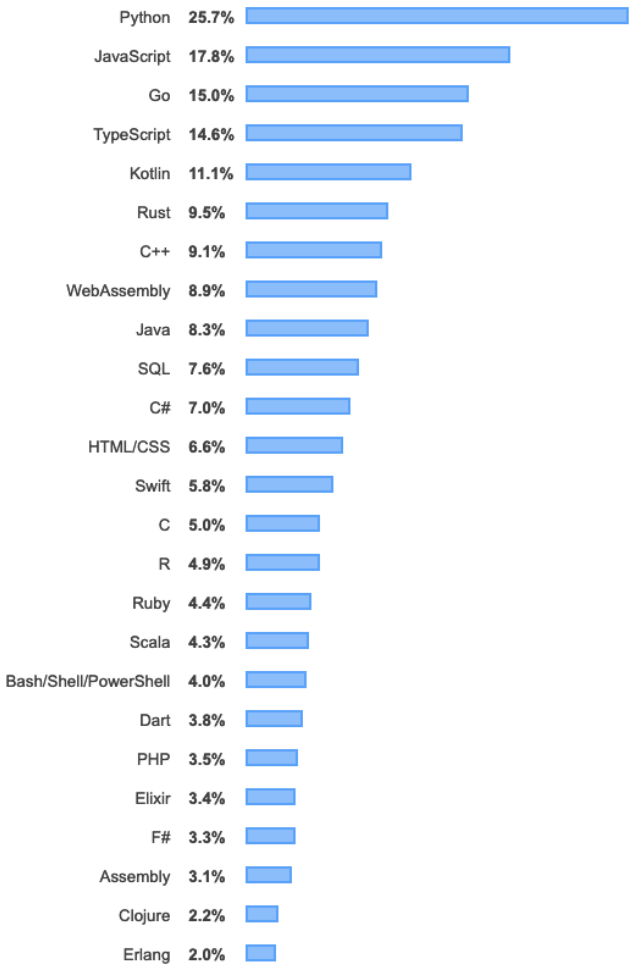

Figure 4. Most wanted languages, Developer Survey (Stack Overflow)

From the employability perspective, it is safe, to begin with, the language most in-demand; currently, it is Python followed by JavaScript. For non-technical professionals and students working in the domain of business analytics Python is the way forward since the language is mostly used in machine learning applications and data mining. JavaScript is suitable for professionals from the marketing industry having an interest in front-end development of understanding the nuances of the web applications. One significant difference is that Python is used as a backend language. In contrast, JavaScript is capable of running the complete applications, for beginners, it can work like a Swiss knife, and the common opinion is that JavaScript is eating the world. (Hacker News 2017.)

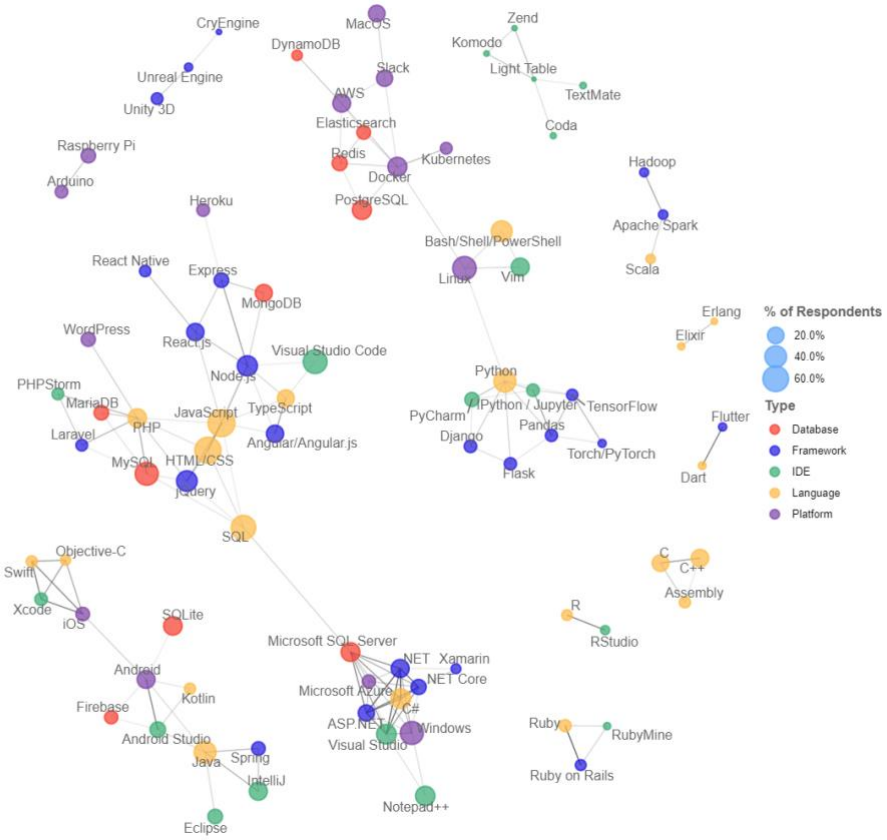

Figure 5. How languages are connected, Developer Survey (Stack Overflow)

The most widely used programming languages are connected and develop an ecosystem of tools such as IDE and frameworks. As figure 5. show JavaScript node connected with the web development technologies HTML, CSS through edges as well as its own set of full-stack frameworks Node.js, React, Angular.js. On the other hand, Python node is connected with edges to nodes of Linux, command-line interface languages and set of frameworks used in machine learning, data analysis such as Tensor Flow and Pandas. Also, web development frameworks based on model-view-controller architecture are available in Python, namely Django and Flask. For simplifying coding, it is possible to categorise the various tools and technologies into five broad categories; databases, frameworks, IDE, language and platform. (Stack Overflow 2019).

3 Qualitative research plan

The main objective of the thesis “Why, how and, what kind of tech education be offered through Xes”. The objective in itself explains the qualitative nature of the research. During the topic proposal phase ethnography, narrative analysis and observation were selected as the main methods but while composing the theoretical framework and during discussions with the thesis supervisor it was agreed that action research and case study is more suitable for this thesis. Also, due to COVID-19 pandemic data collection using observation is interrupted. Narrative analysis is dropped since the study scope was not people experiences of the past events of Xes.

The selected research methods for this thesis are case study, action research and content analysis, which are shown in figure 6. Firstly, the research organisation is selected then a topic proposal is sent for the approval, including the research problem and type of thesis and data from contemporary events is collected. Secondly, new data is collected from the user interviews and analysed as per the suitable tools; then a concept will be derived from the task analysis and requirements. The prime data collection method for research is semi-structured interviews with four users. The insights are extracted from the data using transcript coding, affinity diagrams and task analysis.

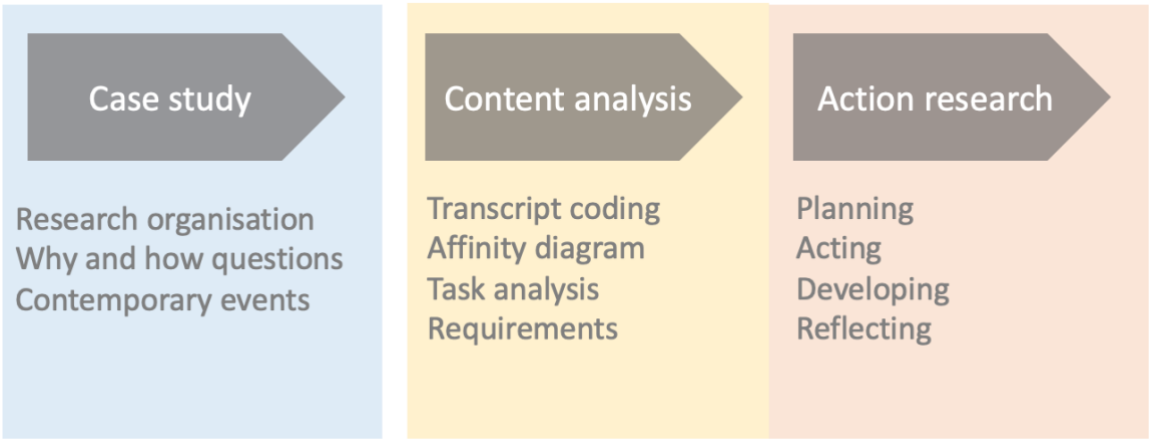

Figure 6. Qualitative methods of this research

During the whole process, action research stages will be taken into consideration. At the time of the thesis seminar questions and feedback will be taken into account on the research process, concept and results. Regular updates and advise regarding the research work will be discussed with the supervisor on Kontto and emails. Then the final compilation of the thesis work will be sent for evaluation and publishing according to the thesis guidelines of Haaga-Helia.

The thesis aims to fulfil the needs of mainly three stakeholders' of Xes, and semi-structured interviews are conducted with at least stakeholder from each segment show on next page in figure 7.

1. Students
2. Potential entrepreneurs
3. Training providers

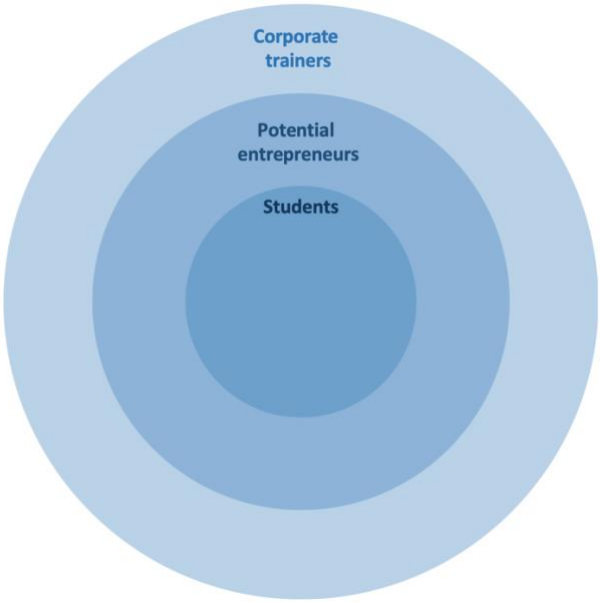

Figure 7. Stakeholder map

3.1 Case study

The case study method is used for investing Xes as a platform to provide tech education to non-technical students through its environment of community mentors, peer support and events. One of the offerings of Xes is challenges organised in collaboration with companies, for example, Hilda case competition (Xes Helsinki 2020). In the case competition, a problem statement was designed for the case company Hilda; the organising team invited the mentors. It helped the individuals present on the spot in making team formations for solving the problem. All the teams presented the solutions, and participants enjoyed from the cross-learning. It will be evaluated further on how Xes can offer a platform for technical challenges.

Figure 8. The first Xes Challenge. Hilda Case competition.

3.2 Action research

The action research is best suited for this thesis since the method extensively focusses on the workplace development with the community. Xes has over 250 members in its fold, and the community actively encourages members to suggest ideas for development. Action research is experimental learning, and a creative change and new knowledge creation are possible fulfilling the goals of the research.

Figure 9. An action research cycle (Education Research in the Canadian Context)

The action research cycle was followed during the research. During the planning stage, the users are informed a month before about the ongoing thesis work for community development. The questionnaire is designed to take inputs from the non-technical members of the community. Then as per the suitability of the interviewees, I will organise the interview remotely over the Zoom. Due to the ongoing COVID-19 pandemic, there are challenges in the observing phase in collecting the behavioural data. The reflecting stage is where the outcomes of the research will be put to use in writing the results and discussion chapter.

3.3 Content analysis

Analysis data that is in the form of words, pictures are complex. It is suggested to follow three concurrent flows of action:

1. Data reduction
2. Data display
3. Conclusion drawing/verification (Miles and Hubermann 1994.)

Transcript coding is used in data reduction using three colour codes Pink, Yellow and Green. Each of the colours represents a component of the research problem. To display data from the transcript coding affinity diagram is used in the next chapter. The conclusions are drawn using the Venn diagram in the result and discussion chapter.

4 Research and Analysis

During the process of collecting and analysing the data, various qualitative methods listed in chapter 3.3 were used to create the final concept. The empirical study of the thesis classifies the collected information using affinity diagrams and after that task analysis is drawn.

4.1 Data collection method

The case study data collection method is discussed shortly in the previous chapter. The users selected for this research are from the research organisation only.

4.1.1 User Profile Table

For data collection, four users were interviewed during the complete project management process of the thesis work. The users were carefully selected from the stakeholder mapping with three of them actively contributing to the research organisation.

Table 1. User Profile Table

No.	Interviewee	Gender	Stakeholder	Xes member	Method of interview
1	Interviewee 1	M	Entrepreneur	Yes	Audio call
2	Interviewee 2	F	Student	Yes	Video call
3	Interviewee 3	F	Student	Yes	Video call
4	Interviewee 4	M	Trainer	No	Audio call

4.1.2 Semi-structured interviews

Since the topic of the thesis is broad, interviews with the users were organised in a semi-structured manner. Some users requested for video to be turned off while freely answering the questions.

Before the interviews started, the users were asked to read and sign the consent to take part in the research. The interviewer read all the guidelines to conduct a successful interview and prepared a list of conversation starters to spark interviewees interest in the research. Post-interview, two out of four users returned the signed consent immediately.

The detailed interview questionnaire is attached in the appendix.

4.2 Data Analysis method

In this phase, the data is analysed using a number of qualitative methods firstly affinity diagram, secondly task analysis, thirdly a concept and finally creating a new persona.

4.2.1 Affinity diagram

The data gathered during the four interviews are classified into affinity diagram after the transcript coding is done using three colour codes which were pink, yellow and green, as shown in the table below.

Table 2. Affinity diagram

Why	How	What
A whole new skill set if you have interest in it, really then I think it's possible whatever you are, whoever you are.	Have someone to talk about your ideas and problems that are at the same phase as you.	Well, I would definitely say project based. For example, in school when we had like real companies and we did projects for them.
With this immediate availability of quick answers and quick fixes is that quite often people don't really learn.	Anything where I can do the steps myself and go through the process myself because I feel like I remember it better when I do it.	Teamwork. Project based collaboration. Mix of face to face and virtual. Now with Covid more and more remote work.
I would love to be a bit like more tech savvy.	To get best learning results, you have to sort of invent the thing yourself.	Make a little simple basic level project Guided by an instructor Maybe with a group, maybe or a pair.
A more attractive skill to learn in the future. It's already is.	Learning institute, IT training like Hive.	Very noncommittal. I made this thing. It's my deliverable.
Basic level courses are, aren't directly contributing to employability.	People learn when they are actually working.	Gold standard: design project-based learning.

Each lecturer is struggling to with how to communicate what skills their courses provide. And how those skills are relevant.	It doesn't make sense to sort of replicate things that the school is already doing well, but rather do something different.	Maybe a peer support or you know, like network, where I can go and learn coding with other people who are maybe on the same level as me.
To maintain my edge to maintain my situational awareness.	How to build in certain codes, what do they mean.	Creating code as soon as possible.
Lot more valuable as a potential employee or someone to hire. Full kind of package: I could also do some programming.	Constantly learning, and I don't think it ever ends or probably at some point you feel like comfortable with your knowledge.	Essentially having a project that's something you want to accomplish Challenging enough, not too difficult, not too easy.
What about software architects, CTOs, the high-level engineers?	I learn every day from the customers that practice augmenting and from the trend blog today.	Peer reviewed: others are taking, looking at your code and accepting it into projects.
Understand a little bit more about HTML that would make my life a lot easier, especially as a consultant.	Get those learners to understand it, this, there's some long-term goals that you need to work towards, that aren't sort of providing reports immediately.	Start contributing to something that they feel meaningful, you know, an open source project or something.
When we learn about tech, you're like, we don't really learn of it. We just kind of get used to it.	Fake customers in that you can have teams of students working for other teams are working for the teachers.	Wanted to learn in a reasonable amount of time.
Have a difficult time finding jobs	Internet is full of free content. Good quality	Pay for the support, services or content or opportunities.

	content, nobody really pays.	
Lot of the free coding programs are like maybe for people that aren't employed Want something more for people that are just interested, want to know better themselves and expand their knowledge.	Automatic engagement: What problems I could solve with this thing and how it makes my life easier. What I could do with the thing and it keeps bring me back to actually studying it.	Pay for added value or service. There is a service that helps you learn, be it mentoring or formal teaching. That is value for money.
Improve learning and future employability.	Provide multiple skills to learners. Multi subject and multi skill.	Website building and probably this is the front-end side of of development.
I do like a little bit of data analysis already.	Could get mentoring. You could pay for those.	A full of session of like five courses, 200 to 250 euros.
So, technology as such, doesn't do a thing. You can build amazing things with technology, but you need to understand why you build and how to build it and how it looks like.	Cross institutional collaboration, cross disciplinary collaboration organization should serve its purpose. Bringing people together and create the community around this.	At least three different languages because that sort of allows you to see beyond the limitations and the idiosyncrasies of that one language and actually actually understand how does programming work and and about the concept.
I'm really interested that in these no and low code apps that you can make.	Students able to work on the project later and develop that further.	What the current IT or tech sector is looking for in employees.

Quite hard to incorporate the time in your schedule to learn it.	Biggest challenge for me is patience.	Some sort of coding project: can be a pet pet project.

4.2.2 Task Analysis

The next step after organising the data is to create the task for non-technical students to learn tech education. The task is further broken into many parts using the task analysis method. From the affinity diagram, it was clear that project-based learning is what everyone referred to as the best mode of learning. The expert trainer interviewed explicitly mentioned the need for having pet projects, invent the things which are already done similar to proving a question in maths.

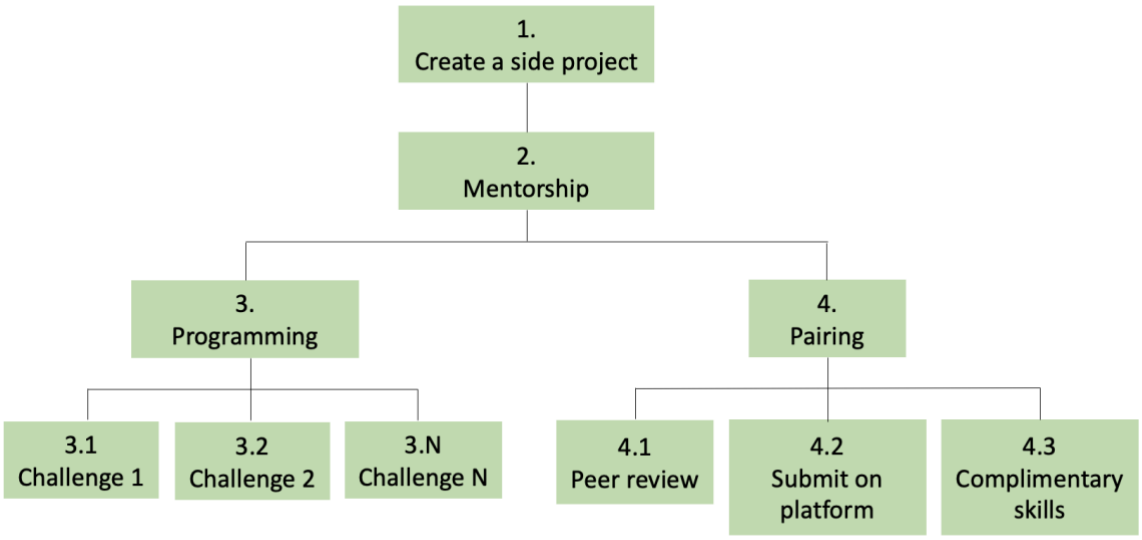

Figure 10. Task Analysis

The first step is to create a side project; then the user needs a mentor who must be from the technical background. The mentor must have at least the understanding of agile methodologies to break a side project into a series of challenges with points. The complexity of the challenges can be set to increase systematically. The novice users do not understand how to break a side project into smaller technical challenges.

The mentor also has to pair the user with another peer who is on the same level. The expert interviewed also mentions the need for peer review explicitly and adopting code into each other projects. The code can be submitted on the platforms providing hackathon

solutions for institutes. In this research, Hackerearth and HackerRank (2020) are used for setting up the environment.

4.2.3 Concept

A question was asked to each respondent “how do you staying engaged in learning for several weeks”. The response was it is hard, but one has be willing to change your opinion and learn new stuff, essentially having a meaningful project or something that you want to accomplish or is interesting. To summarise the interviews experiences in a nutshell within the community, a concept Xes CodeCamp is created. Learning to code or going to work has to be like going to camping and doing things together.

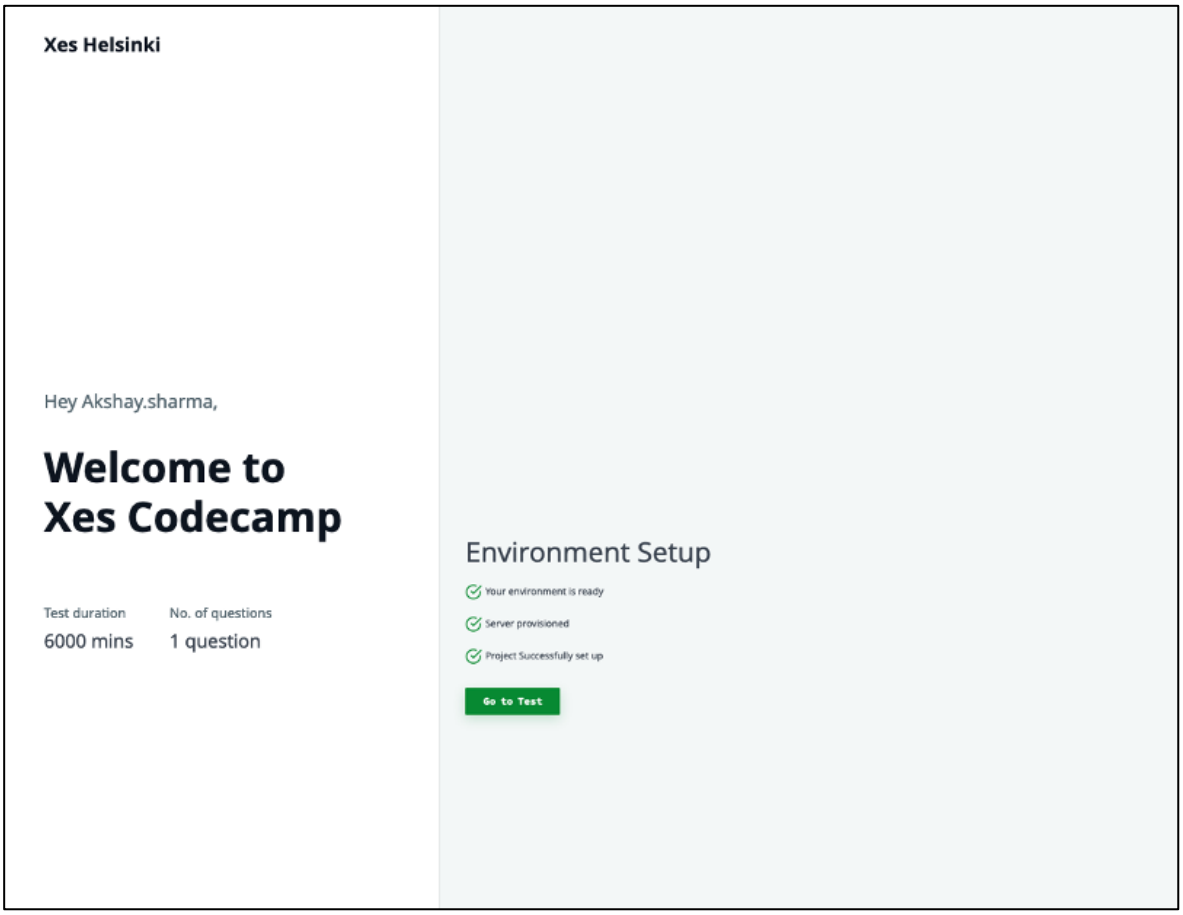

Figure 11. Concept, Xes CodeCamp

“Creating code as soon as possible” was the key message from the expert interviewed as a part of this research. For this, the industry standard for coding assessments HackerRank (2020) is selected for setting up the challenges and questionnaires. The inspiration for Xes CC is also drawn from 100 days of code. In Xes CC, a user has to commit 1 hour of coding per day. The Xes CodeCamp offers excellent opportunities not only for entrepreneurs, corporate partners but also fulfil the growing demand of learning programming skills. The Xes CC will be setting the tech foundation for Xes and may improve the quality of ideas emerging out of the community. It is targeted for entrepreneurial individuals with an idea or side project, but little or no technical skills to

build one. During the Xes CodeCamp, participants learn to create an MVP based on their idea or side project.

4.2.4 Persona

A persona is designed based on interviews for the ideal users of Xes CodeCamp. The figure 12. and figure 13. shows the persona with profession, age, background, tech skills and challenges. Furthermore, figure 12. Shows Xes CC mentee's persona, though age limit is not a barrier, but the minimum age is categorised as 25 since before that students might be in the exploration stage of career and unsure yet to make the change to the tech industry.

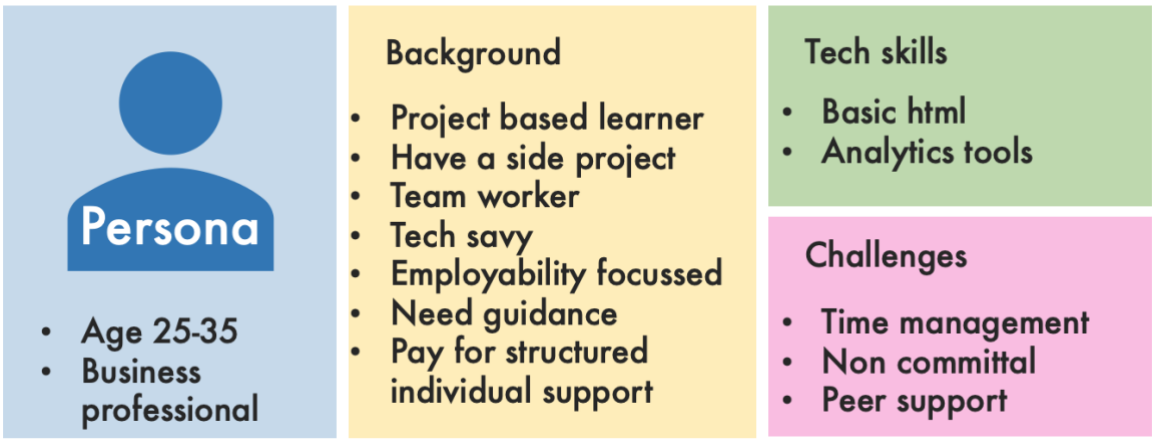

Figure 12. Xes CC Mentee's Persona

It was recommended after the thesis seminar and feedback session to create a persona of the mentor as well and after drawing the requirements from the expert interviewed during the thesis work, an elementary Xes CC mentor's persona is shown in figure 13.

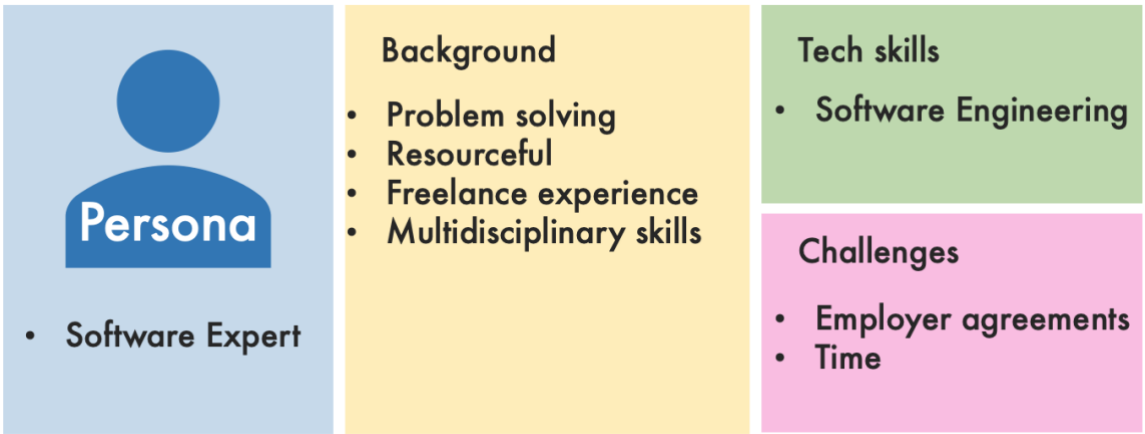

Figure 13. Xes CC Mentor's Persona

To gather a detailed and more accurate persona, future research is required with more user interviews to discover the challenges and needs of the Xes CC mentor. Interviewee 1 suggested the need to organise mentor under Special Interest Groups commonly known as SIGs. A mentor could become special interest group champion as per his domain expertise and select participants from the Xes CC as mentees from the SIGs. A subchapter is dedicated to future research in the discussion chapter.

5 Results

This chapter measures the results against the main objective and sub-objectives of the thesis. The empirical outcome obtained from the research and analysis is visualised using a Venn diagram and pictures from the Xes offerings.

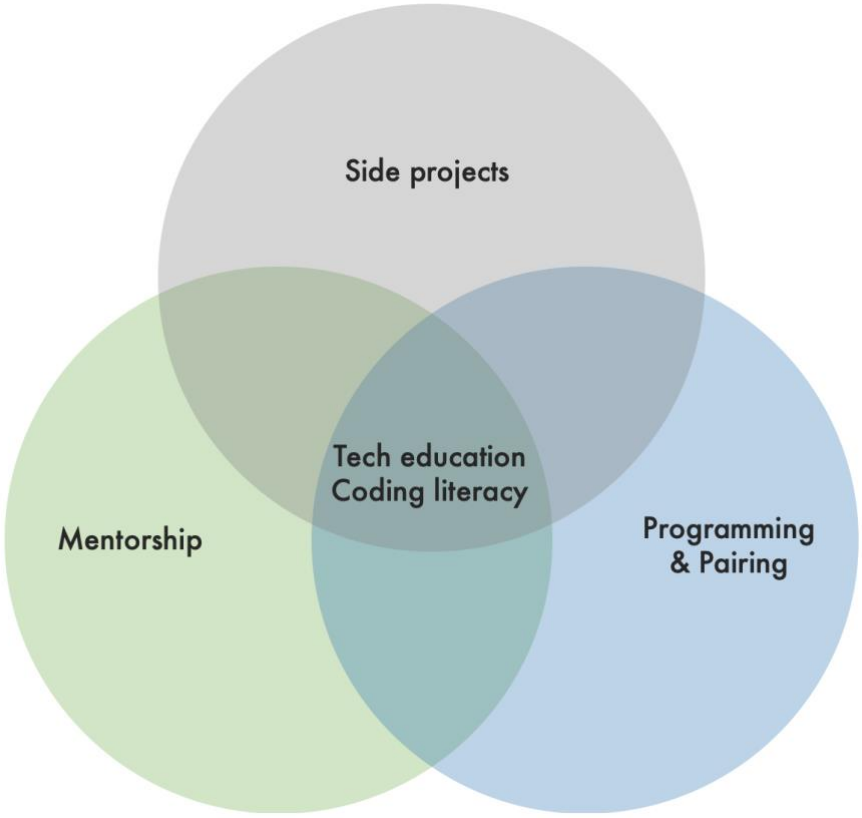

Figure 14. Venn diagram. Tech education opportunities through Xes.

There are three logical and finite relations between the important factors in tech education and developing coding literacy for non-technical students.

5.1 Definitions of tech education

The participants in the interviews uniquely defined tech education. There is no standard definition as per the research data.

Table 3. Definitions of tech education

No.	Definitions of tech education according to interviewees
Interviewee 1	Two components, it has education and tech. Very transformative
Interviewee 2	Not just a degree, could be implemented very early stage. When we learn about tech, we don't really learn it but get used to it.
Interviewee 3	A guy spends his weekends reading textbooks about some crazy thing and doing practice tests online and then get certified.
Interviewee 4	There can many different definitions and each learning institutes has their own. Need to scope it well to the audience, can also include building factories

According to interviews, Design Project-based learning (DPBL) is the gold standard where the participant gathers requirement from the customer, then design and code the features. Also, product management is essential for participants of Xes CC to deliver the feature requested by the customer continuously. Product management is continuous and evolving with the product in contrast to project management which is centred around a project with starting and ending dates.

5.2 Tools and curriculum overview

The tools and curriculum for tech education can be divided into four categories:

1. Design: The introductory module on UX, prototyping and requirements
2. Scripting: The second module on the command line interface, Python
3. Programming: The third module on JavaScript, the architecture of applications
4. Complimentary skills: The final module on product management and pitching

From the empirical analysis of the research data, it was mentioned the use of no-code apps to spark the interest of the new participants. For example, building a fake twitter using no-code of developing your side project and then building it backwards using the programming languages and tools.

Table 3. show how the participant skills could be assessed. Each level can have a set of challenges designed by the mentor, and a pair of two participants can develop the skills together.

Table 3. Xes CodeCamp Challenge levels

Level 1	**Level 2**	**Level 3**	**Level 4**
No-code Apps	Linux commands	HTML	Product Management
UX	Github	CSS	Pitching
Prototyping	Python	JavaScript	Usability Testing
		Frameworks	Methodologies (Agile etc.)

5.2.1 Side projects

According to results, the most critical element in developing coding literacy is side projects. The best companies in the world, for example, Google, Apple, Facebook are started as side projects. It is recommended for the potential participants to read “Before the startup” essay by Paul Graham, founder of Y Combinator (Graham 2014). Even the research organisation Xes was started as a side project with the support from Startup School and Haaga-Helia. Special Interest Groups SIGs could create a pool of ideas and sub-community within the main community where participants can freely discuss with peers about potential side projects.

5.2.2 Programming and Pairing

According to the results, the participants of the Xes CC are recommended to find a tech mentor from the Xes. A clear sign of the progress made is the acceptance of code in peer projects and submission on the platform. There is no need to have a starting and ending date of the side project.

Figure 15. NodeSchool Hackathon, 2018. Xes Corner.

5.2.3 Mentorship

The participants of the Xes CC can be offered individual structured mentorship for a fee. The mentor needs to be responsible for pairing the participant of the Xes CC and breaking each participants side project into smaller challenges. Further research is required to design a structured mentorship process.

5.3 Mode of delivery

From the research, it was clear that the best method to delivery tech education is a peer to peer/pairing and project-based learning. The organisation can utilise the learning platforms like HackerRank (2020) and YouTube to engage participants. YouTube live streaming especially holds lot of potential in attracting new participants to Xes CC.

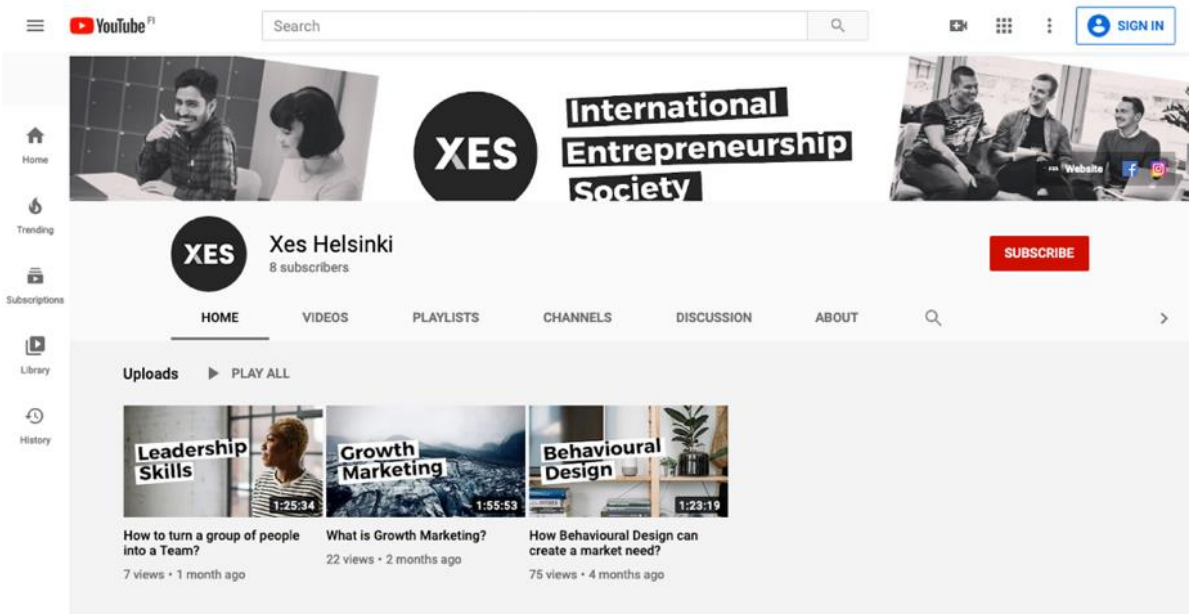

Figure 16. Xes Helsinki's YouTube Channel

6 Conclusion

The problems in learning tech educations are significant for students from non-technical background. From the research theoretical base and interviews it was concluded there maybe discouragement by domain experts in the workplaces which may disrupt personal confidence level the individuals. A further point is that mentorship is actively desired to enter the tech industry and also the willingness to pay for the mentorship.

6.1 Key findings

The key findings of the thesis are visualised in the form of a Venn diagram of three sets side projects, programming and pairing, mentoring. Besides, new knowledge is created for the research organisation Xes.

Project-based learning is desired by both the students and trainer in delivering tech education to non-technical students. The participants of the Xes CC program are willing to pay for the structured mentorship. Patience and managing time to learn is the key challenges for the non-technical students since the expert interviewee 4 mentioned all it takes to learn programming is a computer and time.

6.2 Reliability and validity

The outcomes from the qualitative methods could be quantified in future research to increase the validity of the research work. The methods selected during this thesis are well executed. Action research cycle can be continued to insert the current feedback into the planning stages of the next problem statements.

The interview transcript is generated using the transcribing services, so there are some words not spelt correctly and may affect the transcript coding and affinity diagrams.

6.3 Further research

At the end of the thesis project, a further area of research opened on discovering the needs and suitability of tech mentors for the organisation. 2020 is the year of entrepreneurship in Haaga-Helia, and there is great opportunity to continue further research with RDI Projects and Xes (Haaga-Helia 2020).

Also, further research can be conducted on what is the right platform for implementing the Xes CodeCamp challenges or is there a need to build a own platform? At what stage and how the platform can integrate with Haaga-Helia?

7 Summary

The main objective of the thesis is to discover the possibilities to offer tech education to Xes, its members and participants of the yearly activities and also to find out the stakeholders of the organization desire to learn tech skills. The thesis is based on qualitative research where semi-structured interviews are conducted to answer the research problem “Why, how and what kind of tech education can be offered through Xes”?

The research has shown the importance, challenges and tasks for an individual from non-technical background to get started with learning tech skills. The first is that it is significant to have a side project, secondly find a mentor and pair and lastly start creating code. The real value is in increasing employability prospects.

What I learned during the thesis project is pivoting from the narrative analysis to action research after the recommendation by the supervisor made a big difference in the outcomes. The experimental nature led to the creative change from instruction led learning to project-based learning and discovering the need to create a mentor persona. The project missed the deadlines due to uncertainties around COVID-19 and need to reschedule meetings. The theoretical framework has been the most challenging part, and a lot of new knowledge is created from the empirical analysis for the research organization. The thesis will help me in progressing my technical career path and finding mentors to develop.

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Appendices

Appendix 1. Interview questionnaire

Interview questionnaire?

1. Can you tell me about your professional background?
2. How would you define tech education?
3. What do you think about the current opportunities for any adult to learn tech education?
4. What do you/students expect or wish to learn?
5. How do you stay engaged in learning for several days or weeks?
6. Which type of learning you prefer? Classroom, remote, project-based or any other and why?
7. Tell me about how you would like to learn or leaned programming? What would happen so that you would want to learn?
8. What do you think happens/happened after you learned programming?
9. Would you pay for learning? How much? Why not?
10. Do you have anything else in your mind to share?