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Design and Evaluation of a Digital Educational Tool

Benefiting from Educational Tools
in a Distraction-Free Environment

Master's thesis in the Interaction Design and Technologies master program

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CHALMERS UNIVERSITY OF TECHNOLOGY

UNIVERSITY OF GOTHENBURG

Gothenburg, Sweden 2026

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Abstract

This thesis explores assisting students in having better learning experiences by benefiting from digital educational tools while not getting digitally distracted. Digital distractions come from entertainment platforms like social media, streaming services, games, and notifications that pull focus from studying and get the students unfocused.

The project starts by evaluating the strengths and limitations of existing digital educational tools in the market and in schools. The process also involves looking into research conducted on using these tools for learning and educational purposes. The aim then is to design and evaluate prototypes of possible ideas based on user feedback, and interaction design and human-computer interaction principles. The objective is to deliver a final solution in form of a descriptive concept and prototype to effectively assist students in their educational journey.

The project follows a user-centered design approach, mainly the triple diamond design method. The project starts with requirement gathering, prototyping, and iterative evaluation involving the target group, students. The methods used also include sending out surveys for pilot studies and conducting A/B testing to compare and evaluate the concepts.

The research resulted in the development and evaluation of multiple prototypes, with findings indicating a user preference for a software-based "Study Space" solution integrated into users' personal devices: phones, pads, and laptops. This outcome provides a clear direction for creating focused digital learning environments that leverage educational technology effectively.

Keywords: Constructive Design Research, Education, Generative Artificial Intelligence, Human-Computer Interaction, Interaction Design, Research through Design, Study Space, Triple-Diamond Design Method, User Studies, Video Prototyping.

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I wish to thank my family and friends for their unwavering love, support, and belief in me throughout this academic journey.

Noor AlAllaf, Sweden, 2026

List of Acronyms

Below is the list of acronyms that have been used throughout this thesis listed in alphabetical order:

ADHD	Attention-Deficit / Hyperactivity Disorder
AI	Artificial Intelligence
BYOD	Bring Your Own Device
CDR	Constructive Design Research
EEG	Electroencephalography
E-Waste	Electronic Waste
GenAI	Generative AI
HCI	Human-Computer Interaction
HiFi	High-Fidelity
HTTPS	Hypertext Transfer Protocol Secure
IxD	Interaction Design
IT	Information Technology
LMS	Learning Management Systems
LoFi	Low-Fidelity
MidFi	Mid-Fidelity
MDM	Mobile Device Management
OS	Operating System
PISA	Programme for International Student Assessment
QR	Quick Response
RtD	Research through Design
STEM	Science, Technology, Engineering, and Mathematics
UCD	User-Centered Design
UI	User Interface
UX	User Experience

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1

Introduction

In this project, I explore the design and development of a digital educational tool. Specifically, one that focuses on highlighting existing educational applications and websites while minimizing distractions from notifications and entertainment software like games, streaming services, and social media. The aim is to support and improve students learning experience and help them focus and learn more effectively.

In this chapter, an overview of the main points researched and developed during the thesis is presented. Starting with a general introduction to the thesis, the focus then is on exploring the aim of the project, followed by the research questions to be investigated throughout the project. The target group is then defined. Finally, the limitations that affected the practical side of the project are presented.

Students often need assisting in their studies and learning journey. Many tools are available to quicken and improve their learning, but they are mostly embedded in multi-purpose devices like phones, tablets, and laptops, which all are sources of distractions. This makes entertainment software and other noneducational tools easily accessible which makes the students more prone to getting distracted. Distractions are even more effective with notifications constantly dragging the users focus back from studying.

Education has always been influenced by the tools available. In the past, students mainly relied on books, teachers, and handwritten notes. It was then time-consuming to find knowledge and references as it required physical attendance in libraries and schools and face-to-face contact with teachers and other students. The physical requirement also restricted the amount of data present, as there is a limitation to how many books and other scientific resources can take place in schools and libraries.

With the rise of digital technology, it is quicker to get hold of knowledge. It can be said that the amount of information available is unlimited. There are many useful applications and websites, Generative AI (GenAI) is no exception, that have helped reshape and improve education massively [14, p. 1].

On the other hand, with the rapid and scattered way of getting information, it is getting more distracting as there is less time for the mind to process the information causing cognitive overload [34, p. 3]. Moreover, digital distractions and the addictions that come with them have become a global issue affecting individuals' personal, professional, and social lives [2, p. 3], directly influencing the quality of their educational experiences.

This project explores the problem space, identifies needs, and proposes a solution using a user-centered design (UCD) approach to design a digital educational tool.

1.1 Aim

The primary aim of this thesis is to design and evaluate a digital educational tool to help students maintain focus when studying. This is to be done by evaluating the strengths and limitations of existing tools in the market and practices in schools, as well as by looking into research conducted on education and technology. The aim then is to design and evaluate a concept of a digital learning tool based on user requirements and user feedback.

1.2 Research Questions

This research aims to explore the following questions:

- How can a digital learning environment, whether hardware or software, be designed to support students' ability to maintain focus when studying?
- What core functionalities should a focused digital learning tool include to effectively support learning?

1.3 Target Group

The user group is primarily defined as students capable of using a digital device. Ages may vary as the final concept aims to include existing educational applications and websites for the students to benefit from. These are available for children and adults of different ages.

The environment in which the device will be designed to work in is in classrooms in schools but also with students at home, in libraries, and wherever they deem suitable for a learning environment.

1.4 Process

A Gantt Chart was created to follow as basis and plan for how the project would be conducted. The Gantt Chart used for the project after being filled in is presented in figure 1.1. What makes Gantt charts unique in a sense is that work planned and work done are shown in the same table in their relation to time [10, p. 2]. It was decided in this project to use color codes as presented in the bottom of the figure: green for complete, blue for incomplete, yellow for in progress, purple for ahead of plan, red for cancel. The table was updated weekly to follow the plan and stay on schedule.

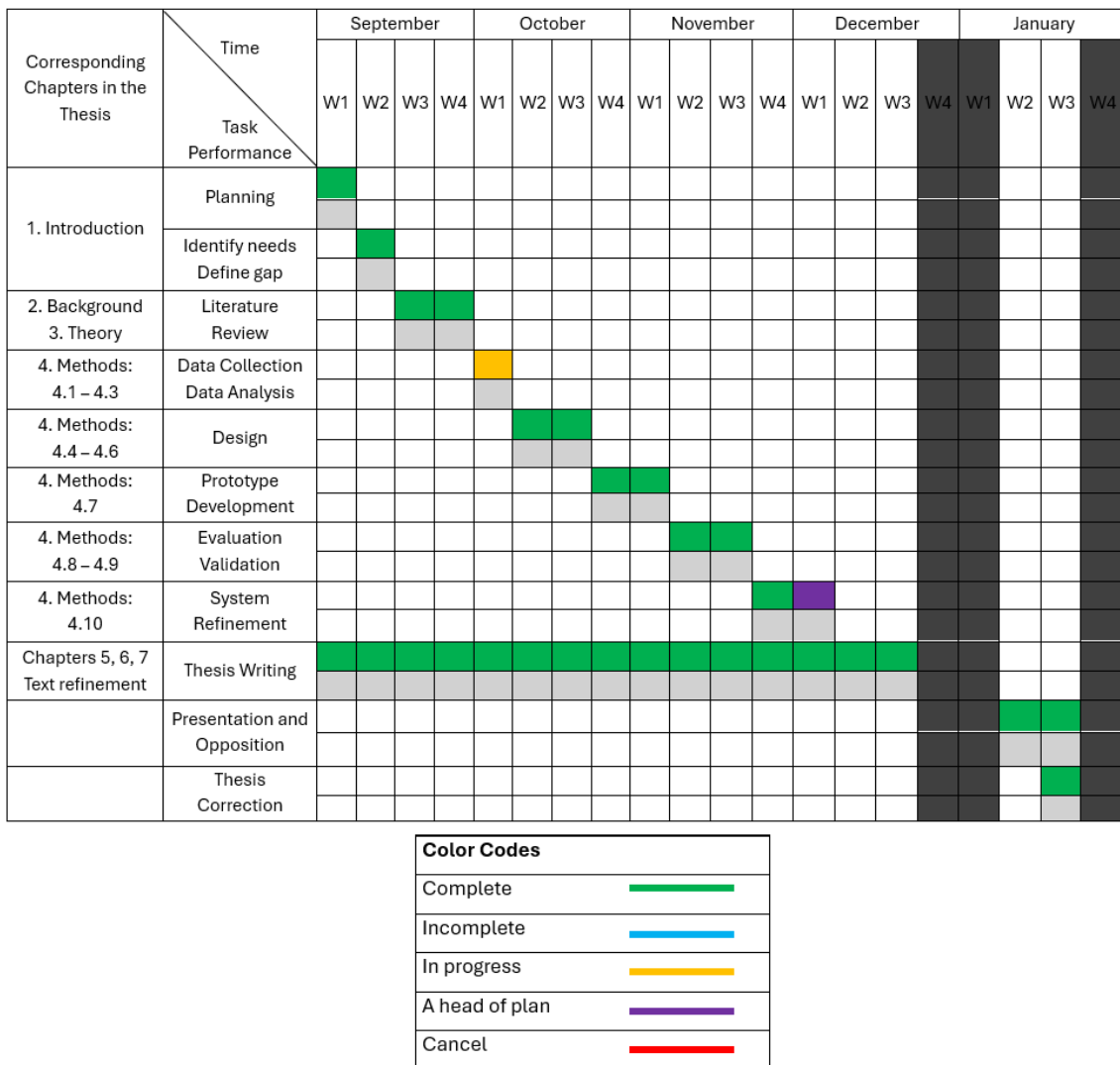


Figure 1.1: Filled-in Gantt Chart and Color Codes used for this Project.

For adding more details to the project plan, an initial time plan was created to ensure all necessary details of the project are moving forward within the time-frame of the course. The time-plan is presented in the color-box *Time Plan* below. The Gantt chart combined with the time-plan helped create a clear structure and steps to be followed for the project.

The first week was to plan for the project, it's in the first week that this Gantt chart and time plan were created themselves. The week after was to define the problem and do research on the subject. Following is to conduct a literature review and to among other things think about the environmental conditions that surround the students and affect their studies such as ethical and socio-economic aspects. These were the parts that built the chapters 1. Introduction and 2. Background.

The following month focused on the practical work, from conducting user studies to ideating and prototyping. The month after was spent on evaluating the concept. That is including performing design iterations and evaluation of the concepts designed with regards to previous research and user feedback. During those two months, the content for chapters 3. Methodology and 4. Design Process was ready.

1. Introduction

During the whole project, different parts of the thesis were written to ensure no details during the design and development process were forgotten to document. Images, tables, and citations were updated constantly to keep track of the work.

Time Plan.

September 2025

W1: Plan the project. Create a Gantt Chart and a time plan. Start reading on the subject briefly.

W2: Read on the the subjects of educational challenges and technology. Identify needs and define the problem and gap in research.

W3: Begin literature review. Conduct market analysis. Find what solutions already exist and why they're working or not.

W4: Look into related work and scientific studies on education and technology.

October 2025

W1: Run user studies to make sure the need(s) identified from the market analysis and gap in research are accurate.

W2: Initial design sketches. Ideate several ideas (diverge) and focus them down on the most relevant ones (converge).

W3: Make sure everything is being documented in the thesis. Add all citations, figures, tables, etc.

W4: Develop concepts and develop low-fidelity prototype(s).

November 2025

W1: Continue developing the prototypes. Start planning for evaluation.

W2–W3: Conduct user studies to get feedback on the concepts.

W4: Refine the concepts following the feedback from the evaluation.

December 2025

W1: Write the results obtained during the project in the thesis. Write discussion including future work.

W2: Conclude the thesis in the last chapter. Make sure to add appendices. Refine the thesis draft.

W3: Finalize thesis and hand it in.

January 2025

W2: Prepare for thesis presentation, defending the thesis, and for opposition.

W3: Present and oppose. Feedback corrections and final submission.

Data collection and analysis took longer than a week to do. The survey in section 4.1 Exploring the Project Area in chapter 4 Design Process didn't take that long time to prepare itself but sending the link and awaiting responses took longer than originally planned. However, this didn't affect the work of the next week as waiting for participants to answer the survey didn't require more personal time spent on that part. Preparations on the next step started already while the participants were filling the survey in and submitting their answers.

System refinement which was in section 4.9. Design Iteration was done somewhat quicker than planned. As the evaluation phase in the step just before had two weeks planned, there was time at the end to work on refining the system and delivering the final results.

Thesis writing started earlier than planned. Structuring the thesis report, planning its format, starting with chapters 1 Introduction and 2 Background, and writing a first draft of them was done the first month. This is to keep track of the research conducted during the first month and to have it written down as not to miss important details and information.

1.5 Limitations

Limitations include the complexity of developing a high-fidelity device in the limited time-frame of less than half a year with one developer working on the project. Therefore, the focus was on defining the necessary functions and evaluating concepts with low- to mid-fidelity prototypes. It remains to future work to create a high-fidelity prototype and perform a thorough user research before delivering the final concept to be available for students to use.

This chapter introduced the project. The next one, chapter 2. Background, presents the background that built the foundation for this project and the theoretical details to consider in the methodology phase which is described in chapter 3. Methodology. The design process and the practical parts are written in chapter 4. Design Process. The results of the project are presented in chapter 5 and are discussed along with future work in chapter 6. Discussion. Finally, a brief conclusion of the thesis is described in chapter 7. Conclusion.

2

Background

This chapter presents the background which this project is based on and started from. Beginning with discussing the dilemma space, a market analysis is then conducted to have an overview of what digital educational tools exist and are used in schools and by students. Followed by looking into research and theories on the area of digital tools and their influence in education. The chapter also presents the ethical and socio-economic considerations that the solutions produced by the end of the project should take considerations to.

This thesis was inspired by a previous project done in the 7.5 credits (hp, ECTS) course "Open-Project in Interaction Design" at Chalmers University of Technology. The project was about designing a scanner educational pen that would with a scanning functionality, such as those in translator pens, read an exercise and with AI working in the background, give back an answer on an output screen. Instead of the input being translation of the scanned text to another language, it's an AI answer to the question scanned. The first edition of the design is shown in figure 2.1, it was a mechanical pen with physical buttons and switchers. A storyboard of the updated digital version is shown in figure 2.2.

The drawbacks of the design in that project was that the scanning functionality only allowed the user to send in text by sliding the pen along it, but there is no way to ask anything about pictures such as graphs and tables. It's not possible in that design for the user to write but only to use a few predefined buttons to interact with the chat. These shortcomings will be considered in this project and a new approach to assist students in their education will be conducted.

Part of the the background is to understand the problem space, learn what products already exist in the market, and review related work to know what concepts have been discussed on the subject. For starters, the cause and need for this thesis will be discussed by researching the dilemma of educational advantages but also distractions that come with digital devices.

2. Background

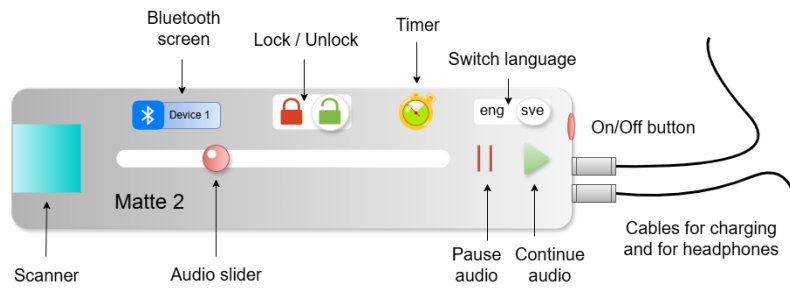


Figure 2.1: A Sketch with Notations of the Mechanical Version of the Interactive Learning Pen

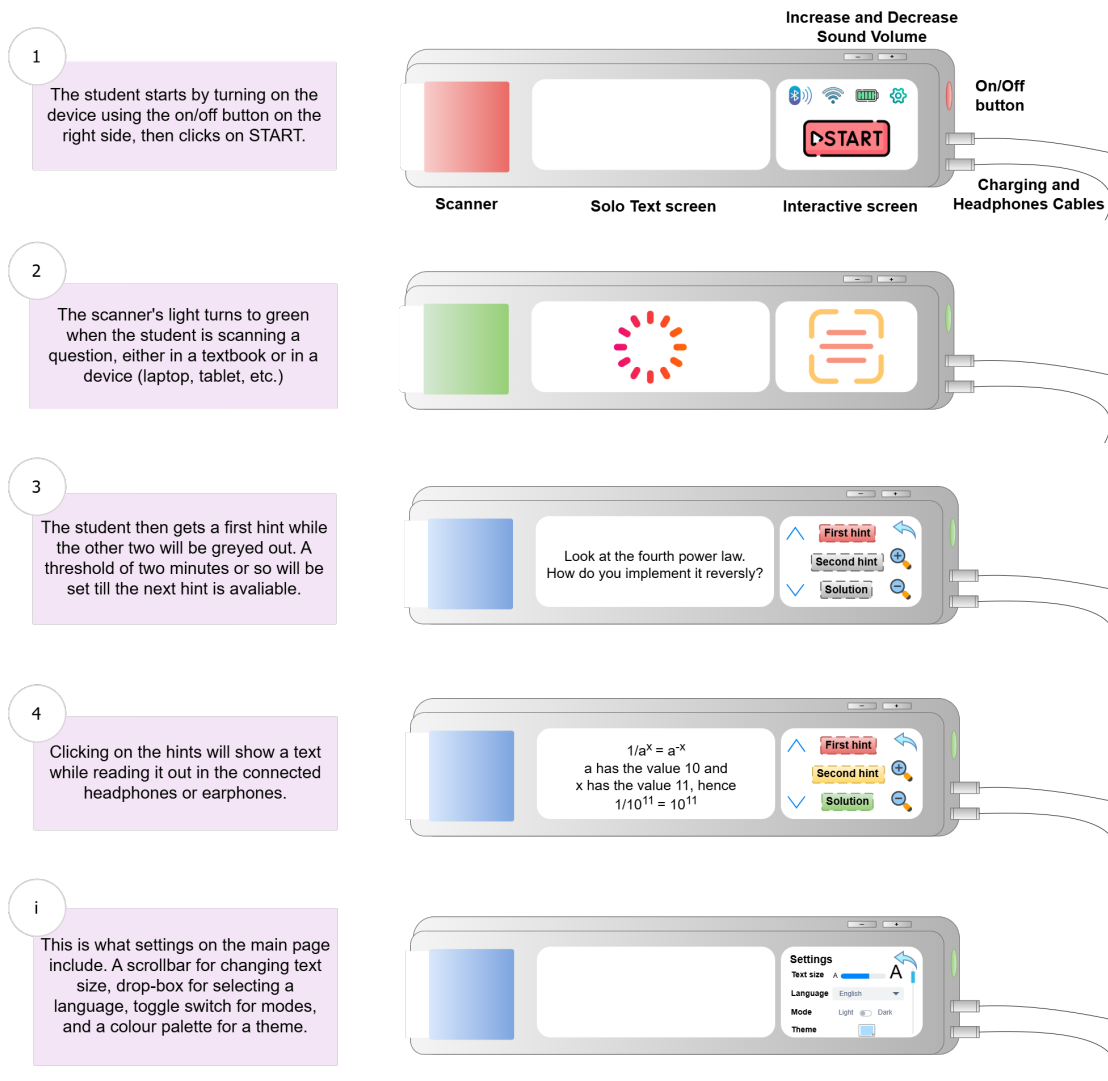


Figure 2.2: A Storyboard Showcasing the Updated Digital with it's Functionalities.

2.1 Digital Benefits and Distractions

Digital distraction is defined as any distraction caused by digital devices that diverts one's attention from previous task. It does not only affect productivity, but also disturbs feelings and moods [1]. As the research conducted on "Digital Distraction" states:

Government needs to implement policies and create a conducive environment for work to enable employees to remain free from digital distraction. This will not just increase productivity but also make people more calm, relaxed and happy.

Prior research suggests that excessive digital media use is associated with an increased risk of developing Attention-Deficit / Hyperactivity Disorder (ADHD)-like symptoms in adolescents, highlighting the importance of minimizing distractions in educational technologies [31].

For limiting distractions in schools, some elementary and secondary schools are prohibiting the students from entering the classrooms with their phones, either by leaving them in their lockers or handing them over to their teachers at the start of the class and taking them back at the end. This does limit distractions but it also takes away all the benefits of the educational applications and websites that students need to use in the classroom.

Educational tools are becoming an essential part of the educational system. Calculators, Geogebra, and other digital applications and websites are being integrated into scientific books and sometimes allowed to be used during exams. Regarding GenAI chats, a study in Sweden comparing students learning with and without using ChatGPT, has shown that there is a positive influence of ChatGPT on the students' perceived learning [41].

One of the concepts that tried to tackle the dilemma of finding a balance between benefiting from educational and work-related tools while limiting the distractions of digital devices is whether to have multi-purpose or single-purpose devices. Another aspect is to restrict access from certain software and only allow access to tools with purpose to the objective of the device.

2.1.1 Multi-purpose and Single-purpose Devices

Unification of software, as in gathering all applications in one single device as it is done and advertised in the multi-purpose devices common today, is helpful because it gives easy access to many services in the same place [45, p. 2]. It allows the users to move quickly between messaging, browsing, and learning without carrying several devices physically.

However, this same unification also creates the problem of constant distraction. Notifications from social media and entertainment apps appear in the same space as study tools, making it harder for students to focus on learning and other activities for a longer period without being interrupted. Additionally, merely the easy access to entertainment platforms might lead the students to, sometimes subconsciously, do something that at the time seems easier than studying like scrolling through social media or checking progress in a game.

Former studies and market examples show that separating different functions into dedicated devices can be effective for focused tasks, as demonstrated by Amazon's Kindle for digital reading and reMarkable for note-taking tablets. These take features existing in multi-purpose devices, in this case similar to Adobe Acrobat Reader and Evernote, and place them in separate devices to increase focus on a single task. One could argue that creating highly task-specific devices might be bothersome as there has to be a limit to how many devices one could carry, that this could be distracting in itself. Rather than dividing technology into single-purpose devices, it makes more sense to draw a reasonable line, separating devices for personal use, school, and work might be sufficient without over-complicating what devices need to be used in everyday life.

2.1.2 Restricted-access Devices

Many companies have tried to solve the problem of their employees getting distracted by using their personal phones for work purposes and have solved the issue by providing their workers with work phones and laptops [12]. The intention here is the same, that when employees need to use their phone for work, no other notifications or distractions that they otherwise would get in their personal devices would pop up, unless work-related. These devices have often no restrictions so the users, in this case adult employees, can download and use whatever applications and websites they want or need.

Many schools have adopted the same concept and provide students with tablets or laptops that have limited access to services, so it is only the applications and websites permitted by the schools that students can access.

However, a lot of educational software is going missed by schools and hence unseen by the students even though they could be of assistance to the students' studies. School-issued laptops are configured to block access to websites using unencrypted Hypertext Transfer Protocol (HTTP) connections, allowing only HTTPS-secured sites. This is often part of a web filtering and security policy designed to protect students from unsecured or malicious sites. Yet some older educational websites due to several reasons haven't migrated to HTTPS and students aren't allowed access to them because of that.

The primary objective in companies is productivity and output while in schools it is learning and safeguarding, hence the restrictive tools in schools. Moreover, a key differentiator that makes it crucial for schools to restrict certain software is legal and duty of care, this is especially important for minor students.

Another issue is that some entertainment apps that come default in the device like Microsoft's entertainment pack for Windows making it a cause of distraction in the classroom.

Furthermore, it is only students learning in the schools who get to borrow school-issued devices, but those taking courses in Municipal Adult Education (Komvux) or taking courses online and studying from home don't always have the same opportunities.

2.2 Market Analysis

There are no dedicated devices whose main and only purpose is education. The market still lacks a simple and classroom-friendly device that centers on deep focus. All of the educational applications and websites used by the students are only found embedded in multipurpose devices. Knowing what students need will help shape the solution, hence some of the common educational applications and websites used by the students are mentioned below:

2.2.1 Learning Management Systems

Learning management systems (LMS) are common to use in schools for the students to see which courses they are enlisted to, what modules they include, the assignments they need to submit and the grades they got. These LMS are also necessary for teachers to keep track of the courses and students' submissions, to easily contact the students, publish lessons and lectures, and grade the assignments. Example of these systems are Canvas, Google Classroom, and Moodle.

2.2.2 STEM Subjects

For STEM subjects such as mathematics, physics, chemistry, and biology, applications like WolframAlpha, Symbolab, GeoGebra, and PhotoMath, are used in elementary schools, high schools, and universities. These applications can be accessed in "Play Store" under the category "Education".

To understand the subject and get assistance in exercises, YouTube and Khan Academy are often used by students as learning resources for explanations and step-by-step guidance.

2.2.3 Social and Language Sciences

For social sciences like history and geography, it is common to use software like Wikipedia, Quizlet for making flashcards, Kahoot for quizzes, and Google services like Google Maps.

To study languages, some of the digital tools available are Google Translate, Grammarly, and Duolingo.

General tools needed for most kinds of majors for documentation and assignment submission are Microsofts' tools, like Word, Excel, and PowerPoint, corresponding to Google tools such as Docs, Sheets, and Slides.

2.2.4 GenAI Tools

Many students are using Generative AI (GenAI) tools like ChatGPT, Copilot, Gemini, and DeepSeek, to assist them in their education. GenAI tools have become some sort of a substitution to looking around for information by browsing in Google or YouTube. Browsing used to be the traditional way for looking for information, it still is used as GenAI tools do not cover all the tools the web has to offer.

However, GenAI tools do a quicker job of answering specific information with a personalized explanation which gives the students a unique learning experience, as if they have a private teacher by their side. AI programs adapt to the student's tone and language, letting them feel understood and assist them in learning the subject in a specialized way suitable for their level of knowledge.

AI-driven tools cover for many types of subjects, from social and language sciences to STEM and programming, AI is allowing the users to correct text, translate, create new content whether as text or pictures, answer emails, help navigate other services, and many other tasks.

There are a few concerns surrounding GenAI tools. There have been concerns that the answers provided by these tools might not be so accurate, ChatGPT already tells the users that "ChatGPT can make mistakes. Check important info.". Although with the rapidity of which GenAI is developing with, the accuracy of the answers might with time be incredibly high.

GenAI tools also advise users not to share sensitive information during conversations. However, since the intended use in this context is strictly educational and study-related, this concern is not directly relevant.

The most relevant and spoken-of concern however is plagiarism, as in students copying text directly from the AI chats and using them in their assignments. AI tools are slowly being integrated and accepted to be used in schools but teachers are stressing for the students to use AI chats reasonably so they develop a critical thinking and researching abilities.

The educational systems haven't yet been completely adapted to the quick development of GenAI tools as new tools often face resistance when firstly introduced but it's probably a matter of time before they get integrated into the educational system as a necessary if not primary source of gathering information.

2.3 Related Work

There has been a concept discussed of an AI-driven technology to assist learning that is in a separate devices, it's an idea about a calculator that uses a camera lens to take photos of equations and has a built-in microphone for the user to verbally ask for help, the calculator will then display the answer on a screen. This concept is titled The 'OBSCURA' Calculator Concept and is cited at the end of this chapter. The concept is very similar to the way Photomath works in, but it uses a regular scientific calculator to separate the program in it's own hardware. This concept is specifically directed to calculation sciences, it's not a universal or general educational device that can assist students regardless of the subjects they are learning.

Despite the wide range of educational applications, none of them are integrated into a purpose-built, distraction-free, educational device. This indicates a clear design opportunity to focus on education in separation of other attention-consuming platforms such as social media, entertainment apps, and streaming services.

2.4 Ethical and Socio-Economic Considerations

The adoption of educational technology involves ethical and socio-economical considerations such as affordability and how it reflects broader questions of equity, while privacy and security highlight the ethical responsibilities of protecting users' data and digital well-being.

2.4.1 Access and Affordability

Some GenAI tools require the users to pay for longer conversations if they don't want a time-lockdown till they can continue the chat, and for the benefits that come with Plus and Pro plans. ChatGPT for example gives the message "You've hit the Free plan limit for GPT-5. You need GPT-5 to continue this chat because there's an attachment. Your limit resets after XX:XX PM.". Students, and by extension their parents, who can afford these paid plans gain a significant advantage in their studies compared to those with limited financial resources.

Moreover, some socio-economic groups can afford to provide their children with private teachers which companies like Allakando and StudyBuddy thrive at [16]. These services allow one-to-one contact with a coach and teacher who would guide the student with their studies and give them advice on how to do so in a suitable way for them.

Students with families of lower income groups don't have the same possibilities, it's only in the classrooms in which there are many other students needing likewise assistance that these students can require help.

Some schools provide additional opportunities for study assistance either in the school itself with teachers often being students of the higher classrooms or via external organizations like Intize. Intize is a non-profit organization that holds 3-hour drop-in sessions 3-days a week for all students regardless of age or program to come in, self study, and ask for assistance when needed. These free services are not available in all cities, especially the smaller ones, and not always with the same assistive qualities as the paid services. Moreover, school is usually from 08:00 AM to 16:00 or 17:00 PM, enough long time to spend at school. Having to stay even later than that or spending the weekends in schools might cut down even more time from the students to spend in non-school related activities like hobbies and social activities, possibly affecting their overall being. This puts students with lower income at a tough position when seeking assistance in their studies.

A way to assist students in their education could be to help them focus and learn efficiently during school-time to open up some free personal time. A device that would work as a private teacher and coach would also help reduce socio-economic class differences and bridge the gap between the high and low paid families.

2.4.2 Safety, Privacy, and Security

AI-based websites often allow the users to take and send pictures to be analyzed. From an integrity perspective, logging in and sending the picture might get it stored, this could open risk to breaking GDPR [32] laws as pictures of people could be taken and sent in the chat.

As much as schools work to prevent bullying, and even though it is constantly being addressed through policies and awareness initiatives, it continues to pose a risk [37]. With the introduction of digital devices in classrooms, that risk extends into online spaces and could include taking pictures of students and teachers without permission and playing around with them unreasonably using the GenAI tools.

This can be argued to not be an issue for older students as they already are allowed to carry their mobile phones in schools, under the guidance of teachers who spread the awareness of the matter of bullying and its significant consequences. However, for younger students who are still learning where to draw the line between joking and possibly harassing, will either require extensive guidance from teachers or slightly adjusted devices to suit younger students needs and age considerations.

GenAI tools have been developing from the ethical perspective side. When asking Deepseek, ChatGPT or its paid text-to-video model Sora to provide images or videos of famous people performing an activity like walking or eating, it responds with a warning: "Image Violation Detected: Uploading a famous figure's image is not according to our content guidelines" and "As an AI, I do not have the capability to generate images of real people.". However, it is possible to take a picture of someone, send it in the GenAI chats, and ask the chat for example to provide an animated or Ghibli style picture with certain qualities.

When asking ChatGPT itself how it would handle any sorts of student uploads making fun of other students or bullying them, it responded with "If I personally received something like that (say, in a chat or upload), I wouldn't show, share, or process it — I'd stop the upload, flag it for safety, and encourage reporting to a trusted adult or authority.". Hence, from the chat side, GenAI tools are quite advanced in making sure the proper words are chosen to respond, but from the photos side, there is still a part that can be used for bullying, and other sorts of disrespect and harassment.

Some solution that scans the images taken and blurs out all material not related to the question or learning objective might be a way to avoid that issue.

This chapter introduced the background that this project stands on. The next chapter will present the methodology used in the practical part of the project after.

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3

Methodology

This chapter presents the methods used in the project, the theoretical part of the project, and their relation to interaction design and human-computer interaction that the solutions produced by the end of the project should take considerations to. The research methodology used in this thesis is grounded in constructive design research (CDR). CDR is "to design research in which construction — be it product, system, space, or media — takes center place and becomes the key means in constructing knowledge" [21, p. 5]. Accordingly, the development and evaluation of concepts using video prototypes was the primary method for investigating how digital tools can support focused learning in this thesis.

Research through design (RtD) is a "research approach that employs methods and processes from design practice as a legitimate method of inquiry." [48]. By using RtD, this project investigates the problem space through a constructive process, designing concepts and displaying them in prototypes that present potential solutions, resulting in insights about student needs and preferences, and suitable technological possibilities.

The main method used in this project is the triple diamond design process with its steps shown in figure 3.1. The triple diamond model is an approach that guides the process of design and innovation. It consists of three main diamonds or phases: Discover, Develop, and Deliver [28]. The triple diamond design approach implements RtD and is an iterative process [47].

The main idea is for each of these phases to diverge and explore the subject before converging and deciding on a specific part of it to continue the project with. As this project aims to explore the area of education and technology and understanding what challenges the students are facing in their studies and choosing an area to focus on, before looking into possible solutions and suggestions and deciding on what idea to prototype, and to evaluate it and perform design iterations when needed, the triple diamond method seemed as a suitable choice to help guide this project.

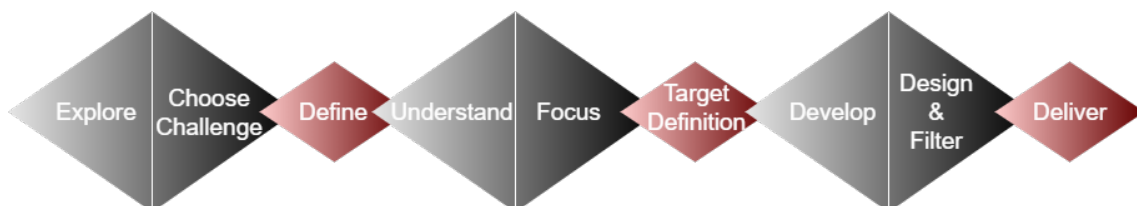


Figure 3.1: The Triple Diamond Design Model. Inspired by the Triple Diamond Method Protocol [27].

Interaction Design (IxD) and Human-Computer Interaction (HCI) are introduced below as the disciplines guiding the project's design philosophy and evaluation criteria. A theoretical synthesis then clarifies how concepts such as focus, distraction, and learning effectiveness, are operationalized into practical design decisions. Finally, a validity and reliability discussion sets the boundaries of the research. Together, these sections provide the framework that shapes the phases in the triple diamond method used later in the project.

3.1 Interaction Design

Interaction design involves designing elements of products that the users will interact with [29]. IxD focuses on understandability and usability. It examines the interactions between a system and its user, in other words between the user interface (UI) and the user experience (UX).

Understanding these relationships is important when designing a digital educational tool, as effective interaction design ensures that students can engage with learning tools intuitively. By aligning the interface (UI) with positive user experiences (UX), an environment that supports focus and productive learning can be created.

3.1.1 User Experience

In the website [We Feel Fine](#) (a clickable link), and in his book "The Basics of User Experience Design", Mads Soegaard writes that user experience is about how people feel when they use a product or service [42]. He several times mentions feelings and emotions being a core part of UX design. Many students experience a whole lot of feelings in schools, Harris and Kamvar noticed people expressing their selves on the web and created a website as well as wrote a book gathering these digital footprints starting with "I feel or I am feeling" cited in Endnote at the end of this chapter.

Going through some of peoples' expressions wrote in the book, some of these were related to schools, such as: "I arrived at school feeling excited and left feeling very depressed", "I want to be excited about school but honestly I just feel so awful", "I'm feeling pretty good today considering it's the last day of my middle school years ", and some other opposing feelings like "I love high school, I feel secure there, the real world scares me a little" [17].

These thoughts could be due to many factors but as time spent at school is mainly for classrooms and learning, frustration from not understanding the subjects and getting low grades could significantly shape students' overall experience of learning. Moreover, as time spent in schools is no less than several early years of most peoples' lives, the educational experience is most likely a shaping and life-altering experience. More the reason to why schools should be made into an exciting and learning-rich journey.

This highlights the importance of designing educational systems that acknowledge and respond to emotional factors, by serving their purpose of assisting students in their education and helping them understand the subjects and getting better results.

3.1.2 User Interface

In the book "User Interface Design: Bridging the Gap from User Requirements to Design" [46, p. 2], the author Larry E. Wood described user interfaces as:

To be usable, a user interface must provide access to the functions and features of an application in a way that reflects users' ways of thinking about the tasks that a potential application will support.

User interfaces change many people's lives, intuitive user interfaces for students mean that they can learn more effectively [36]. Building on this idea, this principle means that the device must not only provide the necessary educational functions but also present them in a way that aligns with students' natural ways of thinking and learning.

3.2 Human-Computer Interaction

Human-Computer Interaction (HCI) studies how people interact with digital systems [23] and how technology can be designed to support accessibility, ergonomics, and usability.

3.2.1 Accessibility

The way accessibility matters are handled today in schools is often by teachers assigned individually to help students with special needs. However and due to workforce limitations, students with ADHD and other special needs sometimes face challenges that are not fully supported. Students also have different home-life conditions and their parents can't always assist them fully when they are at home which leads to unfair differences in their learning opportunities. It can also cause unnecessary frustration and suffering as the students with special needs have to put in extra effort to gain the same results as their classmates.

3.2.2 Ergonomics

Ergonomics main purpose is the design of systems and tools for a safe, efficient, and comfortable use [35]. Ergonomics in education refers to the the way learning environments influence learning performance [38].

Physically, this includes considerations such as device size dimensions and shape, weight, and keyboard and screen placement, which can affect hand posture, eye strain, and long-term usability.

On the cognitive side, ergonomics involve reducing unnecessary mental effort by ensuring that interfaces are intuitive, well-structured, and easy to navigate. It also involve aesthetics and discussions like whether having vibrant colors and cartoonish icons would make the tool feel friendly and engaging, or if that would distract the students and make the environment feel less professional.

3.2.3 Usability

User-centered designed tools help keep the students' attention on the educational content instead of on the operating device itself. Steve Krug wrote three laws of web and mobile usability in his book "Don't Make Me Think" [22]. These are: "Don't make me think", "It doesn't matter how many times I have to click, as long as each click is a mindless unambiguous choice", and "Get rid of half the words on each page, then get rid of what's left".

These usability laws show the importance of designing user-centered, in this case student-centered interfaces. The simpler and more intuitive a tool is, the more cognitive resources students can use to learning rather than figuring out the interface. Applying Krug's usability laws can be used as a guideline for designing and evaluating educational interfaces. Tools that follow these principles are more likely to be intuitive and support continuous attention, these are all important for effective learning which is the main purpose of this project.

3.3 Theoretical Synthesis

While the previous sections describe relevant theoretical frameworks from IxD and HCI, it is important to clarify how specific theoretical concepts informed the design criteria for this project. The challenges of focus, distraction, and learning effectiveness were operationalized as follows:

Focus was conceptualized as the ability to maintain attention on learning tasks without digital interruptions.

Distraction was defined as any digital interruption (notifications, access to non-educational apps) that diverts cognitive resources away from learning tasks.

Learning effectiveness was framed as the efficient use of cognitive resources to achieve understanding and lasting knowledge.

3.4 Validity and Reliability

This research follows a constructive design research and Research through Design (RtD) approach, which focuses on exploring ideas and generating insights rather than making broad statistical claims [47] [48]. The number of participants in user studies (N=12-24) as will later be informed in chapter 4. Design Process, is appropriate for identifying patterns, preferences, and design directions within the target group, not for making broad population claims.

Therefore, the findings should be seen as exploratory, reflecting emerging preferences and design opportunities. Statements such as "the research resulted in..." or "students preferred..." refer to trends observed within the studied groups of participants, not to generalizable truths of what students everywhere will prefer.

To enhance validity, different methods were used: surveys, A/B testing, and interviews. This allowed verification of insights from different evaluation methods.

However, possible limitations include self-selection bias in survey responses, meaning that only people who chose to take your survey are represented. Hence, results of the user studies might reflect the views of particularly motivated or opinionated students. Another possible limitation is the homogeneity of participants, as most participants are higher education students in Sweden as will be shown later in chapter 4. Design Process. One more limitation could be the self-reported nature of focus and distraction measures. Students were asked to tell about their focus and distraction levels, these were not measured objectively.

Reliability was supported by the iterative design process, where concepts were tested and refined across multiple cycles. Nonetheless, the findings should be validated through larger-scale and longitudinal studies in future work.

In summary, this thesis provides exploratory evidence and design implications and the results are intended to inform future design decisions and research, not to serve as final generalizable claims.

4

Design Process

This chapter presents the practical application of the triple diamond design methodology introduced in chapter 3, using theoretical frameworks into concept design decisions. It starts with the development of the project from initial problem exploration, goes through iterative prototyping and evaluation, leading to the final concepts designed.

Starting with finding the need in society and gap in research to motivate for the project as was done in chapter 2 Background, the steps of the design process followed are user studies conducted in section 4.1 Exploring the Project Area, to confirm that the challenges found in theory are relevant and up-to-date. Ideation was performed in section 4.4 Ideating, prototyping in section 4.7 Prototype Development, and evaluating the concept is presented in section 4.8 Evaluation. Following is an iteration of the design that aims to enhance the concept as outlined in section 4.9 Design Iteration, before delivering the final concept in section 4.10 Deliver.

4.1 Exploring the Project Area

Earlier in chapter 2. Background, it was discussed how students are having a difficult time staying concentrated on their studies when using digital devices, on the other hand they need to use some applications and websites to assist them in their education. The next step is to confirm, adjust, or deny these findings from the theoretical part and make sure accurate up-to-date insights from the user group is used as base for this project to be built on. This is due to the fact that some of the scientific references used were of previous years and as technology is evolving and education is adapting to it accordingly, up-to-date data is crucial for the accuracy of this project.

Knowing that questions on using AI can come as a sensitive topic to many students as using it is often considered a form of plagiarism, the study was conducted in form of a survey, to allow the students to anonymously and freely answer the questions.

4.1.1 Survey

This user study was conducted to find out the primary struggles and needs of the students. The questions were mainly qualitative in order to gather as much open information and let the students share as many thoughts as possible. A random trial method was chosen to distribute the survey on a wide range of the user group and get as many different insights as possible.

The survey was designed not to be long as not to bore the participants and make sure they answer all the question while giving as much details as possible. The survey is listed in the color-box *Anonymous Online Survey on Education Tools for Students* below.

Three questions were deemed enough to understand the background of the participants. The first question was asked to make sure the survey reached participants from different educational programs. The second was to see that the survey was equally or nearly equally distributed between different genders, and the third was to ensure the participants are on different ages of the target group.

Eight questions were added to get knowledge on the students' study habits and educational experience. These are to clearly understand what challenges the students face when self-studying to make sure this project is relevant and the pain point is an actual real-life dilemma, what digital tools they use to think of including in the solution proposed in later stages, and if they use AI and how they feel about it.

Additional questions are if the students get distracted when using digital devices, as studies are directed to being digital and many students are taking lectures and doing assignments online, a direct or indirect affect of the health precautions and social distancing measures during the COVID-19 pandemic.

Question 12 is asked to get a feeling about how students would take in adding a device specific for their studies and their insights on it. Question 13 is to finalize the survey and was mandatory just like all the other questions ensure the participants shared all the insights and thoughts they have in mind and think would benefit the progress of this project.

Anonymous Online Survey on Educational Tools for Students.

Form Description: This project aims to identify students' challenges and needs in their education and how they perceive using AI and digital tools for learning. Your responses will help guide us in improving a potential solution to better meet your needs. Thank you for participating!

Q 1. What program are you studying? Please specify the program name.
[Short answer]

Q 2. What is your gender? [Multiple choice]

- Female
- Male
- Other:

Q 3. How old are you? You may provide an approximate age if you prefer.
[Short answer]

Q 4. What subject(s) do you find most challenging to learn? Which ones do you find to be easier? Please explain what makes them difficult or easy for you. [Long answer text]

Q 5. What are the biggest challenges you face when studying on your own?
[Checkboxes]

- Staying focused - Finding resources - Understanding content
- Motivation - Other:

Q 6. What methods have you found or you think could be helpful to overcome these challenges? [Long answer text]

Q 7. Do you feel like lessons/lectures are enough for you to understand the subject? Or do you have to study it again on your own to understand the content? [Long answer text]

Q 8. How do you feel about your teachers and their teaching methods in general? Feel free to share your perspective and provide any insights you have on the educational system as well. [Long answer text]

Q 9. What digital tools or applications do you use for studying? Please list as many as you can think of. [Checkboxes]

- Video platforms (YouTube, Khan Academy, etc.)
- AI tools (ChatGPT, DeepSeek, Copilot, etc.)
- Search Engines (Google, DuckDuckGo, Brave, etc.)
- Scientific Databases (ACM Library, PubMed, Google Scholar, etc.)
- Other:

Q 10. Do you think AI tools help you improve your learning experience? Why or why not? [Long answer text]

Q 11. Have you ever felt distracted by social media platforms or entertainment apps while studying on your phone, tablet, or laptop? Please share how so in "Other/Övrigt". [Checkboxes]

- Yes
- No
- Other:

Q 12. If there were an educational focus-oriented device with AI chats and all the applications needed for studying without social media platforms or entertainment applications and sites, would you use it? Why or why not? [Long answer text]

Q 13. Is there anything you would like to share regarding your studies? Feel free to write whatever it is on your mind. [Long answer text]

4.1.2 Survey Results

There were in total 12 responders to the survey, eight of them are female and four male. Their ages were in the range of twenty to thirty years old. The programs they are taking are a mix of high school studies and Komvux, pharmacy, civil engineering and bachelor of science in building and construction engineering, information security, pedagogy, history, political, and society sciences. The exact answers can be found in appendix A.

For question four: what subjects the students find most challenging and easy to learn, the answers indicated that students have very different opinions on whether calculation or social sciences are most difficult/easy to learn.

The answers indicating that mathematics, physics, and chemistry are challenging were explaining that it is hard to work with numbers, to find a relation between theory and real life, and because these subjects involve a lot of formulas and problem-solving which makes it hard to understand the concepts and apply them correctly. The answers pointing to these calculation sciences as easy were saying that they are simply easy to understand, they just make sense, and that they are practical.

The answers about societal sciences were pointing that they are challenging because the students need to memorize a lot of details and that it's theoretical. The students who liked these subjects clarified that by saying that they have a natural interest in them, and that they are exposed to world maps and how politics works in games.

When it comes to learning languages, one participant said that they know many languages and often speak different languages within their family, another wrote that languages are easy to memorize.

The biggest challenges students face when studying on their own were staying focused which got eight votes, motivation with six votes, understanding content with three, finding resources with two votes, time with a vote, and forgetting to take breaks with a vote.

The methods students find helpful to overcome these challenges are to listen to music, take their ADHD medication, use AI, have a studybuddy, use the Pomodoro technique and flashcards, and watch educational videos.

Whether students feel like lectures are enough to understand the subject or if they need to study on their own gave quite varied answers. However, nine of the students indicated that they have to repeat the content and study on their own in order to understand it, and three were saying it depends. One student wrote that it's enough to learn language during lessons but social sciences requires them to practice on their own, in other words that it depends on the subject.

Students have different views on how they perceive their lecturers teaching methods. Some say they're pleased when teachers are enthusiastic about the subject and get creative and use e.g. Kahoot. Some prefer practical work in projects but get overwhelmed when teachers go through way too many slides in a short time. Time pressure seems to be a mutual and frequent problem that students face. This is furthermore confirmed of what students shared in the last question where one stated that "balancing work and study and personal life is very difficult". Additional challenges are that students feel like teachers don't care or assume students already know the subject.

Almost all of the participants, eleven out of twelve, use AI chats for studying, nine use video platforms, five use scientific databases, and four use search engines. Some students even followed by writing that even their teachers use AI. One participant wrote that schools should adapt to using AI to facilitate understanding the subjects for the students, stating that "We should instead put more time on applying what we learn on our daily life/ work life in order to get the most of our education."

Ten out of twelve students feel like they get distracted by social media platforms or entertainment software when using their devices. This is being confirmed by question twelve when a student wrote "distraction is killing my time".

4.1.3 Survey Results Analysis

There were significantly more female responders than male in the survey. Since gender was not a key variable in this study, the uneven distribution is not expected to have influenced the overall findings. Yet, it can be taken away to ensure the survey is spread out to more male responders in the next iterations to make sure the voices are spread out across different genders.

The age range and programs indicate the participants were mostly students in Komvux and universities. The project aimed originally to include students from different ages, meaning younger students in elementary and high schools as well. The answers still provides valuable insights into how students engage with digital focus tools and what challenges they face, though future research would benefit from including younger age groups to see if the findings are similar or if new insights would be brought to light.

There were completely different answers on what sorts of subjects are most challenging or easy. It was anticipated at the start that calculation subjects would come as most difficult as Programme for International Student Assessment (PISA) results in 2022 showed a decline in mathematic scores in Sweden [5]. However, from the survey responds students seem to have difficulties in different subjects for different reasons.

Staying focused and motivated is one of the challenges that a majority of respondents are struggling with. These two variables, focus and motivation, are essential factors for efficient study and learning sessions. Students later in the survey indicated that they are getting distracted by entertainment platforms, which is most likely the cause to their struggling with maintaining focus.

The consequences of using social media and other digitally distracting platforms in developing ADHD-like symptoms as was earlier discussed in 2.1 Digital Benefits and Distractions, could be one of the reasons to why very few find lectures enough to understand the subjects. Most responded that they have to study the subjects again to understand them. This could also be the cause to students having difficulties maintaining a healthy school-life balance, which could be the reason to the overly usage of AI tools. GenAI tools are quick and direct in their answers so many students are using them to gain high-quality answers in a remarkably short time.

4.2 Choosing Challenge

This step in the design process is about listing all the issues found from the students' answers in the user study, that is without suggesting solutions. Each problem is written on a digital post-it non-hierarchically and completely randomly, and is presented in figure 4.1.

Students differ widely in what subjects they find difficult or easy, their reasons for it are also different, whether they are personal or environmental. Keeping focus and avoiding distraction is a struggle many students are facing, the big amount of study materials and lack of time is also another factor making them feel overwhelmed. This can be one of the reasons students are leaning towards using AI tools, to gain time and reduce the pressure on themselves. Each of these challenges was written individually on the sticky notes in the figure below.



Figure 4.1: Challenges and Needs Written Separately on Sticky Notes.

The next step to find a suitable area of a challenge and focus on it is to map and categorize the notes, this was done digitally as shown in figure 4.2 below. The matrix normally has two scales, important/less-important and excitement/boring. The scales typically cross in the middle, like a plus (+), but since all the aspects the students mentioned are in fact important, the horizontal scale was moved downwards to indicate that. For the horizontal scale, exciting was thought of as something that can be worked on within the scale of this project, and boring was considered as something more difficult to control or affect. This idea was inspired by Richards in his book, *The Behavior Gap*, where he noted that the focus area should be the intersect of things that can be controlled and things that matter [33].

Important to note is that just because clusters were made and it's clear that the focus area will be on the most important and exciting cluster, the first one on the top right in the figure, does not mean that as the other needs and challenges will not be considered when designing a solution in later stages in the project.

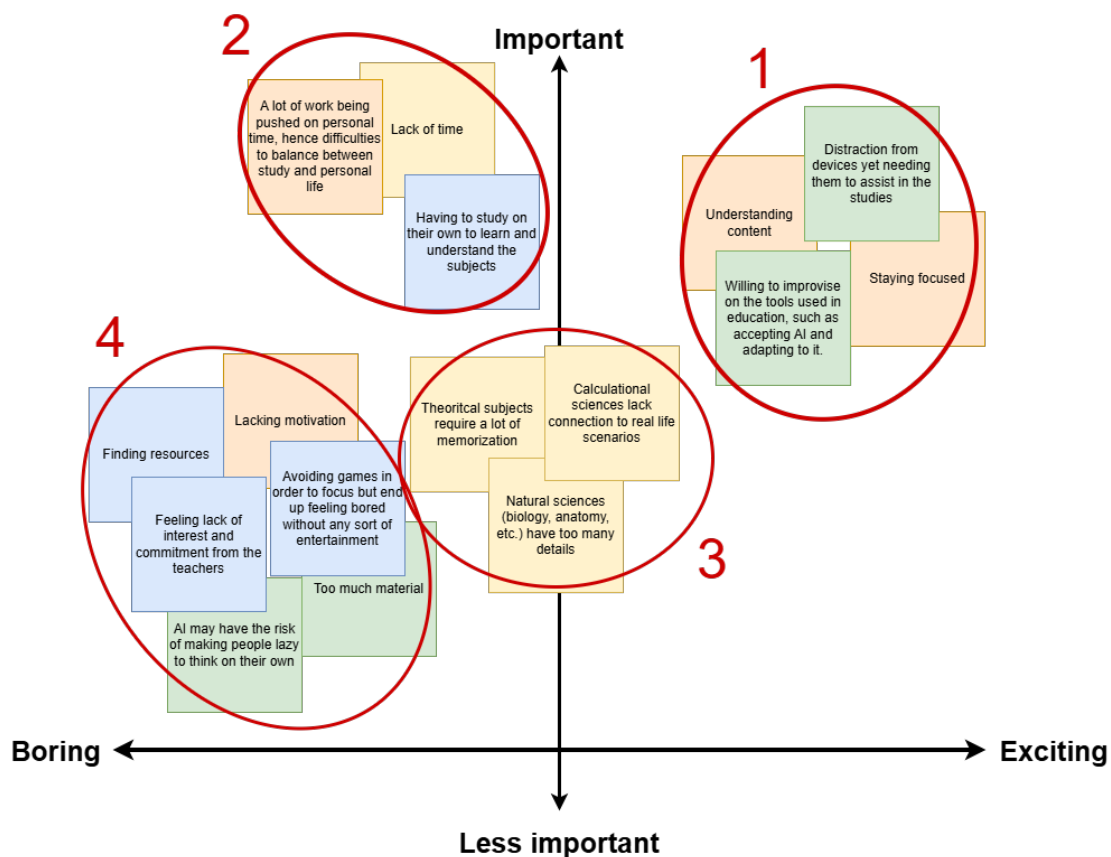


Figure 4.2: Challenges and Needs Mapped and Categorized into the Matrix.

The first cluster was deemed to contain the challenges that are the root causes leading to the challenges in the secondary ones. Being able to focus while simultaneously gaining the most out of the digital tools to enrich the educational experience, would be the leading challenge this project will focus on. Understanding the content is a crucial point not just to pass grades but to actually learn the content of the scientific material presented in schools.

The second cluster concerning time pressure issues, can be an indirect symptom of students not being able to focus which leads to them spending even more time studying. These concerns are incredibly important as they are affecting not only the students' educational journey but also their personal life and health.

Regarding the cluster 3 in the middle, these too were individual opinions of the students and how they feel about different subjects. Seen from the survey, different students had completely different opinions on the same subjects, possibly a consequence of environmental factors like their parents' jobs and interests and how they get affected by them, or their teachers explanation methods, or if they have personal interests in certain subjects.

The cluster on the bottom left, number 4, is there as these challenges are somewhat difficult to affect directly. When it comes to personal factors on the students side, their reasons for studying, their motivation for it, and their educational experience or how they view it; these factors are very individual and unique to each student. It's safe to assume that they are complex to influence as they are not easily changed by external interventions, like teachers or system changes. Moreover, many aspects can be affecting the students motivation, taken as example: family, home life, neighborhood, and community environment. However interesting, exploring these influences would require a separate studies.

4.3 Defining Research Questions

This research aims to explore the following questions:

- How can a dedicated learning-aid device be designed to support students' ability to maintain focus when studying?
- What core functionalities should a learning-focused device include to effectively support learning?

As the project aims to help students benefit from the digital educational tools available, the solution has to be some sort of digital device. The question then is how such a dedicated focus and learning aid device affect the students and how effective is it. However, before being able to test that part and evaluate it, decisions have to be made on what functionalities the device should have, hence the second research question.

The methods in which these questions will be researched are user testing, interviews, and surveys. Before that, ideating a solution and prototyping it is a necessary step for the evaluation afterwards.

4.4 Ideating

Ideation is the source of human endeavor [15]. When talking about ideation, imagination is the foundation of that process. A quote on the importance of imagination follows below, stated by Albert Einstein [13]:

Imagination is more important than knowledge. For knowledge is limited, whereas imagination embraces the entire world, stimulating progress, giving birth to evolution. It is, strictly speaking, a real factor in scientific research.

The process of transforming ideas into reality is challenging, and only a few ideas successfully make it through [15, p. ix]. Ideation isn't just wild brainstorming, it's a structured mindset that focuses on improving things and turning ideas into action. This mindset was kept both during the ideation phase, but also in the step after when one of the ideas was chosen to continue the project with.

4.4.1 Brainstorming

As a solo brainstormer and worker on this project, I took my time thinking about the problem and remembering a few partial ideas that kept coming up through the years of working and volunteering as a private teacher and coach while observing the students and their behavior and thoughts. Many students either shared that they were distracted by their devices but couldn't put them away as they needed them for their studies, or actively got distracted by the notifications on their phones during the classes.

This reflective and independent approach aligns with the ideas presented by Anton and Nordell in "Me, Myself & Ideas", who highlight that effective solo brainstorming allows individuals to draw from personal experiences to generate original and authentic insights [3]. A few ideas brainstormed are discussed below. The design and technical details are briefly mentioned as these will be researched in a deeper level on the final chosen idea.

4.4.1.1 Interactive Desk Mat

The first idea was a smart, foldable, and touch-sensitive desk mat that supports focused learning by subtly integrating study tools and feedback into the workspace as shown in figure 4.3. Instead of using screens, it turns the flat surface or desk itself into a study place. This product will be specifically educational and the intention for the design is to be for learning purposes.



Figure 4.3: An Interactive Desk Mat.
Illustrative Image Created with Assistance from ChatGPT (GPT-5.1 Thinking).

4.4.1.2 EEG Headband

The second idea was a wearable headband that monitors concentration levels using electroencephalogram (EEG) signals during study sessions, as illustrated in figure 4.4 below. The headband can show how long the user has studied and maybe show a happy emoji when the user has reached their goal for the day but then resets the day after. There are many applications built with the same concept.

The information isn't meant to be showing on the band itself. The reason for that is mostly privacy but also that the user can't see the band as it's worn on the head to gather signals from the brain. The user would probably not want their progress or lack of it to be displayed for everyone to see wherever the band is being used, home, at school, or other public spaces. Instead, an application in the phone can work as part of the set and will show these information. The data can include how long and how much the mind had been highly active and focused.

There will also be settings as part of the application for the user to control, like what the goal is and for how many hours the students aims to focus daily. The set can also identify environmental factors like time of day and location that correlate with focus lifts and dips. It can also show progress over time with comparative analytics. Another possible idea is to allow tagging study sessions by subject to see which topics require more and less cognitive effort, and for the student to know how much time they has spent on each subject.



Figure 4.4: A Wearable EEG headband.

Illustrative Images Created with Assistance from ChatGPT (GPT-5.1 Thinking).

4.4.1.3 Study Pad

A more thorough idea of a device, a study pad was ideated and is presented in figure 4.5, and as a storyboard in figure 4.6. These figures were created in Diagrams.net, formerly Draw.io, which is a web-based diagramming application used for creating mind maps and other visual representations. It's referenced in Endnote at the end of this chapter. The idea is a device that can be used to open educational and scientific applications and websites, and to take photos of questions and send them to an AI chat.

The device contains three main parts, an output screen where data or answers get presented, a writing and drawing platform where the text, symbols, or signs the student draws is shown, and a keyboard with a gate button to specific scientific symbols to use to write questions and input for the chat.

There is Bluetooth and a AUX plug for listening to the read-aloud functionality, this was mainly added for students with dyslexia, a disorder that affects the brain's ability to process written and spoken language [18], but can also be used for students who prefer a text being read out aloud to maintain focus on the subject.

The colors have to be chosen in a way that takes consideration to color-blindness. There's a side pen that is meant to facilitate using the device to draw instead of write, especially helpful for students with motoric difficulties.

The front side of the device is made of a touchscreen to make sure any future updates and upgrades of the functions in the device can be implemented. Such improvements might come from after-market-release analysis and could be special needs requested by teachers, students, and other users of the device who are in need of accessible functions such as a voice-controlled input function or multi-language support. These and other possibilities can be implemented in the device over time but it's important to make sure the device keeps its main purpose, an educational or self-assisting tool designed to maintain focus on the subject at hand and to avoid any distractions that come with regular multi-purpose devices.

The user can choose to login to the device or use it anonymously. Logging in can open up for new feature possibilities such as tracking improvements and personalizing answers. If each student got their own personal device, it would be easier to sign in one time than if the students had to borrow the device for each lesson or lecture and constantly repeat the cycle of login in and out.

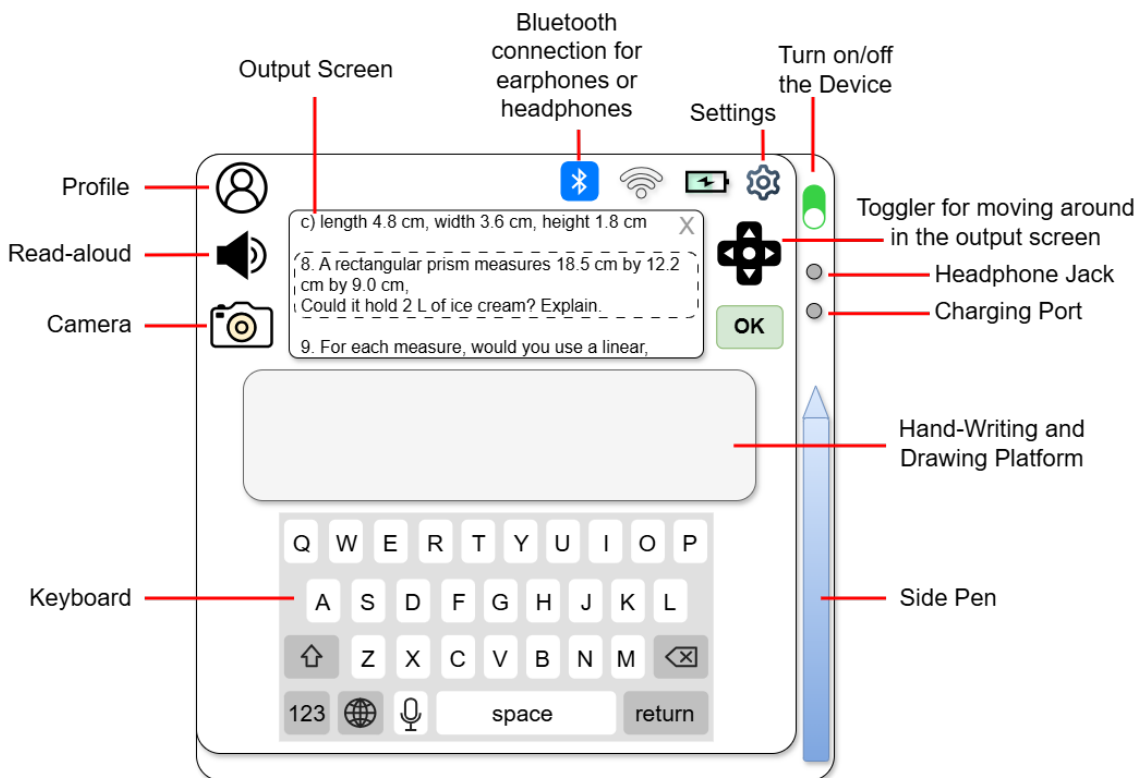


Figure 4.5: A Sketch of the Initial Concept of the Device.

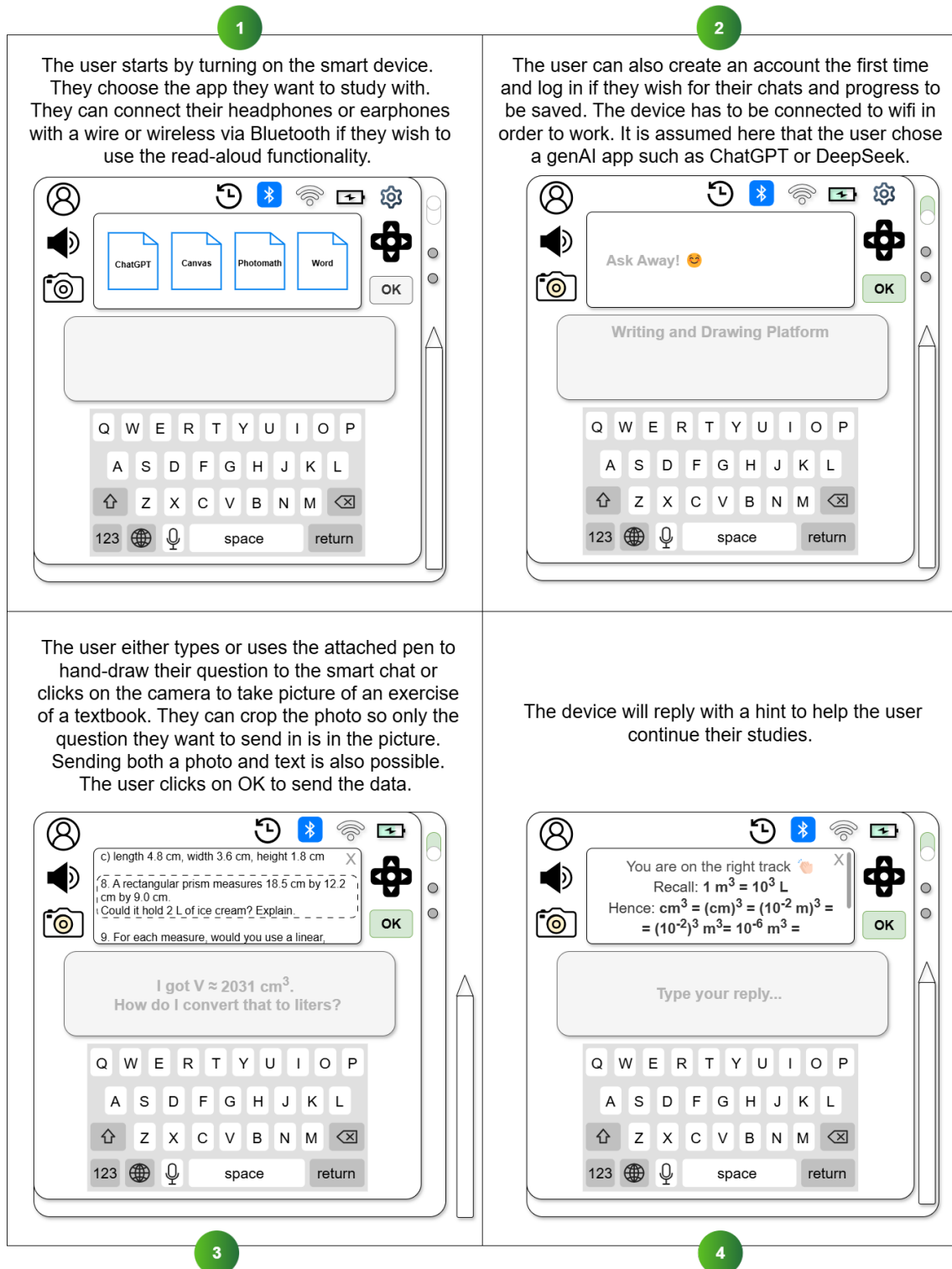


Figure 4.6: A Storyboard of the Initial Concept of the Device.

A thorough review and critical evaluation of every idea was carried out to refine and strengthen the concepts.

4.4.2 Reflective Practice

Sridhar wrote in his book a couple of questions to help unlock the real power of ideation as he states it, one of these is: "Is this the best we can do?" [43]. This question guided the process of reflecting upon the initial ideas created earlier in the reflective practice of each as described below.

4.4.2.1 EEG Headband

Starting with the EEG headband, this concept already exists in many applications. "Forest: Focus for Productivity" and "Focus Plant: Pomodoro Forest" tell the users to avoid using other applications during their focus time. When the user has achieved their goal, they will be granted with water and sprouts to plant and grow plants. So a gamified solution of the same concept already exists.

Moreover, there is a risk which signals the device would interpret as focusing, as the user might be focused on studying or focusing on a game, and the signals might mix up, so the reliability is not optimal.

Additionally, the level of technology where a digital headband that reads brain signals accurately is not reached yet, EEG in medical circumstances for example require a more complex setup to read and measure the electrical activity of the brain.

Comfort is another factor to be concerned about as wearing a possibly tight headband for it read brain signals for longer periods of time can be anticipated to feel uncomfortable.

4.4.2.2 Interactive Desk Mat

The interactive desk mat is an interesting idea yet somewhat futuristic. A completely foldable screen, like how thicker textile can be folded, is still not out in the market. The concept and idea is out there as can be seen on some of the modern devices and how they can fold on certain lines, often in the middle of the device, but a completely foldable textile-like device is still yet to come.

4.4.2.3 Study Pad

Moving on to broadly observing the shape of the study pad, a squared version is not so easy to hold and is not the optimal ergonomic design. That's why phones, calculators and many other devices designed to be held in the hands are rectangular shaped so they can be carried with one hand.

Having a keyboard constantly is taking a lot of space from the screen. Some of the applications like GeoGebra have their own keyboard designed specifically for the application's own functions. Other applications like Google Maps don't exactly need a keyboard all of the time, on the contrast, the user often moves around the screen after typing a location without need for the keyboard. Same thing can be argued for the drawing pad, not all subjects nor applications need a permanent drawing pad so it takes a lot of unneeded space.

The output screen is too small. Many applications and websites need a wide screen for better navigation. A small screen like those in scientific calculators are often deemed to be bothering as the user has to play around in settings in order to see the whole of the graph, or other things in other programs.

Moving around the screen with a directional pad isn't the optimal way to move around a screen intended for educational and scientific software. It takes time and isn't as easy to use as simply scrolling or zooming out and in on a tangible screen. Having many applications and navigating through them with a directional pad is another difficult task.

Moreover, creating a device with a lot of mechanics as in having too many physical buttons, can make it vulnerable to be easily breakable. It's especially risky since the device can be used by kids and young students who are still learning to control their fine motor control.

The two ideas interactive desk mat and EEG headband are interesting but fall outside the main focus of this study. The focus was to help students benefit from digital tools while not getting distracted. Both of the ideas however create additional hardware focusing on the act of studying, but not actually assisting students to learn in terms of content. Therefore, both of the ideas will be set aside for now and excluded from further exploration in this project. The concentration in this stage will be on the third idea, the Study Pad. Finetuning of the idea will be the next step of designing the concept.

4.5 Focusing on a Possible Solution

The ideation phase threw out some interesting concepts, and Study Pad was chosen to focus on as it is the closest idea to the aim of this project. Modification of the idea was divided into two parts: hardware and software, and are mentioned below. These aspects aimed to improve usability and functionality of the product.

4.5.1 External Appearance and Physical Components

Most of the critique of the brainstormed idea came from the fact that this device aims to integrate most if not all applications and websites intended for scientific and educational purposes. This kind of software is often intentionally built for and used in phones, tablets, and laptops. Hence, a whole remake of the device will be done where it's shaped like a regular portable device that is easy to hold and carry, regardless if it's a mobile phone, pad, or laptop. A strong benefit coming out of this redesign is that users are already familiar with the way these devices are used so intuitiveness and familiarity will come ready with this idea.

Another point that strengthens that decision is that a mechanical device would be quite limited and rigid compared to a digital one with a screen that can be well-protected and more durable. This is especially important since the device can be used by a younger user group which makes it even more prone to being vulnerable. Also, updating a mechanical device would mean creating a whole new version, which uses more financial resources and isn't environmentally friendly. A digital device, on the other hand, can easily be updated with new features and applications.

Worth to mention, just because the device would look like any other regular device, it doesn't mean that it is one. Similarly to the concept of reading tablets, they look nearly like regular tablets, but they are task-focused and have less features which makes them more affordable than regular all-in-one tablets.

4.5.2 Software

Regarding software, it's important to decide on all parts so the whole concept is clear in the prototype for the user evaluation later on. Having a clear software structure also ensures that feedback focuses on how well the device supports studying, rather than risking the participants being distracted by missing or unclear functions that weren't thought of in the design process. Decisions have to be made on what applications and websites are allowed on the device, but also regarding privacy and accessibility aspects.

4.5.2.1 Applications

When it comes to basic software in devices, applications like GenAI, settings, weather, calculator, alarm, these will all be included in the design. Microsoft and Google services like Word and PowerPoint are crucial for education as well, but without the entertainment platforms these companies provide.

Play Store and Apple Store will have to be limited, applications categorized for entertainment like games, communication such as social media platforms, shopping, and beauty will all have to be constrained. However, all educational related software will be in the devices for the students to install when needing them.

It can be argued that some applications do help teach mathematics and other subjects through a gamified way. If these lean more towards games then they have most likely been categorized as entertainment in Play and Apple stores. They would otherwise be categorized as educational and be included in the filtering options. Applications categorized as both can be kept as most gamified educational software are low-paced and not as distracting or addicting as conventional entertainment applications and social media platforms. Moreover, this kind of software can be used by kindergarten and earlier grade levels of elementary schools. Digital educational games also have the benefits of educating and motivating students to extend the range of their ability to learn in classrooms [7, p. xvi], hence the decision to keep them.

4.5.2.2 Managing Web Access

When it comes to web access, browsers play a crucial role in both learning and distraction. The device should therefore provide access to educational resources. Students will be able to use browsers and search engines to look up educational material, scientific articles, and study-related websites. Websites like Khan Academy and Wikipedia would remain accessible for learning. However, access to platforms that contain entertainment, social media platforms, or any content not related to social media will be restricted through a built-in web filter.

4.5.2.3 Privacy

Even though it was argued before in chapter 2 Background, section 2.4.2 Safety, Privacy, and Security, that there's a risk for cameras to be used for bullying and other sorts of harassment, it's not logical to deny that they already exist in all devices carried around by students in schools. Cameras are moreover needed for educational purposes, to take pictures of exercises and other parts of textbooks, notebooks, and whiteboards, and send them into GenAI chats.

Moreover, as no social media applications will be included in the applications, there would be no way to transfer any photos between different students' devices. This would combine in maintaining the benefit of having a camera in the device, and make the classroom a safe place for students to be without worrying about photos of them getting transferred online. Even though social media has its benefits of keeping communication between students, for example if they wanted to have a meeting to work on a project or to use it for activities like studying together as studybuddies, applications like Zoom and Microsoft Teams, are still available for these purposes.

4.5.2.4 Accessibility

Accessibility is an aspect that is included in most if not all modern devices. In settings, the user can use a magnifier and change font size to improve visibility. There are also color-filters for color-blindness, screen-readers and braille, and contrast themes for low vision and light sensitivity. There are other accessibility options for hearing and interaction activities, such as activating live captions, voice access and typing, text to speech, and eye tracker features. There are also many downloadable applications designed to enhance digital accessibility but most of them are already included in the built-in settings.

4.5.3 Designing for Consistent Use and Habit Formation

It is important for the device to include everything students need so they don't have to go back to their personal device just because an application or website they need isn't available in the study device, but also to make sure the software does not include any sort of distraction. This device is meant to be used in the classrooms, at home, libraries, and anywhere else when the students want to have a focused study time while also enjoying the benefits of digital services.

Physiologically, the cues that trigger a habit can start out very specific, as James Clear noted in his book "Atomic Habits" [11, p. 61]. For the device to be used mainly for studying, it can help trigger a habit for students to focus for longer and longer periods as they would take the study device up in calm environments frequently.

In traditional learning environments, knowledge typically flows from teachers to students, with tutors holding the main responsibility for teaching. However, digital tools and interactive platforms might be able to shift this balance and relieve stress from the teachers, allowing students to take a more active role in their own learning.

4.6 Defining Target

This project is primarily designed for students to help them benefit from the digital tools to enhance their studies while making sure they maintain focus on their education and not get distracted by the remaining software that send notifications or simply attract the students to use, like entertainment and social media platforms. Young students, starting from the first grade or even kindergarten, are being taught with digital devices. The device can hence be used by students old enough to be capable of using a digital device.

The target group extends to all users who wish to have GenAI, educational, and work tools, in a separate device used for the purpose of learning, working, and assisting in daily-life tasks. There are many of the younger as of the older generation who need devices for daily-life tasks, but have to actively avoid entertainment and social media platforms if they want to focus on their personal life growth.

These users have tried to purchase and keep old devices as these typically lacked support for entertainment and social media platforms. However, necessary applications to have like banking (e.g. Nordea and Swedbank), payment services (e.g., Swish, Klarna, PayPal), digital identification (e.g., BankID), public transport, e-parking, traveling, online shopping, health (e.g. 1177 Vårdguiden), and many more require newer devices. Not benefiting from these services that aim to save time might complicate life more than necessary, which forces the users back to newer devices. This solution would then might be useful to this group of users as well.

4.7 Prototype Development

Prototyping is a necessary step in the triple diamond design method. It's about creating an early version of a product that shows or tests parts of it [25, p. 14]. This can be anything from a low-fidelity rough sketch of an idea to a high-fidelity fully working model. Prototyping ensures the concept is tested in earlier development stages before it's fully developed, evaluated, and iterated to save time and financial resources.

For this project, it is way too complicated to create a high-fidelity prototype of a device with all the hardware and software development details. Moreover, it might not be of huge importance to develop a device like a phone, pad, or laptop and test it as it is something, safe to say, everyone has and use. The prototyping in this project is more for the concept to be clear for the evaluation phase in the next step. Hence, another simpler way for developing the concept that wouldn't affect the evaluation phase significantly would be more time- and resource- effective to use.

There are several possible ways of doing the prototyping. One is by developing a Figma design that is run on a mobile phone, that would give nearly the same effect as developing a high-fidelity prototype. Figma is a design platform for creating interfaces and graphic designs [44, p. 4].

Another option would be to develop a video prototype using Canva that shows all the details of the device's design. Canva is a graphic design platform that allows designers to turn their ideas into visual content as in photos and videos [30, p. 1].

A third option would be to use a mobile phone and install all educational tools on it while removing any social media and entertainment software and use it as a prototype for the users to try out and study with.

Thinking forward, a video prototype can be used for online surveys and these help gather insights from a higher number of participants in a short time. It is also easier for the users to watch a video describing the concept than having to install Figma and sign up or log in before being able to see and test the prototype. Moreover, it has shown that a generated video supports a faster understanding of a textual scenario compared to static mockups [20], hence it would be easier to understand the concept better with a video describing the idea clearly than a low-fidelity paper prototype. For testing the concept, a usual mobile device, only without the entertainment and social media platforms and websites would also be a suitable solution to start off with as a Wizard-of-Oz prototype.

4.7.1 Wizard-of-Oz Prototype

A wizard-of-oz prototype is about a setup in which a human acts as an intermediary between user and machine [40]. In this case, the wizard will be a mobile device and no human intervention will be done as the whole idea here is measure focus and learning and how it is affected by a dedicated device. A human presence might cause the participants to lose focus possibly affecting the reliability of the test.

The applications have been opened once to check if they needed sign up or log in, and passed these introductory steps so the users would get to access the tools directly during the test to make sure the experiment feels more natural as if the student had already used the mobile device before.

As shown on the first page in figure 4.7 on the left, the folders "Google Services", "Microsoft Services", "School", "GenAI", "Academy", "Quizzes & Flashcards", "Notes", "Focus & Study Buddy", and "Brain Games" with applications suitable for each folder installed in it. On the next page in the middle of the figure, there were applications installed for the subjects: "Mathematics", "Physics", "Chemistry", "Biology", "Languages", "French", "Spanish", "German", "History", and "Geography".

All the notifications were turned off and social media and entertainment platforms removed. Moreover, watch histories, playlists, and everything else not related to education or work or what comes around them, were removed as shown on the last page for YouTube in the figure. The gallery and contacts and any personal information was completely removed, but the account stayed logged in for the applications that need accounts. The reason for that is so the user doesn't spend time on creating accounts or saving passwords but can dive in to using the tools directly.

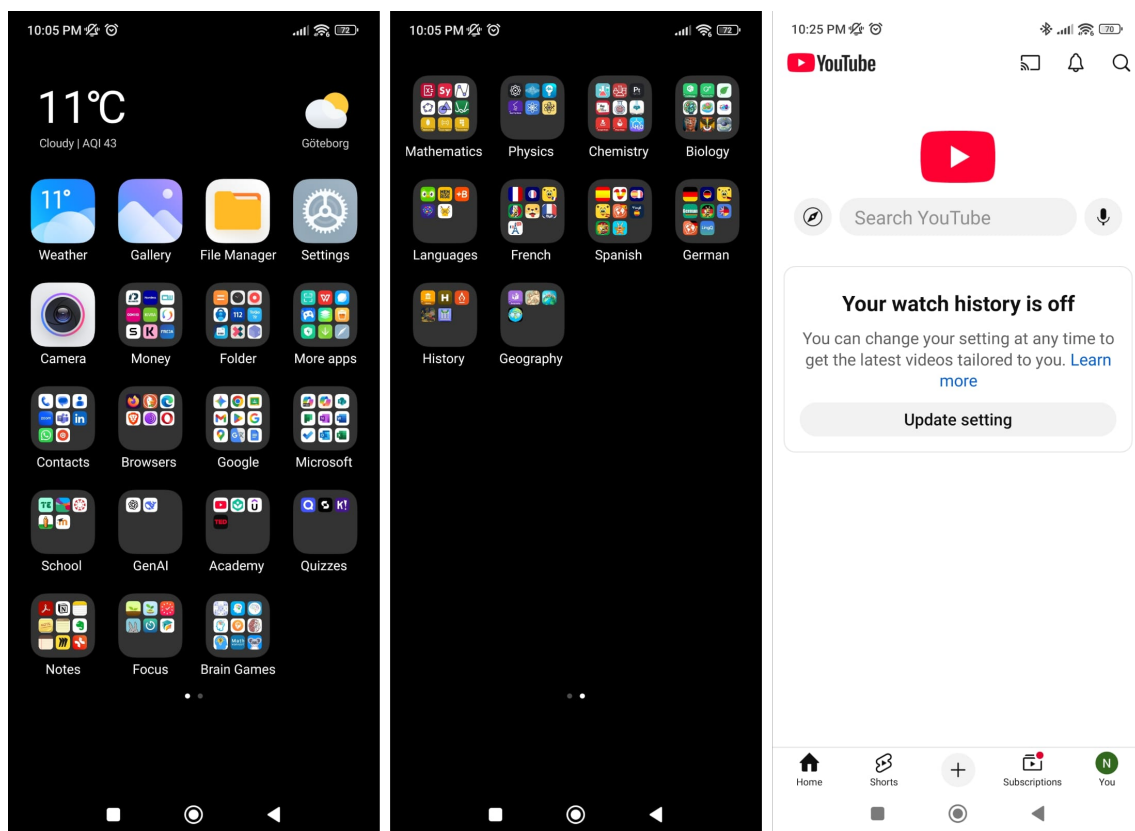


Figure 4.7: Screenshots for some of the Pages in the Study Phone.

The idea here is to make a mobile phone as close to the idea of a study phone as possible. One thing that wasn't changed is how Play Store still gave access to all applications and anything can be looked up in the browsers so this part will have to be explained to the participants.

4.7.2 Pilot Study

A pilot study was conducted to test this idea before developing it further. A pilot study is a small feasibility study that helps researchers see if their planned methods are practical and effective, before starting a larger or more detailed study [4]. It was chosen to do the study with an A/B testing where users get to try the difference between their usual mobile devices and with the one prepared to function as a Study Phone.

4.7.2.1 A/B Testing

The evaluation in this part aims to test how the students would feel about the study phone. The testing will be conducted in a way that users study with the help of their personal phones for 45 minutes, followed by half an hour break, to then study for 45 minutes with the study phone. Before all of that, the user gets to familiarize themselves with the study phone and install all applications they use in their studies that weren't pre-installed.

The thought behind this arrangement is to minimize unreliability factors to the tests. The 30 minutes break for example is to let the participants get enough rest to ensure that any tiredness or boredom of the first trial wouldn't affect the next. As for the 45 minutes sessions, these are the norms for how long lessons and lectures usually are in Sweden, hence it is somewhat a habit for many students to study in that time-frame before taking a break.

There was no observational testing and the students were left to try out this method on their own. This is to confirm that no factors of stress or discomfort are there and that the focus is all of the learning experience itself. To ensure this schedule is thoroughly followed, not too young students were chosen to try this out. More specifically, the participants chosen were a female student in her middle twenties studying the pharmacy program, a male student in his late twenties studying the civil engineering program, and a male student in his early thirties studying and working in the information technology (IT) field.

4.7.2.2 Qualitative Post-Test Interviews

During the three interviews, the users were encouraged to give as much of honest feedback as possible, and to speak their minds about whatever they felt or experienced knowing that others would probably feel it too and how their insights could improve the quality of the end concept. No recording was done to let the users be at ease as much as possible.

No questions were prepared as the interviews were structured to be open-ended where the participant got to tell their experience and thoughts, and the interviewer encouraged the discussion and asked questions to help continue the conversation.

Notes were taken during the three tests and these are summarized for each participant respectively below.

4.7.2.2.1 First Participant The first participant didn't notice much of a difference between the two devices. They explained that they in their personal phone don't have any social media and have turned off all notifications aside from direct calls and messages. As this person already gets many necessary calls that they have to take and has a lot upon their sleeve at work, they simply don't have time for distractions whatsoever at work and hence don't really get affected by the distractions modern devices carry as they have already disabled them.

This participant liked the idea of the study phone and recommended it for students and others who have difficulties letting go of the scrolling habit in social media platforms, for gamers who constantly want to check the progress in their games, and people in general willing to focus on their tasks without constant disruptions.

4.7.2.2.2 Second Participant The second participant was happy with the device and managed to focus without thinking about opening Instagram, SnapChat, and TikTok the whole time. However, they stated that they sometimes delete all applications that distracts them when they need to focus at school. This person doesn't find it too necessary to have a separate phone for this task and feels like it takes away the freedom of choosing what to install and what sites to visit from the user. The participant also mentioned that they feel more comfortable and connected having their personal phone close to them so they can stay updated on what's going on with their friends and the communities they have been enrolled in, and that the device can be muted for absolute focus times.

4.7.2.2.3 Third Participant The third participant's experience was very similar to the former. They liked separating educational material from their personal phone and would have liked if schools gave students their personal mobile phones just like they lend out laptops. The tester also liked that they'd be able to separate personal, family, and friends time from study time and that this separation will help balancing study or work from personal time.

This tester however suggested thinking about some solution to the personal phones as due to inflation, it might be financially difficult for schools to implement this idea. They also mentioned an incredibly valid point, some students use applications like Pinterest and even Facebook and Instagram for inspiration on certain subjects like design and art, disabling them completely would prohibit that, this study phone would hence exclude these students from the user group which is exactly the opposite of the aim of this device.

4.7.2.3 Analyzing Test Results

The last tester's observation about some students needing social media platforms sometimes for educational purposes is an important one. It appears crucial to modify the concept so it takes consideration to this point too.

The first aspect of the marketing meltdown according to Andreas Buchholz and Wolfram Wördemann in their book "What makes winning brands different?", is that there are more products for fewer consumers [9, p. 1]. The need is still there so the question is: what if the solution is to create an educational mode to regular smartphones which would modify the system to limit distractions and create a study-focused environment? Much like the "Kids Mode" or Google's "Parental Controls" feature that adults can activate before giving children their devices so it is only suitable applications for their age range available on that mode of the device.

One risk with this idea is that it might be too easy for the user to switch back to the original mode in their devices and the focus mode wouldn't be of much value in that case. That is however a technical detail and some solution like adding administration controls at schools, parental controls for younger students, and a password requirement to switch between the two spaces for personal use for adult students so they have to actively think before deciding to switch to the main space or not.

Before moving forward with this thought, checking out what already exists in the market is a necessary step. After looking around what different companies provide, it appears that, safe to say, all devices use Google Services who give their users access to "Digital Wellbeing" as shown in figure 4.8 on the left screen. One of the tools provided in that service is "Focus", it is a mode that allows the users to turn off notifications on the applications they select as shown on the right screen in the figure.

Xiaomi has a feature called "Second Space", it's like having two phones with full separation in one device and the user can switch from one user profile to the another. In this case, the main profile can be the user's personal, and the second separate user environment can be setup and organized to contain study or work related software. Apples' iPhones don't have a second space but allows the users to hide certain applications in addition to turning off notifications temporarily in their "Focus Mode". Samsungs' Androids don't provide a second space either but has Google's "Focus Mode" as well.

Worth to mention that for moving between the main the second space in Xiaomi, all it takes is to press a button and a fingerprint which leads to the risk of users easily switching back to the main space where all the social media and entertainments platforms are. One more factor to consider is that users need some applications to be on both spaces, hence they might decide that it's easier to use one space for all their applications instead. Another point is that some users simply haven't discovered this second space in their devices, if their phones have it that is, or focus mode and might be not using it simply because they don't know about them.

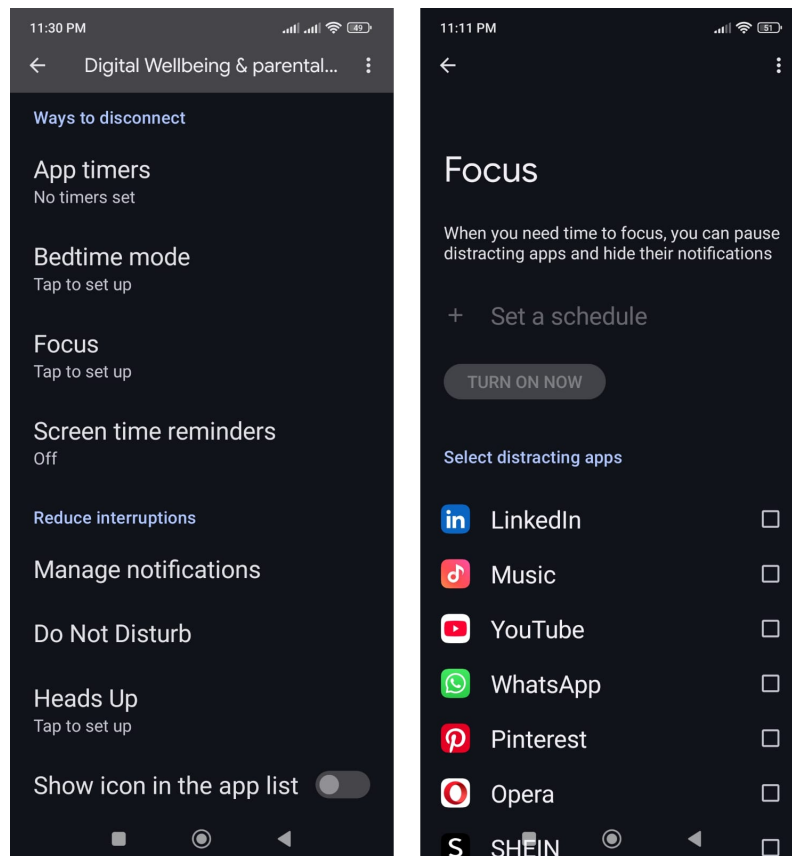


Figure 4.8: Digital Well-being and Focus Mode.

As a similar idea to this project's aim is already developed, that is in Xiaomi as they have a close version to this idea, it is most likely only a matter of time before the other companies implement it as well.

Most laptops have the "Multi-user Operating System" feature which allows different people to have separate accounts on the same computer, in this case the same user can divide their personal, study, and work lives. The other feature most laptops have is multiple windows for one user, and can be used for the same purpose as the multiple user accounts feature. Both of these features can be implemented in mobile phones and pads for the purpose of separating a study space from the otherwise all-in-one space.

This moves us back to the previous idea of having a separate device to be used for education, along with the separate software solution. A graph was created as presented below in figure 4.9 that shows the four possible forms of a digital learning tool, a study phone, pad, laptop, and space. The three on the left are physical dedicated devices, while study space is a software mode integrated in personal devices.

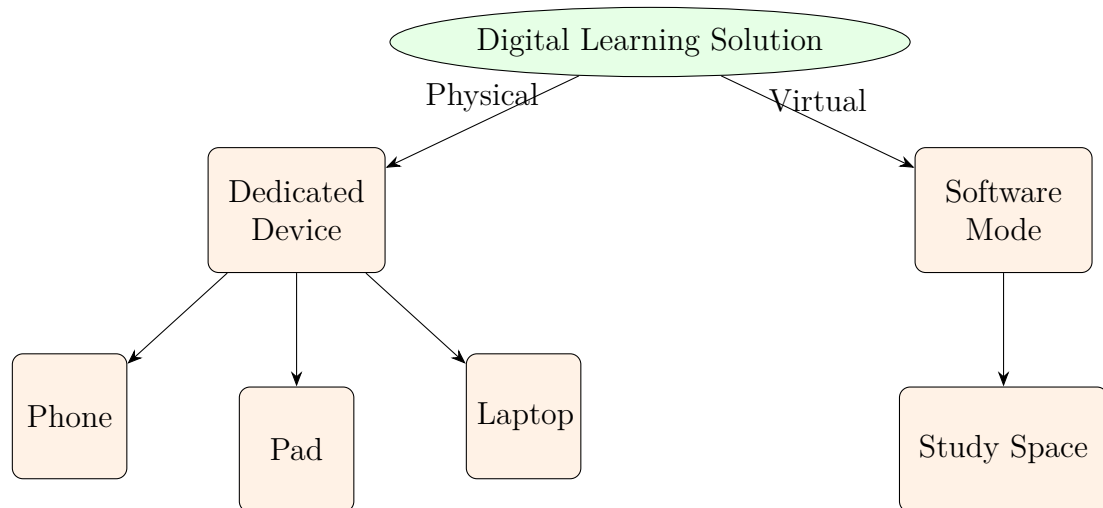


Figure 4.9: Digital Focus Solutions: Device-Based vs. Software-Based Approaches.

The next step would be to conduct a thorough user study on what students would think about these digital tools, starting with creating video prototypes to be used in a survey that evaluates the four concepts after.

4.7.3 Video Prototyping

Video prototypes consist of several components and can be made in different styles. Some of them are commercial videos that show off the product with its features. Some are instructional that describe to the audience how to use the product. Others show a persona or usage case of a user from the target group and how they're benefiting from the product. It is also typical for a video prototype to be produced as a comparison between a user's life style with and without the product. Some videos can come as combinations of different styles.

There are several factors that need to be determined when making a video prototype. Sound is one example, whether to have text being read aloud or music or nature sounds playing in the background [8, p. 59]. Additional decisions are the quality of the video, the choice of filters, whether it's a live-action video or a slideshow video made of sequential images [26].

These and other components will be walked through in this subsection, starting off with sound and content of the video.

4.7.3.1 Sound

The same sound was used for all of the videos, the reason is to keep the music as a background noise and maintain the viewers attention on the content of the video. The music was chosen to be slow and with quieter notes as it tends to be interpreted as calming, or at least neutral [24, p. 90].

4.7.3.2 Content

The video style chosen here is informing and descriptive of the concept. Keeping the content concise and on the point, and the videos short, would keep the viewers attention more than long detailed videos, and help them stay focused on the main points stated and shown in the video.

There are many things that can be told about a concept's characteristics, but it's important to only mention what users would be attracted to hear. Going through every small design choice could make the concept lose impact and make the video confusing and less engaging. It was therefore decided to exclude the study laptop from the videos as it carries the same concept as the phone and pad. The reason to why specifically the laptop was chosen to exclude from the other devices is that students already get to borrow them from schools and that it is mainly mobile phones used for social media and are most likely the biggest reason for digital distraction when studying at school.

The first video is about introduction and problem statement. Its purpose is to set context, explain the problem, explain the need for the participants and their opinions, and state what the project is about and what the research aims to explore. The length of the video is 1 minute and 44 seconds. The narration is presented in the color-box *Video 1: Introduction* below.

Video 1: Introduction.

Scene 1:

VISUAL: Opening shot of a mobile phone on a desk with notebooks.

ON-SCREEN TEXT:

"Ever tried to study and look up something in your phone..."

"But ended up being distracted and spent longer time than intended on the phone?"

"possibly also forgot why you opened it in the first place?"

Scene 2:

VISUAL: A student raising their hand in a classroom.

ON-SCREEN TEXT:

"Ever needed help in the classroom..."

"but the lesson ended before your teacher had time to assist you?"

Scene 3:

VISUAL: A student looking overwhelmed with many notebooks scattered over a table.

ON-SCREEN TEXT:

"Or maybe tried to study at home by yourself..."

"yet it felt like a lifetime to understand the subject and move forward in your studies?"

Scene 4:

VISUAL: A student sitting in a college classroom with many others in the background.

ON-SCREEN TEXT:

"You're only one in many..."

"who are struggling from the same situation."

Scene 5:

VISUAL: A school building and playground.

ON-SCREEN TEXT:

"Schools have tried many different solutions..."

"Many provide students with laptops restricting any distracting software, so the students can't access social media or games."

"Others have prohibited the students from taking their personal phones in the classrooms,"

Scene 6:

VISUAL: A student in a library studying.

ON-SCREEN TEXT:

"Digital devices come with educational software essential for effective studying, and with distracting software..."

"so we have thought of three possible solutions and we'd like to have your opinions."

"You are more than welcome to come up with your own suggestions as well."

The second video introduces Study Phone, its core features, and how it addresses the problem. The length of the video is one minute and four seconds. The narration is presented in the color box "Video 2: Study Phone" below. Pastel background colors were chosen for the three video prototypes to fill in the white empty wallpapers and give a calming effect; this video had a blue-purple gradient background. The narration is presented in the color-box *Video 2: Study Phone*.

Video 2: Study Phone.

Scene 1:

VISUAL: A black-screen phone.

ON-SCREEN TEXT:

"Meet Study Phone, your distraction-free study companion."

Scene 2:

VISUAL: A phone with a black-screen.

ON-SCREEN TEXT:

"It's a focus-oriented mobile phone that is meant to be provided by schools aside from laptops."

"Many companies use this approach; providing their employees with work laptops and phones..."

"so the employees can separate work life from personal life and effectively focus on their work."

Scene 3:

VISUAL: A phone screen showing different folders with educational titles and applications in.

ON-SCREEN TEXT:

"You'll have all the material needed for your studies gathered in one place..."

"so it's easier to keep track of what tools can assist you in learning better."

Scene 4:

VISUAL: A phone screen from Play Store showing educational applications.

ON-SCREEN TEXT:

"Social media, games, and other distracting software won't be accessible..."

Scene 5:

VISUAL: A phone screen showing pre-installed contact forums, Zoom, Teams, and other messaging applications.

ON-SCREEN TEXT:

"but you'll still have access to messaging software so you can be in reach for important situations."

Scene 6:

ON-SCREEN TEXT:

"What do you think of this solution? Feel free to comment your thoughts below."

4. Design Process

The third video is to present the alternative solution of having both a laptop and a phone to just a pad, the "Study Pad". The length of the video is forty seconds. The narration is presented in the color box "Video 3: Study Pad". The narration is presented in the color-box *Video 3: Study Pad*.

Video 3: Study Pad.

Scene 1:

ON-SCREEN TEXT:

"Would having two devices, be distracting in itself?"

"so why have a laptop and a mobile phone, when there is a middle solution?"

Scene 2:

VISUAL: A pad/tablet with a black-screen.

ON-SCREEN TEXT:

"Introducing Study Pad"

"It's smaller than a laptop to easily carry around..."

"and bigger than a phone to read, write, and do everything you need for effective studying."

Scene 3:

ON-SCREEN TEXT: "What do you think?"

The fourth video is to present the alternative solution based on the findings, the "Study Space" software mode, and summarize the research conclusions. The length of the video is one minute and seven seconds. The narration is presented in the color box "Video 4: Study Space". The narration is presented in the color-box *Video 4: Study Space* below.

Video 4: Study Space.

Scene 1:

ON-SCREEN TEXT:

"Speaking realistically, with the global inflation going on, we don't know if the solutions of providing students with more devices us implementable right now..."

"and the environmental impact of producing physical systems isn't optimal..."

"so we had to think of another solution, that doesn't require any additional hardware..."

Scene 2:

VISUAL: A phone screen showing Xiaomi's Second Space.

ON-SCREEN TEXT: "and found inspiration by Xiaomi's Second Space."

Scene 3:

VISUAL: A phone screen showing Xiaomi switching between two spaces.

ON-SCREEN TEXT:

"The idea is a Study Space, that can be accessible in all regular devices."

Scene 4:

VISUAL: A phone screen showing how a Study Space could look like.

ON-SCREEN TEXT:

"It's a space where you can have all your study-related material..."

Scene 5:

VISUAL: A phone screen showing regular applications that people use in their daily-lives.

ON-SCREEN TEXT:

"separated from your other programs on the main screen."

Scene 6:

ON-SCREEN TEXT: "What do you think about Study Space?"

A few screenshots taken from the videos are shown below in figure 4.10. These are to show the visual design used in the video prototypes.



Figure 4.10: A few Screenshots from the Video Prototypes.

4.8 Evaluation

The evaluation's main purpose is to gather the students insights on the concepts and ideas that were ideated and created in the prototyping phase. The four videos created earlier were used in a survey with the goal of gaining feedback on the ideas and gathering insights of new possible ideas that would help students have a more effective learning experience.

4.8.1 User Study

The survey consists of nine questions and are presented in the color-box *Anonymous Online Survey on Educational Tools for Students* below. The exact structure is in the color box below. All the questions were made required to signal for the participants that anything they have to say on any question would be appreciated so they don't skip through questions thinking they might be insignificant if not flagged as required.

The first three are customary questions about what programs the participants are taking, their gender, and age, to ensure there is diversity in the user group. Following is the first video introducing the project and what dilemma it's trying to tackle.

The next three sections are about the three ideas, Study Phone, Study Pad, and a Study Space, with a video and description of each. With each video, a short description of the idea was written to ensure the participants get all the important details enough to understand the concepts and the reason behind the design decisions made. The participants were asked to provide their opinions on each concept, whether it's advantages or disadvantages, and to suggest any improvements they think would make the idea better.

Question 7 involves a comparison of which solution the student think would benefit them most. The aim with this question is to clearly understand what students have in mind when it comes to what tools they think is missing to help them benefit from the digital educational material without the distractions from other programs.

Question 8 is to gain insights on what solutions the students have either thought about, or the ones they would think of in the moment in hope that they got inspired by the concepts presented earlier. The last ending question is to let the students write down any thoughts they didn't find a suitable box for earlier and to encourage them to do so. This way, all thoughts that came across the participants would have had a place to be written in for a maximum quality of gathering information in the survey.

Anonymous Online Survey on Educational Tools for Students.

Form Description: This survey aims to get the students' opinions on the solutions ideated to improve their learning experience and get their insights on possible solutions to be implemented in the educational system. Thank you for participating!

Q 1. What program are you studying? Please specify the program name. [Short answer]

Q 2. What is your gender? [Multiple choice]

- Male
- Female
- Other: —

Q 3. How old are you? You may provide an approximate age if you prefer. [Short answer]

Introduction Introducing the dilemma of digital devices providing educational tools essential for studies, yet also containing many distracting applications that worsen the students' focus and performance in their studies.

[Video 1: Introduction]

Study Phone: The first solution ideated is a separate mobile phone restricting any games or social media websites and applications. Similarly to how schools provide students with laptops constraining access to any non-study or work related material, a mobile phone with the same concept might be beneficial as many students sometimes find it easier to just grab their mobile phone wherever they are and use it to study.

[Video 2: Study Phone]

Q 4. What is your opinion of this idea? Please provide any thoughts you have on it; advantages, disadvantages, and if there are any changes you think would make it better. [Long answer text]

Study Pad: Maybe a mobile phone might be too small to effectively use for all kinds of study activities, like writing and drawing. A laptop, similarly, can't be easily used to take hand-notes and draw on. How about a Study Pad that has all the applications related to your education, and is built to be distraction-free from any notifications and entertainment tools?

[Video 3: Study Pad]

Q 5. What is your opinion of this idea? Please provide any thoughts you have on it; advantages, disadvantages, and if there are any changes you think would make it better. [Long answer text]

Study Space: Some devices, like Xiaomi, have a Second Space that allow the user to switch between two different spaces in the same device. Likewise, there is a feature provided by Google called Kids Zone, where it similarly creates a whole new space with software designed to be safe for children. This inspired us to think about a Study Space, to be used in your personal devices.

[Video 4: Study Space]

Q 6. What is your opinion of this idea? Please provide any thoughts you have on it; advantages, disadvantages, and if there are any changes you think would make it better. [Long answer text]

Q 7. Which idea do you like best? Please clarify why in "Other". [Check-boxes]

- Study Phone - Study Pad - Study Space - None - Other:

Q 8. Do you have any concepts or ideas that would enhance the learning experience of your own? Feel free to write anything on your mind. [Long answer text]

Q 9. Is there anything else you would like to share regarding what solutions you think would enhance your educational journey? [Long answer text]

Flyers with the title "Survey on Educational Tools in Self-Study" as presented in figure 4.11 were sent to students.

These students were kindly asked to fill out the survey and encouraged to write everything that have crossed their mind to have a better learning experience, and to spread the flyer to their fellow classmates if possible.

A few acquaintances were contacted and asked how the female/male range in their programs are beforehand in attempt to spread the survey equally between different genders.

A student in Komvux was asked to answer the survey and send it to her fellow students, another in the pharmacy program was asked to do the same. These two mentioned that most of the classmates they know and have contact with in their respective programs are female.

The other two participants that were contacted were in the cybersecurity and civil engineering program (corresponding samhällsbyggnadsingenjör in Swedish) and these had a majority of male students in their programs. They were also asked to answer the survey and forward it to their classmates.



Figure 4.11: Survey on Educational Tools in Self-Study.

4.8.2 Evaluation Results

There were 15 participants whom answered the survey. Nine of them (60%) are female and six of them (40%) are male. Their age range was between 18 and 34 year old. The exact answers are presented in appendix B.

The educational programs they're studying are a mix of data science, pharmacy, business development and marketing, cybersecurity, civil engineering, history, politics, cognitive neuroscience, game development, aesthetics and narration, and mechanical engineering. It's all from high school and Komvux to bachelor and master programs.

The ideas suggested got different amount of votes. Study Space topped all and got 11 votes (73.3 %), followed by Study Pad with 9 votes (60 %), and lastly Study Phone with 2 votes (13.3 %).

Study Phone got positive feedback mainly on the concept itself of separating personal and educational devices as it minimizes distractions and increases focus. The students wouldn't be able to subconsciously or secretly open social media or other distracting software. Study Phone would also be useful for having a beneficial study session. It's available and easy to carry around and use anywhere. It is also suitable for schools and for parents to provide their children with such phones at all ages without worrying about them getting distracted. A comment also stated that the user would like to have such a phone for their personal use for maximum focus in general.

Study Phone got a lot of reasonable critique. It's not applicable for students who code, program, or design, as they need a keyboard and a wider screen. There's also a risk that students still use their personal mobile phones because they have become overly dependent on having them around as some have even developed attachment to their personal phones so they want to have them close all the time. Students would be having two phones which reduces convenience, they would need to keep track of two phones and not lose them. There is also a cost consideration either for schools if they were to provide the students with these Study Phones, or for individual users to purchase these devices. Moreover, one comment stated that having personal phones Mobile Device Managed (MDM) might be enough of an approach to reach the same results of increasing focus and cutting distractions from them without needing extra hardware.

Study Pad had remarkably higher votes than Study Phone. Some of the feedback for this idea were supportive of it having a big screen. It's good for the eyes, suitable for handwritten notes, drawings or sketching, and scribbling over lecture slides especially if it's pen-friendly and comes with a keyboard. A Study Pad is lighter than a laptop to carry around and easier to use than a phone for taking notes, drawing, using applications, and browsing. Some comments again complimented the concept of gathering only and all educational materials in one place which is great for focusing.

Some of the opposing opinions were on costs, that a Pad would be too expensive. A pad or tablet like a phone is not suitable for coding, unless equipped with a keyboard. Others stated that too much restrictions can get the user to be frustrated, this comment can be counted on the concept itself of restricting all sorts of social media and games.

Study Space was the most preferred idea among the participants. It's a cost effective and time saving solution as the students can just use their personal devices instead of buying new ones. Schools can control these devices instead of prohibiting them completely with all the educational benefits in them, or providing new ones which requires additional hardware costs, by making sure all of them are in the Study Space. It can be in form of policy profiles that schools use to block entertainment applications during classes and lectures.

This also open new doors for a "Bring Your Own Device" (BYOD) policy, which is typically used by companies as they allow their employees to use their personal devices for work purposes, this same concept can be used in school as an addition to the laptops lent out. Some liked the idea of having a second space in general instead of carrying several devices, and to switch to Study Space when studying anywhere. The main concern surrounding study space was on how to guarantee that students don't switch back to the main space. A concern on the concept itself is if the system is too restrictive, then some beneficial applications might be blocked too. Yet that detail was already figured out from the pilot study before that the user can choose what applications to restrict and what to allow in settings and to custom the environment to their own preferences.

4.8.3 Evaluation Result Analysis

The students clearly favored Study Space, the software-based solution meant to be implemented in the students' personal devices. This concept had 11 votes out of 15 participants, which makes for 73.3 %. The second concept is hardware in form of a Pad or Tablet dedicated for education with no distractions or entertainment software was also deemed to be beneficial by many students (9 participants out of 15, 60 %).

The advantage of the Study Pad concept over Study Space is that there is no way for students to go back to the main space and it can be used during classes in elementary and high schools without teachers monitoring the students devices to make sure they are in the Study Space. On the other hand, this same detail can make Study Pad or any other dedicated device too rigid and risks possibly restricting software the students would need.

Another user scenario is when students are using their Study Space but need their personal devices accessible aside for some reason, for example if they are awaiting response from an application or website that is blocked from Study Pad, they can only do that if the two, their personal device and the educational one, are separate. In this case, the students' education would be directly affected as they won't be able to enter Study Space without thinking about existing it to check if the notification they're awaiting has arrived, which would affect their focus significantly.

How it works today is that when students aren't allowed to have their personal phones in the classrooms, they usually ask the teachers for permission to keep them if there is an emergency or something else they are awaiting. Having Study Pad constantly with them would allow them to always study, and they can occasionally request to keep their personal devices when needed.

This whole argument can be opposed if the teachers could enable certain applications on specific students Study Space when they need them during classes, and for students to have control over which applications and websites they allow when self-studying. A feature like this would hence need to be included in Study Space system.

A comparison between the two solutions is presented in table 4.1 below.

Table 4.1: Comparison between Study Space and Study Pad Approaches.

Feature	Study Space	Study Pad
Core Concept	Software mode that creates focused environment on existing devices	Dedicated physical device for educational purposes
Implementation	App or system feature on smartphones/tablets	Separate hardware device
Cost	Low (software-based)	High (requires hardware manufacturing)
Accessibility	Uses devices students already own	Requires purchase of additional device
Distraction Control	Software restrictions	Hardware level isolation
Flexibility	High (can be activated/deactivated as needed)	Low (single purpose device)
Portability	Depends on host device	Dedicated portable device
User Familiarity	Uses familiar device interface	Somewhat new interface to learn
Environmental Impact	Low (uses existing hardware)	Higher (additional electronic waste)
Customization	High (user can customize settings)	Limited (fixed functionality)

4.8.4 Theoretical Reframing

The evaluation showed a user preference for the software-based Study Space over dedicated hardware solutions. This represents a theoretical pivot in the project: rather than designing a new physical device, the focus shifted toward designing a digital environment that uses existing hardware.

Another point that was changed from the pilot studies was the flexibility of giving students choices to block and allow certain applications and websites according to their own educational needs at the time. From the start of the design process, it was thought best to let the system make these decisions but it showed later that the same applications that cause distractions can be used for educational means depending on the students major and what's suitable for their courses.

4.9 Design Iteration

During the last evaluation phase, Study Space was the most preferable idea among the students. The next step is to evaluate Study Space more closely and add contexts to it's concept. Another video specifically on Study Space was created to be used in the evaluation phase following after.

4.9.1 Video Prototyping

A video on Study Space was created with the narration stated below in the color-box *Narration of the Video Prototype created on Study Space*. Pictures of the scenes of the video are presented in figure 4.12.

4.9.1.1 Sound

Regarding sounds, calm and low music was run as background noise during the whole video. The video also included voice-over narration read by a natural sounding female AI agent, suited to the text showing up on each scene. The narration was added to help participants keep focus on the figures displayed instead of reading the texts if they wish to, to generally help them take in the information as it is passively being read-out to them, and to ensure participants with eye-sight weaknesses would have another way to read the information displayed on the scenes.

4.9.1.2 Content

The video started with a brief presentation of the project, before diving in to Study Space. The first thing presented about Study Space was what it aims to do, then what improvements to the educational experience are meant to happen, and lastly how Study Space is designed to be implemented into the main space, how it looks like, and how it's used. The video lasts for a minute and thirty four seconds.

Narration of the Video Prototype created on Study Space.

Scene 1: Opening page on Study Space

Scene 2:

This is a project that aims to help students have better learning opportunities...

Scene 3:

by adding a second study space to different devices separate from the main personal space.

Scene 4: Study Space contains all educational tools students might need...

Scene 5:

without the distractions that come from social media, games, and notifications.

Scene 6: Study Space aims to help students stay focused,

Scene 7: maintain a healthy study-life balance,

Scene 8:

and benefit from all the digital educational tools available, home and at school.

Scene 9:

Following is a brief scenario of how Study Space can be accessed:

Scene 10: Starting from the main screen on your personal device...

Scene 11: there will be a Switch button available.

Scene 12: That button will switch from the main space...

Scene 13: to your personal Study Space.

Scene 14: A screen with all the educational tools will be presented...

Scene 15: according to what subjects the student is taking.

Scene 16: App / Play Store will be filled with educational applications...

Scene 17: all organized into their respective categories of subjects.

Scene 18: Below are a few questions about this invention...

Scene 19: please take a minute to provide us with your insightful opinions.

4. Design Process



This is a project that aims to help students have better learning opportunities...

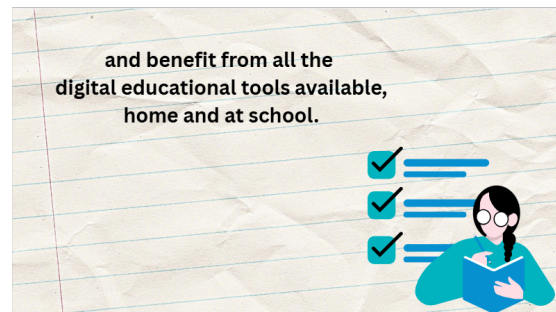
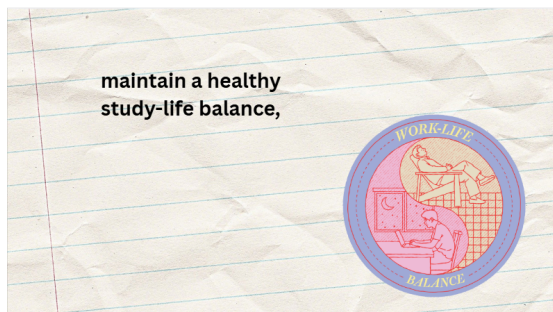
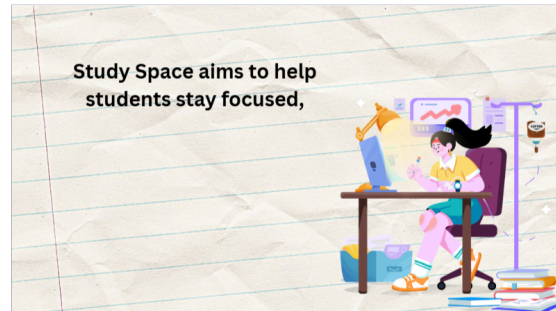
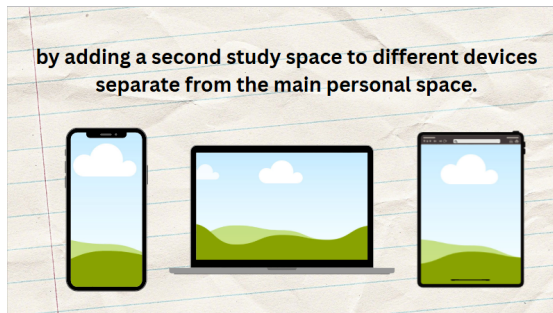




Figure 4.12: Screenshots of the Video Prototype created for Study Space.

4.9.2 Evaluation

The evaluation phase aims to dig into more details of Study Space, how the students think it would affect their educational experience when used in specific contexts. A survey was chosen as the evaluative method to gain as many insights as possible in a limited time-frame. The aim is to gain deeper perceptions on specific parts of the concept.

4.9.2.1 Survey

A quantitative survey using independent variables, specifically satisfaction, importance, effectiveness, focus, and comfort, was created. The survey contains specific questions about the concept to gain more insights on how students think Study Space would benefit them. The questions are stated in the color-box *Anonymous Online Survey on Study Space*.

Likert scales were used for the independent variable in the survey. These are ordinal scales that measure attitudes, perceptions, or satisfaction levels [6]. Likert scales were chosen for this survey as they are easy and quick to answer for the participants, which opens up space for several contexts to be evaluated.

Feedback varied by study context (home vs. school vs. library), this iteration hence develops context-aware versions of Study Space. Starting from creating a table containing the independent variables and different contexts in which Study Space can be used, as shown in table 4.2. These were then limited down to a few questions as not to overwhelm the participants of the survey and risk them leaving without submitting answers or tiring them and have them getting gradually unfocused moving forward in the questions and answering randomly. The chosen parts are colored in yellow in the table.

The variables satisfaction and effectiveness were left to be used for two other important questions. One compares Study Space with the usual main space in devices, in which is more satisfying to use for educational and learning purposes. The other one is about if the study sessions would be effectively benefiting from digital educational tools while reducing distractions.

Table 4.2: Matrix-Style Rating.

Context	Satisfact- ion	Importan- ce	Effective- ness	Focus Improve- ment	Comfort
Individual study at home	[1-5 scale]	[1-5 scale]	[1-5 scale]	[1-5 scale]	[1-5 scale]
Group work at school	[1-5 scale]	[1-5 scale]	[1-5 scale]	[1-5 scale]	[1-5 scale]
Studying in library	[1-5 scale]	[1-5 scale]	[1-5 scale]	[1-5 scale]	[1-5 scale]
Online / re- mote study	[1-5 scale]	[1-5 scale]	[1-5 scale]	[1-5 scale]	[1-5 scale]

Anonymous Online Survey on Study Space.

Form Description: This survey aims to get your opinion on Study Space, a concept aiming to improve students learning experience and educational journey. Thank you for participating!

Q 1. What program are you studying? Please specify the program name.
[Short answer]

Q 2. What is your gender? [Multiple choice]

- Male

- Female

- Other: —

Q 3. How old are you? You may provide an approximate age if you prefer.
[Short answer]

Study Space video

Q 4. How satisfying would using Study Space be for your study sessions compared to using the usual main space on your regular device?

Q 5. How important do you think Study Space would be for maintaining focus among your classmates during group study sessions at school?

Q 6. How effective do you think Study Space would be at benefiting from educational applications while reducing distractions when studying?

Q 7. How much do you think Study Space would improve your focus during individual study sessions in a library or quiet space?

Q 8. How comfortable would you feel using Study Space for extended study sessions at home?

Q 9. Are there any other thoughts / comments you have on Study Space? Feel free to elaborate on your answers above.

4.9.2.2 Survey Results

The answers of the survey are displayed in appendix C. There were 24 participants in total whom answered the survey. 12 of these participants were female which makes for 50 %, and 12 were male equally 50 %. The participants came from different educational backgrounds: pharmacy, intelligent automation, data science, game development, privacy and information security, nursing, web development, system science, civil engineering, bioinformatics, economy, industrial economy, biomedicine, Komvux, substitute teacher, student assistant, cognitive neuroscience, cybersecurity and network administration, and programming. The age range varied between 20 and 57 years but most participants, around 74 %, were in their twenties.

Regarding question 4 on how satisfying students find Study Space when used for studying compared to the usual main space, 11 (45.8 %) participants gave a 5 indicating that it is most satisfying, 9 (37.5 %) participants gave a 4, and 4 (16.7 %) gave 3. A mean is calculated by summing all scores and divided by the number of participants, in this case the number of scores is $(11 \times 5) + (9 \times 4) + (4 \times 3) = 55 + 36 + 12 = 103$. The number of total participants is constant and is 24. The mean then is calculated as $103 \div 24 = 4.29$ out of 5. For the next questions, the mean was calculated in the same way.

The answers are concluded in the table 4.3 below for easier view over the votes and the mean.

Table 4.3: Votes on the Independent Variables.

Variables	1	2	3	4	5	Mean
Satisfaction	0	0	4 (16.7 %)	9 (37.5 %)	11 (45.8 %)	4.29
Importance	0	1 (4.2 %)	5 (20.8)	9 (37.5 %)	9 (37.5 %)	4.08
Effectiveness	0	0	5 (20.8 %)	10 (41.7 %)	9 (37.5 %)	4.17
Focus	0	0	1 (4.2 %)	11 (45.8 %)	12 (50 %)	4.46
Comfortable	0	0	1 (4.2 %)	6 (25 %)	17 (70.8 %)	4.67

The last question on the survey about if the participants have any other thoughts they would have liked to share, all comments indicated a positive expectation with some caution for specific cases and scenarios.

The supporting hopes for Study Space included comments like "yes to anything that stops shorts and tiktok", "helpful", "will be good to click to block tiktok and social media", and "good if everyone could maintain focus all the time during group study sessions".

For the comments that indicated some sort of adjustment of Study Space to suit different usage cases, these were: "good idea but I need exceptions like discord", "I like this idea, just make sure to actually include all applications and websites that can be used for learning and studying. one access denied to something students might actually need can make them use the main space again", "I will use it but same time I donot want to not have any notifications at all", and "good but if I can have some whitelist options for canvas and email".

4.9.2.3 Survey Results Analysis

The rate of female and male respondents was exactly equal in this survey, reducing potential gender-based response bias. The age range concentrating on students in their twenties, and as indicated by the kind of programs they are studying, shows that the participants are mostly all in university level of education.

Study Space is a concept suitable for students of all ages, but insights for the younger generations in primary and secondary schools might have given more insights on specifications suitable for their needs and circumstances.

The educational system prior to higher education is different to after, the primary and secondary education requires the young students to keep a certain behavior at the mandatory classes, with a certain restriction on what devices, if at all, they are allowed to use. That is completely different from higher education, there is no restriction whatsoever on students to bring their personal devices to the classes and use them for whatever they want to, clearly unless disturbing their classmates or the lecture. This distinction can make the educational experience feel different between pre-university and university levels, possibly affecting their needs for learning and creating specific adjustments to their different circumstances.

Regarding the comments that wished to have certain access for their individual learning needs, that part is already sorted out as Study Space is meant to give students permission to allow certain applications and websites when needed, that was however designed to be done using some sort of password to ensure the student has enough time to be aware and make sure they actually need that access for study reasons. That detail in design however was not included in the video of Study Space as all other details in design, the video only contained the main purpose of Study Space with an overview of how it is meant to be accessed and used.

4.10 Deliver

The solution that students felt would benefit them most is Study Space. Therefore, it will be the concept that would be delivered in the end of the triple diamond design method used for this project. A video prototype had already been designed and produced earlier in section 4.9. Design Iteration but this section aims to try and deliver the concept in hope for it to be implemented in our devices. Starting with discussing Study Space, the software solution to be implemented in the personal devices already used by the students, a brief discussion of Study Pad is followed.

4.10.1 Study Space

Study Space can be designed either as a separate software mode like Google's kids zone and Xiaomi's second space, or it can be an administrative application that denies or allows access to certain applications and websites. These two scenarios will be described more thorough below in 4.10.1.1 Separate Educational Space and 4.10.1.2 Restrictive Administrative Application.

4.10.1.1 Separate Educational Space

This is the concept that was used in the Study Space video in the design iteration phase. Study Space would be accessible via a button on the usual main space in the students personal devices. Via password or biometric authentication, the user can switch between the two spaces as shown in figure 4.13. The screen on the left can be considered as the main space, pressing on the blue Switch button will ask for a pre-chosen type of authentication, which will then switch to the screen on the right and vice versa.

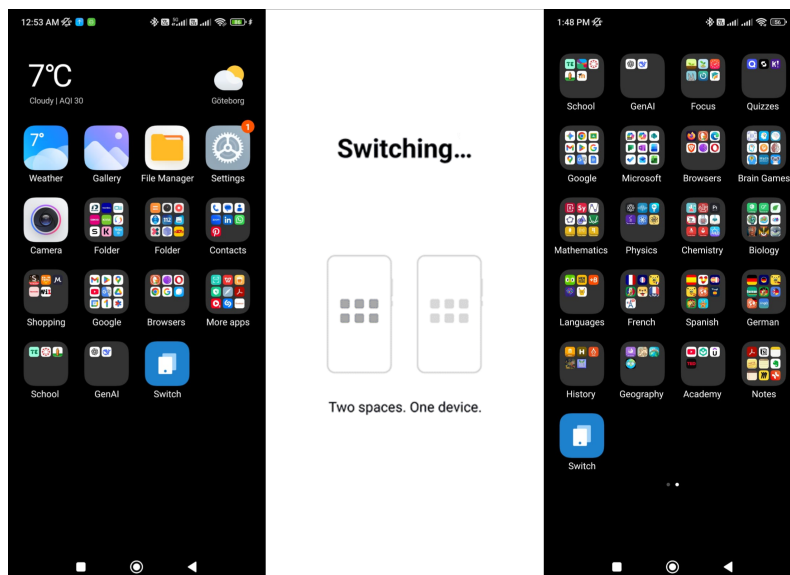


Figure 4.13: Study Space as a Separate Educational Environment.

The risk with this approach is the overly demand on the device in terms of storage and processing power which could impact device performance significantly.

4.10.1.2 Restrictive Administrative Application

Applications that block distracting apps and sites is an idea that already exist in Play and Apple store. This idea might allow Study Space to be in the same space as the students regular zone. The user can schedule blocks during focus time and identify applications and websites that boost or break their focus by seeing how many hours are spent on either modes, applications, and websites. The target group of this concept is students, but the users with access to administrative control can be the students themselves, teachers in classrooms in pre-university education, and parents for younger students.

The students can download and use app-block applications and enhance their focus. Parents can via parental control do the same with the younger students. What remains is for teachers to allow access to certain applications and websites, this feature does not exist today which creates the extreme opinions of either allowing students to have their personal devices in the classroom or restrict them from having them at all.

One approach would be to deny access to all tools teachers don't actively allow access to. The other could be to allow access to all tools instead and let teachers deny access to what they find not suitable or distracting for their respective class. A default option that lets educational tools be available and denies access to entertainment ones, while letting the students ask teachers for permission to access certain applications and websites is also an idea. These options and others can be available when an extensive collaboration with schools and teachers, as well as students and parents is conducted to make sure most if not all needs are covered in the design.

A Study Space concept that gathers all of these qualities in a single application could be a useful tool for students of different ages and backgrounds to benefit from the educational tools on their devices, by maintaining focus when studying and learning and not getting distracted.

4.10.2 Study Pad

Study Pad wasn't far away from being a favorable choice to the students as indicated by the survey. There are two possible scenarios of Study Pad, either for it to be lent out to students by schools or for it to be a commercial device available for purchase in the market.

For the first scenario, schools already borrow out pads for students in elementary schools and laptops for those in high schools.

As for the second scenario, since Study Space can be included in different sorts of devices, mobile phones, tablets, and laptops, it will then already cover the need for a Study Pad or the concept of a dedicated educational device, and also give the users flexibility to have the usual multi-purpose space and the educational one according to their own choice of settings in one device.

If that would turn out to be non-efficient as the younger students might still not be able to focus and switch back to the main space, then a dedicated Study Pad would be worth to consider. In this case, a motivation for such a device would be Kindle, a tablet designed primarily for reading digital books, and reMarkable, a digital paper tablet with a pen included for taking notes and sketches. Both of these took some features of the all-in-one iPads and separated them in other devices. Study Pad would be doing the same, but by gathering everything related to education, without distractions, in one device.

It's worth to consider that a Pad would need a keyboard and pen so it's suitable for coding, writing, drawing, and other activities. Having many separate kits might be an issue as carrying them together and not losing them could turn out to be a challenge for the younger students.

This chapter presented the practical part of the project. The next chapter will present the results delivered in the end of this project with answers to the research questions identified at the start of the thesis.

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5

Results

This chapter presents the results of this project and the findings for the research questions identified at the start of the thesis.

There were two research questions defined for this project as mentioned in 4.3 Defining Research Questions. Throughout the project, these questions were researched and investigated, and the results to each are stated below:

5.1 First Research Question

The first research question was: "How can a digital learning environment, whether hardware or software, be designed to support students' ability to maintain focus when studying?".

Survey responses indicated that staying focused seemed to be a constant challenge among students, 8 participants out of 12, had chosen staying focused as the biggest challenge they face when studying on their own. 10 out of 12 participants felt distracted by social media platforms and entertainment applications and sites while studying on their personal devices. These results showed the need for this project and started the next phase of looking for a solution.

User testing and survey responses indicated that a dedicated learning device would significantly reduce digital distractions by eliminating access to social media and entertainment applications. However, some users expressed concerns about the potential frustration and boredom due to overly restrictive access.

The research began by exploring dedicated hardware solutions and a more flexible software solution, and user feedback pointed toward a preference for the software-based solution. This pivot from device to digital environment reflects a broader design insight: that separation can be achieved through software boundaries rather than physical ones. Thus, the results focused on how a software-based Study Space can create the conditions for focused learning.

Table 5.1 below shows a comparison between the digital tools concepts designed and tested during the course of the project. Students are high-likely prone to being distracted by personal devices. School-loaned devices have the issues of restricting some education materials, while allowing some entertainment platforms which leaves the gap for distractions open. Specialized devices have the issues of being pricey, not all students might be able to obtain these. Moreover, students might need access to certain applications and websites that possibly could be restricted in the dedicated devices.

Study Space offers the flexibility of allowing the students or their parents to choose what applications to have access to during self-study, and administrated by teachers to allow and block certain software in classroom time.

Table 5.1: Comparison between Existing Digital Learning Tools and Proposed Design Concepts.

Feature Aspect /	Personal Devices	School-Loaned Devices	Specialized Devices	Proposed Study Space
Main Purpose	General-purpose	Educational tasks, assignments, school administration	Single-purpose: reading (Kindle) or note-taking (reMarkable)	Educational tools in a distraction-free environment
Access to Educational Tools	Full access via app stores and web browsers	Restricted to school-approved software	Limited to built-in functionality	All educational apps + GenAI but filtered
Access to Distractions	Full access (social media, games, entertainment)	Often limited but default apps (e.g., games) may remain	None (single-purpose devices)	No social media, games, or entertainment platforms
AI Integration	Available but mixed with distractions	Typically restricted / blocked	Not applicable	Integrated GenAI as educational assistant
Portability	Low (backbag-sized) to High (pocket-sized)	Medium (handbag-sized)	Medium	None
Cost	User purchases (high cost)	School-funded	User purchases (medium cost)	School-provided and / or consumer purchase
User Context	Personal life mixed with everything	Schoolwork only	Specific activity only	Study and learning purposes
Customization & Control	User has full control	Admin-controlled, limited user customization	User-controlled within narrow function	Personalization within educational focus
Learning Environment	Chaotic, notification-driven	Structured but often rigid	Isolated to one function	Designed for flow state and deep work

5.2 Second Research Question

The second research question was: "What core functionalities should a focused digital learning tool include to effectively support learning?".

Based on user feedback from the surveys and earlier research in chapters 2. Background and 3. Methodology, the following core functionalities were identified as essential for a learning-focused device:

1. Access to educational applications (e.g., GenAI tools, LMS, subject-specific apps).
2. A distraction-free interface with restricted web and app access.
3. Support for multimodal input (e.g., typing, drawing, voice).
4. Customizable study environments (e.g., focus timers, task-based profiles).
5. Compatibility with school management systems (e.g., MDM, BYOD policies).

These findings were consistent across both the software Study Space and the dedicated hardware concepts.

This chapter presented the results of the project and answers to the research questions. The next chapter will discuss these results and what factors and decisions have affected them throughout the project.

6

Discussion

In this chapter, the user studies conducted in chapter 4 Design Process in sections 4.1 Exploring the Project Area, 4.7.2 Pilot Study, 4.8 Evaluation, and 4.9.2 Evaluation, were discussed. Moreover, the ethical issues that came when conducting this project and future work that is needed to do to deliver final results are also discussed in the sections below.

6.1 Methodological Limitations

Starting off with sections 4.1 Exploring the Project Area, 4.8 Evaluation, 4.9.2 Evaluation, and the user studies conducted there. The number of participants answering the survey were 12, 15, and 24 respectively. This number is quite low compared to the number of students whom their insights is crucial to the results of the project. Moreover, most of the participants that answered the survey were in Stockholm and Gothenburg regions, not spread across the country enough to get varied answers. The age range of the participants answering the survey were 18 and over, which opens questions to how younger students would have perceived these ideas and how their opinions of the suggested solutions, and their suggestions of other possible solutions, would have been.

Another issue that showed to have been somewhat biased with the last evaluation in section 4.8 Evaluation, is that the the two hardware ideas that were presented in the survey are Study Phone and Study Pad of which Study Pad got clearly many more votes. Even though a part of the survey was about asking participants to suggest their own ideas, no Study Laptop was mentioned in the answers. It could be due to a Study Laptop already mentioned in the introductory video saying schools already lend out those. Had there been an idea presenting a Study Laptop as one of the options, it would have been interesting to see if a Study Pad or Study Laptop would be deemed more needed for more effective study sessions and learning experience by the students. A study laptop wasn't initially included in the survey as it was expected for the survey to reach younger participants who already had access to these laptops restricting any tools not related to educational material.

For the user testing conducted in subsection 4.7.2 Pilot Study and specifically the A/B testing there, the participants compared using their personal phones that they were used to, all of them had iPhones, to another mobile phone, Xiaomi, that possibly wasn't customized to their own way of arranging applications and folders which would have given a sense of unfamiliarity. This might have affected their experience of trying out a study dedicated device.

Moreover, as it was only one device prepared to work as a wizard of Oz due to resource-constraints and as the test lasted for almost an hour if not somewhat longer, it was time-consuming to conduct many tests and find participants willing to spend that long of a time on a user study. Additionally, due to the requirement for physical interaction with the prototype device, all testing sessions were arranged to take place in person at agreed locations, rather than through online surveys, which took even longer time.

A challenge faced when conducting user studies earlier in chapter 4. Design Process, was to balance between female and male participants. The surveys were sent randomly to students from different majors, but there were more female responders. Majors with a majority of male students were then targeted to balance out the difference of percentage between the genders, but even then more female responses came. The answers were in the end still tilted to be more of female responses but were balanced out in the last survey. One reason could be that women are more likely to participate in survey responses than men [39].

6.2 User Studies Discussion

The findings from the user studies pointed toward a preference for software-based tools over dedicated hardware, challenging the initial assumptions from the ideation phase that a separate physical device would be necessary for focused learning. This suggests that students value convenience of not carrying more devices and cost-effectiveness over physical separation, raising the question of whether schools should invest in software management over hardware. The low preference for the Study Phone was also unexpected and suggests that the psychological and emotional attachment to personal phones might be a stronger factor than predicted, and that digital habits might be harder to break with a separate device than anticipated.

It's important to differ between solutions that would be provided by schools, those that would be available for purchase in the market, and those that can be implemented in everyday devices. It wasn't clear at the start of the project how the process would go, but it's clear to notice afterwards that this is an important detail to pay attention to.

6.2.1 Tools to be Implemented in Personal Devices

Study Space is a software solution and can hence be implemented into the devices we already use. It can be a feature provided by Play and Apple store, or by Google services such as Kids Zone, possibly extended with focus features already implemented in most modern devices used today. This solution would benefit students at undergraduate and graduate education and would not require any additional cost on the user's level. Moreover, if Study Space were to be added as a feature to the personal devices students use, it would be worth considering if dedicated devices would be needed at all since Study Space would be accessible in different devices from mobile phones to laptops, and serve the same purpose.

6.2.2 Tools to be Provided by Schools

It should be checked what sort of devices are best for the students education to be accessible in schools. In the user surveys, students seemed to prefer a tablet or pad over phones and laptops. An extensive user study is needed to be conducted with young students to check what would improve their studies best. The order, checking with schools and conducting the studies, could also be reversed so the studies and research is done first to possibly prove to the educational authorities the importance of this matter.

6.2.3 Tools to be Available for Purchase in the Market

Students in elementary and high school get to borrow laptops from schools. Students who are in Komvux, taking vocational programs, or studying at universities have to take care of providing themselves with the devices needed for their education. These are the students that would be the target group for a Study Space or separate dedicated devices.

Whether a study phone, pad, or laptop, is the best device to support the student's in their education would need to be tested with this target group. An initial assumption is that it would be a dedicated educational pad. Firstly, there was a clear preference for a pad over a mobile phone in the user survey. Secondly, pads are middle-sized devices, combining the lightness of carrying mobile phones with the bigger screen of a laptop. The pad extended with a digital pen and keyboard will also make it even more suitable for a broader group of students.

6.2.4 Interesting Findings from the User Studies

A few comments that were written in the user studies were mentioned by several participants. These are on the use of AI and about asking for software that already was available in form of applications.

6.2.4.1 Dependence on AI tools

Many students showed heavy dependence on using AI tools to learn and understand the subjects. AI is slowly being integrated into the educational systems in schools. It's considered plagiarism to use AI to write homework and answering exams when open-book, but the content and knowledge is still for the most part being taken from AI tools. Students however, are feeling as if AI should be more accepted to be uses at schools as not all teachers are yet keen on their students shifting towards using AI. Having an educational setup with AI and other tools integrated in it would make it clear what is acceptable to use for education and what not. With teachers being able to prevent certain tools, they can enable and disable access to certain applications and websites according to the subject they're teaching and exercises they're running.

6.2.4.2 Requesting Available Software

Several comments mentioned adding software options to support focus methods like the Pomodoro technique, StudyBuddy, and other motivational and structural methods. However, these already exist in form of applications. What this could indicate is that students aren't able to keep track of the educational tools available in the digital stores, probably due to lack of structure and organization of these tools in the stores.

It can be argued that Apple's App Store and Google's Play Store are more focused on gaming, when opening Play Store the user is presented with four tabs: "Games", "Apps", "Search", and "Books". The name of the store, Play Store, also entitles that. Another insight was noticed in the course DAT585 Responsible Interaction: Theory and Practice at Chalmers, that there are no applications for finance or economy related subjects to kids and the younger students.

In a dedicated educational store however, it would be easier to organize applications in categories so it's easier to explore and find what the students might need in that way.

6.2.4.3 Boredom and Gamifying in Education

Some students commented that it might feel boring to use restrictive devices since there's no entertainment. However, gamifying in education is not a new concept and educational games are common in digital stores. Still, many of them are made for kids, nothing compared to the dopamine-driven feedback loop that comes out of the scrolling effect in social media platforms [19]. Some gamified educational applications for older students is an aspect to be researched in future work.

6.3 Ethical Considerations

Discussing and considering ethics is a crucial factor in educational technology. Digital surveillance and autonomy, socio-economic divide and digital inclusion, environmental impact, and over-reliance on AI and critical thinking from an ethical perspective will be discussed below.

6.3.1 Digital Surveillance

If schools use MDM (Mobile Device Management) or similar tools to enforce Study Space or restrict access, this could be seen as surveillance. If students are prevented from switching out of Study Space, the question is whether this is ethically acceptable if it infringes on their freedom, which might lead to psychological and behavioral impact on the students' side. On the other hand, it could be argued that the students having to take their personal devices with them might be preferred than being restricted of not being allowed to carry them at all.

6.3.2 Socio-Economic Divide and Digital Inclusion

A dedicated device, like Study Pad, may be costly, potentially excluding students from lower-income backgrounds. The same goes for Study Space as it would be integrated into devices different students have. Not all students afford to have modern, quick, and well-functional devices which could create socio-economic classes in the classroom.

Moreover, students with modern devices would have the advantage of getting faster answers and a lower risk of the software glitching which would give advantage over their fellow students when doing homework or open-book exams. The same thing can be said to students who have access to reliable internet and those who don't, that is at home as schools usually provide WiFi-access to their students. Additionally, as the target group extends to students of all ages, the older population might be less familiar with using digital tools.

6.3.3 Environmental Impact

Producing dedicated devices like a study Pad or laptop contributes to electronic waste and increases the demand for materials, manufacturing, and distribution which all have negative environmental consequences. On the other hand, software-based solutions like Study Space use existing hardware. However, there are some technical challenges that might come with adding an additional space to a device. A Study Space environment would require extra storage and processing power. This could impact device performance, especially on lower-end models. Running another space might also increase battery usage, which should be optimized to not disrupt long study sessions.

6.3.4 Over-Reliance on AI and Impact on Critical Thinking

As noted in your user studies, students may become overly dependent on AI tools. There has been some concerns regarding if over-reliance on AI could hinder the development of critical thinking and problem-solving skills.

Using AI might also clash with academic integrity, especially since the educational systems haven't yet coped with the quick development of AI tools. If using AI in learning aligns with school policies on plagiarism and original work or not is another ethical aspect to consider, especially since the solutions discussed in this project all aim to provide access to GenAI and count them as important educational tools.

6.4 Future Work

Future work includes gathering insights from a broader range of the user group, as well as developing a functional prototype to test the concept before releasing it out for usage.

6.4.1 Accessible and Inclusive Design

The user studies have to be conducted in broader demographics. With a larger and more diverse group of participants, specifically including younger students who are the main and primary target for devices provided by schools. Geographical diversity as in including participants from across the country would give better insights into their different settings and needs. Moreover, the proposed solutions must also be tested on a range of disabilities (e.g., dyslexia, ADHD, visual impairments) to ensure accessible and inclusive design.

6.4.2 Market Surveillance

Aside from diversity in the user studies, implementing longitudinal or long-term studies to observe how the use of a dedicated device or Study Space affects study habits, focus, and academic performance over a full semester or school year would give better insights into what solutions are most effective, and gain better feedback from the students on these solutions as they would have had enough time to try them out.

In order to conduct these user studies, development of a functional high-fidelity prototype of the Study Space concept would be needed.

6.4.3 Developing a Functional Prototype

Future work will include adding the functions that were found to be helpful and needed by the students but not implemented in a functional prototype due to time- and resource- constraints in this thesis. The next step would be to construct a mid- to high-fidelity functional prototype and evaluate it in relevant settings, in this case in a school environment but also at home.

A comparative hardware evaluation between a study phone, pad, and laptop, either as the devices separate or a combination of some of them would be needed to determine which form factor is most effective and preferred by students for different usage settings.

Developing the BYOD (Bring Your Own Device) policy would need collaboration with educational systems and schools to incorporate the Study Space concept. This is in addition to the MDM (Mobile Device Management) policy which aims to seamlessly integrate the Study Space concept into existing school systems and tools for easy deployment and management.

6.4.4 Long-Term Future Work

In the longer-term future work, pursuing potential collaborations with tech companies, device manufacturers (Google, Samsung, Apple, Xiaomi, etc.), or educational software researchers and developers to pilot the Study Space would be the first step into getting Study Space out for usage to the students.

This chapter discussed the user studies, ethical issues, and future work of the project. The next chapter will conclude the main points of the thesis.

7

Conclusion

This chapter presents a conclusion and brief summary of the thesis.

This project is about designing and evaluating a digital solution to assist students in their studies and help them have a more effective learning journey. Through an academic study, starting with literature and theoretical studies, followed by a practical methodology using the triple diamond design method as the main working structure, to discussing ethical and environmental considerations, resulted in the Study Space concept.

The Study Space is a separate space to be implemented in regular devices, whether they're mobile phones, tablets and pads, and laptops and computers. Study Space is meant to be a focus zone, where no social media, games, notifications, or any other distracting software available unless actively changed in the settings. This is important to make it a flexible environment and to take away the risk of possibly restricting essential tools for the students education. The students can also choose to be contacted by certain people to not be totally unreachable. However, during exams and studying sessions at school, the devices can instead of being turned off, be managed by the school administration to make sure the students can only access educational material on their devices.

Study Space comes with several advantages, it helps students focus on their studies without getting drawn to entertainment platforms or get distracted by notifications and pop-ups. It also creates a separation between personal and study modes, possibly creating a cognitive separation between free and focus time. It also helps them use the beneficial educational material available on their devices in the classroom instead of having their devices completely prohibited and therefore have them missing a more effective learning experience. The same goes for studying at home, parents can control the younger students devices to make sure they're still in the Study Space instead of prohibiting them for the same reasons.

There are a few challenges to work through in order to implement Study Space:

First of all, the idea needs to reach operational system (OS) providers like Google and Microsoft, or device manufacturers like Apple, Samsung, and Xiaomi in order to be implemented.

Secondly, Study Space has to be implemented at least in the most used devices among the students to give them all the fair advantage of using it. Devices borrowed out by schools that use the same concept could also be a compensation for students who don't own personal devices or well-working ones.

Lastly, integrating Study Space management controls into school systems across different countries would need some work. If this shows up to be too demanding, having Study Space with only the student's control would still be beneficial for them.

7. Conclusion

Schools can continue providing devices with always restricted software to only allow access to educational material.

Future work includes looking into more gamifying software for students to not make Study Space a boring experience, but add gamified learning tools so that the educational experience is more fun and enjoyable for the students.

While the path to widespread implementation presents challenges, the potential of Study Space to transform the student learning experience is significant. This project lays the groundwork for a future where technology is not a source of distraction, but a dedicated partner in education. The future of educational technology is not just about more features, but about smarter and more intentional design, and Study Space is a hopeful step in that direction.

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A

Appendix 1 Answers on the First User Survey

A. Appendix 1

Answers on the First User Survey

Anonymous Online Survey on Educational Tools for Students.

Q 1. What program are you studying? Please specify the program name.

[Short answer]

- Teacher for F-3
- Information Security
- Historia, politik och samhälle
- Kemi 2 komvux
- Gymnasiet
- Statsvetenskap (politik)
- Civil engineering (Samhällsbyggnadsteknik högskoleingenjör)
- Samhällsbyggnadsteknik
- Pharmacy [X4]

Q 2. What is your gender? [Multiple choice]

- Female: (8 votes. 66.7%)
- Male: (4 votes. 33.3%)
- Other: (0 votes. 0 %)

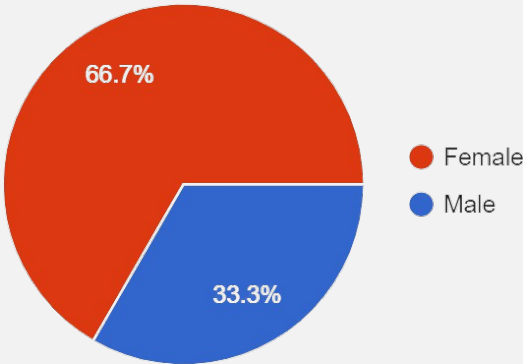


Figure A.1: Participants' Gender Rate.

Q 3. How old are you? You may provide an approximate age if you prefer.

[Short answer]

- 20 - 21 (X2) - 22 (X2) - 23 - 24 - 25 - 26 - 28 (X2) - 30

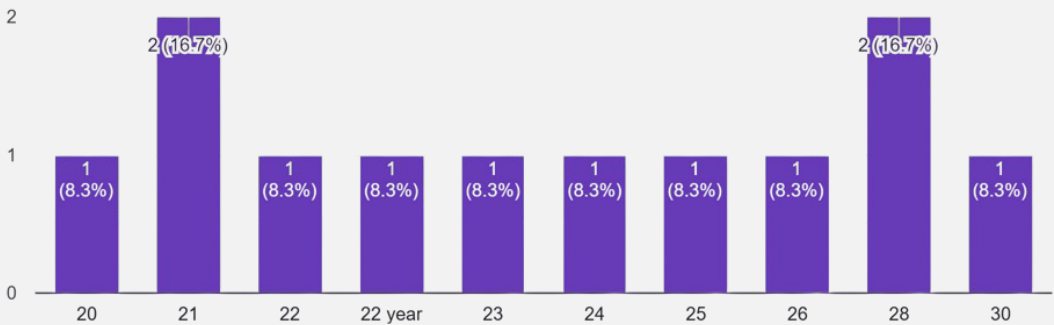


Figure A.2: Participants' Age Range.

Q 4. What subject(s) do you find most challenging to learn? Which ones do you find to be easier? Please explain what makes them difficult or easy for you. [Long answer text]

- Swedish and UVK 1

- hard I'd say advanced cryptography in computing systems alot of math and theory. easy would be programming and incident response in security operations as hands on

- Theoretical subjects are the most challenging I think since we need to memorize alot of details. Subjects with more practical/mathematical things are a bit easier.

- Civics related subjects is generally easier to learn (especially history) because I have a natural interest in it which makes me study this in my free time. Also very exposed to world maps and how politics works in games etc which help make it easier to learn geography and so on.

- I think languages are the easiest subjects for me because I grew up in a family that knows many languages and we often speak different languages with each other. The most difficult subjects for me are physics, chemistry, and math because they involve a lot of formulas and problem-solving, and sometimes it's hard for me to understand the concepts and apply them correctly.

- Matematik

- Svårast - matematik, har svårt med siffror. Enklast - språk, lätt att memorera

- Anatomy is the hardest. too much details.

- Physics because you have to really understand every detail of the theory to determine what formula or formulas need to be used for the question asked. This can be really difficult when dealing with advanced problems. On the other hand I find it easy to understand math it just makes more sense for me.

- Hållfastighetslära för att det är ett praktiskt ämne medan undervisningen fokuserar på teori for some interesting reason.

- Challenging to learn: anything related to maths or physics. I think it is hard to find a relation between information and real life.

- Easier: biology, chemistry. Easy to understand them.

- Pharmacology, due to the big amount of memorization when it comes to medicines names

Q 5. What are the biggest challenges you face when studying on your own?
[Checkboxes]

- Staying focused (8 votes. 66.7%)
- Finding resources (2 votes. 16.7%)
- Understanding content (3 votes. 25%)
- Motivation (6 votes. 50%)
- Other:

My biggest problem is that I forget to take breaks (1 vote. 8.3%).
Time (1 vote. 8.3%).

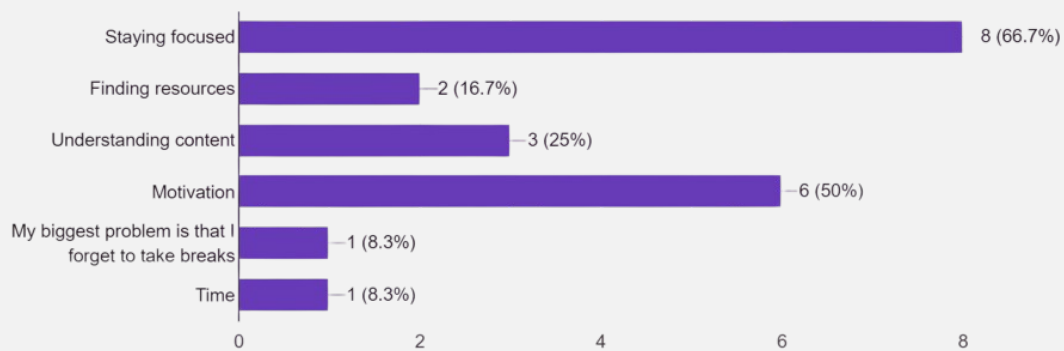


Figure A.3: Participants' Answers on Question 5.

Q 6. What methods have you found or you think could be helpful to overcome these challenges? [Long answer text]

- site/app blockers to kill distractions and focus
- Using AI! Chatgpt explain things a lot moooore easier than most of my teachers! Very helpful!
- Idk yet lol.
- Take my ADHD medication is a good starts :)
- Having a study Buddy, people that push you and pomodoro method. Because of you get more from someone that already knows the answer you will understand the Content more. And you will also feel that if someone could do it then i can too.
- Lyssna på musik
- Pluggar i mindre perioder ex 25 min, 5 min rast sen ytterligare plugg 25 min osv. Små belöningar som man kan ge sig själv för att hålla motivation/ göra saker gjort
- Repeating, flashcards, discussing with other students
- Putting timers
- AI interpreting theory to practice by providing plethora of examples.
- I think I could plan for my studies in a better way.
- Discussing things with AI and following study with me videos

Q 7. Do you feel like lessons/lectures are enough for you to understand the subject? Or do you have to study it again on your own to understand the content? [Long answer text]

- Not so much
- lectures are good but not enough as I need to repeat and see examples and do handson
- Often studying them again on my own to fully understand them.
- Depends on the topic and the lecture sometimes yes sometimes no.
- Sometimes the lessons are enough for me to understand, especially in language subjects. But in subjects like physics, chemistry, and math, I usually have to study again on my own to really understand the content. I need more time to practice and go over the material after class
- Läser själv
- Absolut inte, antingen förbereder man sig innan med att ha läst kurslitteraturen eller kolla igenom pp. Eller så göra man det efter en föreläsning och försöka gå igenom materialet på egen hand
- No it's not enough.
- I need to study and read it again
- Nah lectures are never enough sometimes not even needed to understand anything.
- 50/50

I usually never attend uni so i do study all of it on my own

Q 8. How do you feel about your teachers and their teaching methods in general? Feel free to share your perspective and provide any insights you have on the educational system as well. [Long answer text]

- That's ok
- good in general. project based lectures are good and heavy ppt slides lectures are overwhelming. I hate when some teachers start the lecture with 400 ppt slides and informing that we will go through this quickly during the lecture and details we need to read on our own later on. I think they miss the point here
- Very old methods. There are still many students who sleep during the lectures or do not come at all and study on their own instead.
- But some teachers are more creative by using kahoot for example. Overall, the teaching methods can surely get much better.
- In university or gymnasium or in general? Imo as long as you have a teacher who enjoys the subject he/she teaches they can often make the lesson interesting even if one doesn't have a personal interest in the subject. Enthusiastic teachers imo is important tho some subjects might just be naturally hard like math for me which is not affected by the teacher for me.
- I think most of my teachers are kind and try to explain things in a good way. Some of them make the lessons interesting and easy to follow, but sometimes the lessons go too fast, especially in subjects like math and science. I think it would help if teachers gave more examples and time to practice. In general, I think the educational system is good, but it could focus more on helping students learn in different ways because everyone learns differently
- Har ingen lärare
- Beror på från kurs till kurs, men de flesta lärarna bryr sig inte om om du lär dig eller inte utan de lär ut sen får du ta igen om man inte hänger med eller lär sig från föreläsning/seminarium.
- Not good enough because they think we already know all these things by ourselves.
- It varies some are really good and others just talk and never lets you really understand the deep meaning of what they are saying or writing
- Lecturers feel more to care about filling the boards with as much material as possible without considering if the students comprehend anything.
- Almost all of them do not care if the student actually understand the content or not.
- They're good hut some of them only explain the basics and dont get into the details due to lack of time, so i feel generally that its much more effective to sit and study alone haha

Q 9. What digital tools or applications do you use for studying? Please list as many as you can think of. [Checkboxes]

- Video platforms (YouTube, Khan Academy, etc.) (9 votes. 75%)
- AI tools (ChatGPT, DeepSeek, Copilot, etc.) (11 votes. 91.7%)
- Search Engines (Google, DuckDuckGo, Brave, etc.) (4 votes. 33.3%)
- Scientific Databases (ACM Library, PubMed, Google Scholar, etc.) (5 votes. 41.7%)
- Other:
And books (1 vote. 8.3%)
Ingen (1 vote. 8.3%)

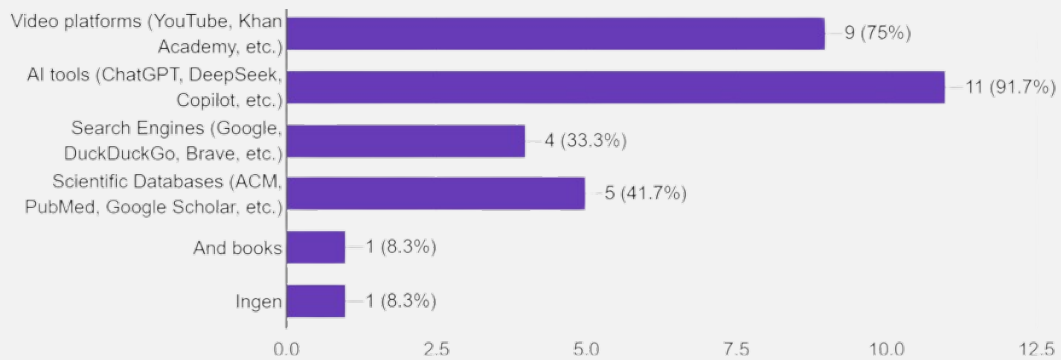


Figure A.4: Participants' Answers on Question 9.

Q 10. Do you think AI tools help you improve your learning experience? Why or why not? [Long answer text]

- Yes

- yes of course . summaries, codes, and save me a lot of time

- Absolutly! I even think my teachers should use them to explain the lectures to the students.

- Sometimes not always but it can help you get better at understanding what's important and what's not important in what you are studying so you can become more time efficient.

- I think AI tools can really help improve my learning experience because they make it easier to find information, explain things in a simple way, and help me practice different subjects. However, one disadvantage is that they can make people a bit lazy. Sometimes we stop thinking for ourselves and just want the easy answer instead of trying to solve problems on our own. It's important to use AI as a tool for learning, not as a way to avoid thinking. In math for exempel i ask chatgpt to give exempels so I can train my brain.

- Ja

- Använder mycket AI för att exempelvis sammanfatta längre artiklar/texter för att lära mig det viktigaste om jag inte har tid. Eller så kan jag lägga in en föreläsning för att be den förklara på ett enklare sätt för att hjälpa mig förstå. Inför tentor lägger jag in kursens material och ber den förhöra mig, lär mig snabbast då

- Yeah, because if i don't understand i can ask it and it will explain to me.

- Yes because you can ask AI to explain to you the things you didn't understand and then let it give you question to solve about this subject

- Yes, AI explaining give usually more details, examples and breaking down theories to base.

- Yes, it explains everything fast.

- Absolutelyyyyyy, they're super helpful. You can keep them explain each thing to you an endless number of times and they can translate texts. you can even do a call with them so you hear the information as well instead of reading all time. More senses —> better understanding

Q 11. Have you ever felt distracted by social media platforms or entertainment apps while studying on your phone, tablet, or laptop? Please share how so in "Other/Övrigt". [Checkboxes]

- Yes (10 votes. 83.3%)

- No (2 votes. 16.7%)

- Other:

Sometimes you get notifications or calls that makes you lose focus (1 vote. 8.3%)

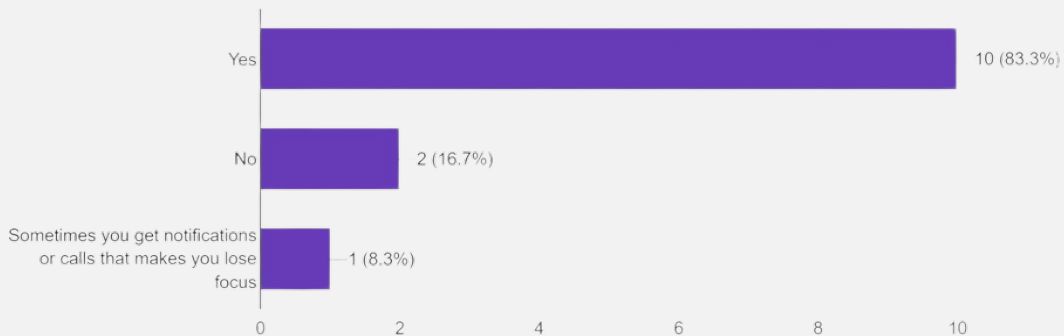


Figure A.5: Participants' Answers on Question 11.

Q 12. If there were an educational focus-oriented device with AI chats and all the applications needed for studying without social media platforms or entertainment applications and sites, would you use it? Why or why not? [Long answer text]

- Google scholar and ChatGPT

- yes that would be the optimal solution as distractions killing my time

- Yeah, why not. There are already many of them like chatgpt, LMnotebook and many other.

- Idk I might try it so see how it is and if it helps or not.

- Yes, I think I would use it because it would help me focus better on studying without getting distracted by social media or games. It would be nice to have all the tools I need for learning in one place, and the AI chat could help me understand things more easily. However, it might also feel a bit boring sometimes since there's no entertainment, so I would probably use it mostly when I really need to concentrate or prepare for exams

- Svårt att avgöra men tror inte finns redan så många sidor/appar

- Maybe. if it's an effective way to study

- Yes because it would minimize distractions

- Of course, a study-oriented device without leaving a room to distraction would be perfect.

- Yes (X2)

- Sureeee, because im an AI person [emoji: rolling on the floor laughing face]

Q 13. Is there anything you would like to share regarding your studies? Feel free to write whatever it is on your mind. [Long answer text]

- No [X6]

- balancing work and study and personal life is very difficult

- The time has changed now and I think that educational methods in universities should also change to the better by both "accepting" the students to use AI (in a good way of course) and the teachers should also accept to use them to better explain things to the students. Why should we read a long scientific article/book when AI tools can summarize them to us in a click and explain the content in a very simple way? (This is just an example). We should instead put more time on applying what we learn on our daily life/work life in order to get the most of our education.

- We are learning a lot about our selves. I would never have known that I could understand or calculate the things I'm doing know

- Nothing more than I rely on my personal tools as AI and such instead of the careless lecturers plan.

B

Appendix 2

Answers on the Second User Survey

B. Appendix 2

Answers on the Second User Survey

Anonymous Online Survey on Educational Tools for Students.

Q 1. What program are you studying? Please specify the program name.

[Short answer]

- data science högskolan i skövde
- Pharmacy
- Komvux
- gymnasiet
- Master program in skövde university - business development and marketing
- Biomedicine Kandidat Skövde University
- Cyber Security Master Program
- Samhällsbyggnadsteknik
- Historia, politik och samhälle
- cognitive neuroscience Master Programme
- Master in games, aesthetics and narration
- masterprogram
- Cyber security and network administration
- mechanical engineering
- Dataspelutveckling

Q 2. What is your gender? [Multiple choice]

- Female (9 votes. 60 %)
- Male (6 votes. 40 %)
- Other: (0 votes. 0 %)

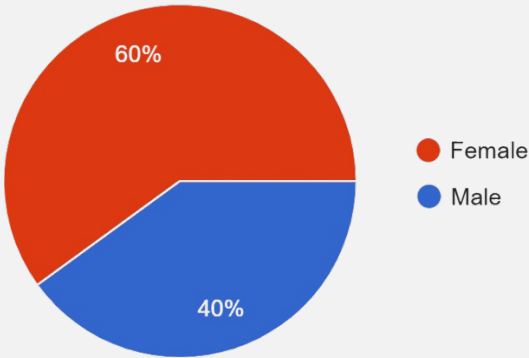


Figure B.1: Participants' Gender Rate.

Q 3. How old are you? You may provide an approximate age if you prefer.

[Short answer]

- 18 - 20 - 21 - 22 (X2) - 24 - 25 (X2) - 26 (X2) - 27 (X2) - 28 - 31 - 34

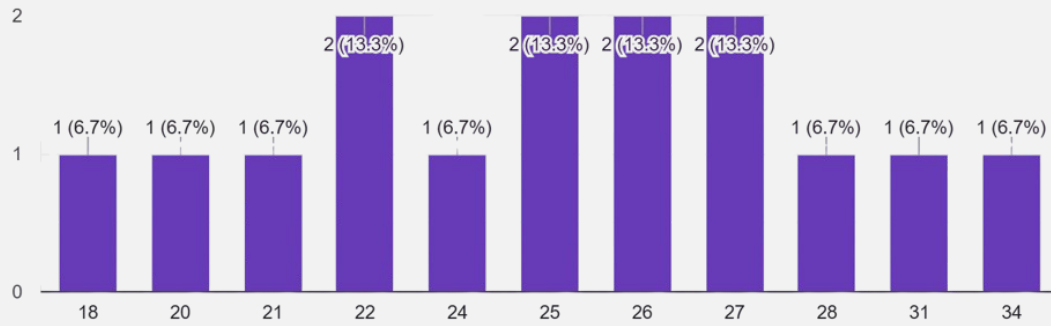


Figure B.2: Participants' Age Range.

Introduction Video

Study Phone Video

Q 4. What is your opinion of this idea? Please provide any thoughts you have on it; advantages, disadvantages, and if there are any changes you think would make it better. [Long answer text]

- easy and small size. issue for me is when coding I need a keyboard and wider screen

- Phones can be useful to study but it's distracting sometimes especially if someone has social media

- **Fördelar:** minskade distraktioner och ökar studiefokus. Lätt tillgängligt och enkel ty använda när som helst. Kan anpassas med utbildningsappar. Passar för skolor och föräldrar kontroll. Hjälper elever att använda sin mobil för studier istället för TikTok och minska skärmtid på distraherande appar. **Nackdelar:** risk att elever byter till sin vanliga mobil för man är så beroende. Elever kan behöva ha två mobiler och drf begränsat användbarhet i vardagen. **Förbättringsförslag:** gör studie app istället för separat telefon. Lägg till fokus timer. Tillåta vissa appar begränsade.

- i like the idea of having a mobile phone without distractions. i think i would buy it for personal use for outside my studies too

- it seems like a phone you get when working in a company. its useful but I don't like having 2 phones :)

- I don't like having a second phone

- I think its a good idea to have phones MDM managed as increases focus and kill distractions. the challenge in my opinion would be cost for devices.

- Gorgeous idea. Would be perfect for having a beneficial study session.

- Seems like a smart way to have students study while not being able to secretly be looking at social media etc.

- easy to carry

- I don't like it

- i feel like this phone would help me be more focused and productive in life in general

- good idea but its still another device to lose. might need a way to remote wipe and mange

- Too costly alternative when the same thing can be achieved using profiles on an existing phone. A phone is usually not used to do work except for to communicate with people or for identification because there are more suitable tools

- no thanks. so hard to do design on a phone

Study Pad Video

Q 5. What is your opinion of this idea? Please provide any thoughts you have on it; advantages, disadvantages, and if there are any changes you think would make it better. [Long answer text]

- great if it comes with keyboard
- Using big screen might be more effective instead of small screen like phones. Good for eyes.
- Passar bra till handskrivna anteckningar och ritande formler för typ om man pluggar fysik och matte. Skapar fokuserad studiemiljö.samlar på alla utbildningsverktyg. Men den är dyr, inte alla har råd, för strikt begränsning gör att man blir frustrerad. Kräver bra med lagringsutrymme . Förbättring: smart penna funktion: pennan omvandlar handskrivet till text, lösa formler. Motiverade funktioner: för varje gång man är fokuserad ger små belöningar.
- a pad is good but a phone is easier to carry around. i need a laptop either way for my programming courses so a phone would be better as a complement
- I like this more .perfect for workshops and taking notes and scribbling over slides
- this fit me better
- this is a good idea as well and I think it would make sense to have this rather than a phone and can be provided with pen and/or mini external keyboard so you have All-in-One.
- I personally use iPad and although for me it's a study-oriented device yet I get distracted very often.
- Seems unnecessary I feel like the iPad or the phone would be enough to do what they are both meant for.
- I'd use this for drawing anf sketchings.
- love it
- an ipad with all the study stuff in it is a really good idea. its light and small so easy to carry in the bag and can be used for taking notes, using apps, browsing osv when studying
- nice to have bigger screen and also for sketching with a pen. i would want read only mode during exams
- better alternative than the phone. cost and durability can be a factor. Would there be some hardware specific modifications which make it suitable for studying or only software?
- yes I prefer this more for UI and sketchings if it pen friendly

Study Space Video

Q 6. What is your opinion of this idea? Please provide any thoughts you have on it; advantages, disadvantages, and if there are any changes you think would make it better. [Long answer text]

- I like this more
- Would be great if the other phones have that different space option
- Lätt o använda. Hjälper elever fokusera bättre. Billigt o tillgängligt för man använder sin enhet. Men elever kan lätt frf byta till vanligt läge. Om systemet e för strikt kan vissa appar nyttiga blockeras.
- i didn't know about second space before. i think having it in all devices would be really great
- also great switch to study space and silent insta and tiktok
- prefer this even better if its a pad not phone and comes with a pen easier for drawings and images
- the challenge with this one how would you guarantee that students will not switch to the personal workspace. otherwise if there is a way to ensure this that students will now switch then they can use there one personal phones BYOD and schools skip additional hardware costs.
- Would be perfect idea and save time. - No opinion on this.
- this idea is more realistic I believe and I prefer this as well as easier to have 1 device rather than carrying two devices and I can switch to the study mode
- love this as well. let me keep the scripts open while muting other distractions
- i think it would be helpful to separate spaces like this. would be great to have a main, study, work osv spaces
- best idea I think. policy profiles that blocks socials. shutoff at the end of class
- The most cost effective and easiest solution but there are challenges regarding what stops the owner of the phone (student) switching back to normal mode?
- also good but I prefer the studypad more

Q 7. Which idea do you like best? Please clarify why in "Other". [Checkboxes]

- Study Phone (2 votes. 13.3 %)
- Study Pad (9 votes. 60 %)
- Study Space (11 votes. 73.3 %)
- None (0 votes. 0 %)
- Other: (1 vote. 6.7 %)

i like studyspace because everyone can use it. u wouldn't need to buy an extra device for studying if youre taking courses outside school especially if your a student and broke

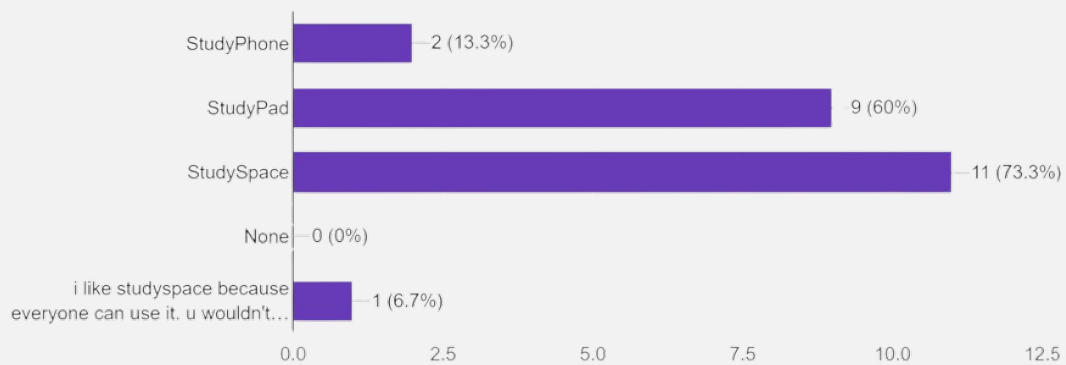


Figure B.3: Participants' Answers on Question 7.

B. Appendix 2

Answers on the Second User Survey

Q 8. Do you have any concepts or ideas that would enhance the learning experience of your own? Feel free to write anything on your mind. [Long answer text]

- collapse columns or close stuff that I don't use for the task i am working on so i keep focus and not overthink
- Set specific time. Taking breaks between. Sleep and eat well also help studying
- Kanske en app eller funktion som hjälper elever att planera sin studietid bättre och påminner om pauser. Det skulle göra det lättare att fokusera och inte stressa
- nej
- team focus room so we put times for focus study
- close myphone and leave it downstairs
- I like the studypad idea if it can be provided with pen and external mini keyboard
- I would agree with the studypad and the space and leave it there cuz that will be all that I need so far.
- No
- sticky note on the screen this is the task I'm doing now and I don't do anything else until I complete what I have on the note
- trello
- nope honestly the ones here are all good
- only having what i need for the task and killing all distractions like when we have a lab, i only open the terminal and docs
- Interactive and problem based learning, learning by doing
- I would say setting timers for each task like a deadline to be completed within and no do anything else during the time period

Q 9. Is there anything else you would like to share regarding what solutions you think would enhance your educational journey? [Long answer text]

- I like the study space as this keeps me in the zone without switching contexts
- I like the ideas here thank you :)
- online synced and can be used offline so everything files saved locally and have cloud version
- nope. I liked the ideas here
- I think the already provided ideas are perfect as they adress a crucial issue among students in its totality and in a wonderful way.
- dyslexia friendly font options
- distractions is a serious problem, its good theres work being done to help students focus better
- No (X8)

C

Appendix 3

Answers on the Third User Survey

C. Appendix 3

Answers on the Third User Survey

Anonymous Online Survey on Study Space.

Q 1. What program are you studying? Please specify the program name.

[Short answer]

- Pharmacy
- master program
- Intelligent Automation (Master in skovde university)
- Data Science Master
- datavetenskap
- Master program Game development
- Privacy & Information Security
- Dataspelutveckling
- sjuksköterskeprogrammet
- webutvecklare
- Systemvetenskap
- Samhällsbyggnadsteknik (X2)
- Master in Bioinformatics
- datavetenskap inriktning systemutveckling
- Ekonomiprogrammet
- Biomedicine
- Komvux
- Industriell ekonomi Skövde högskola
- Elevassistent
- substitute teacher
- Cognitive Neuroscience
- cyber security and network administration
- programmering

Q 2. What is your gender? [Multiple choice]

- Female: (12 votes. 50 %)
- Male: (12 votes. 50 %)
- Other: (0 votes. 0 %)

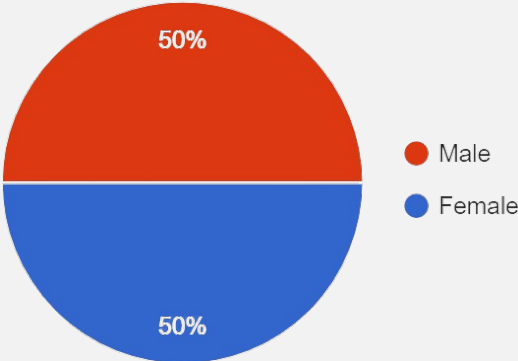


Figure C.1: Participants' Gender Rate.

Q 3. How old are you? You may provide an approximate age if you prefer.
 [Short answer]
 - 20 - 21 - 22 (X2) - 23 (X3) - 24 - 25 (X3) - 26 (X2) - 27 - 28 - 29 (X2)
 - 30 (X3) - 31
 - 54 - 57

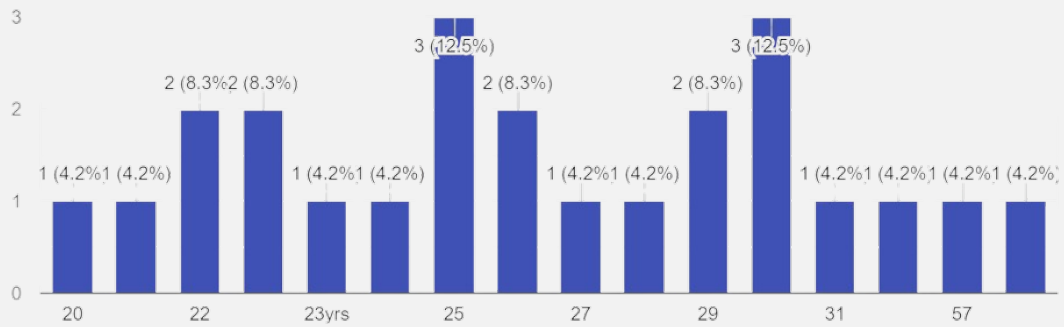


Figure C.2: Participants' Age Range.

Study Space Video

Q 4. How satisfying would using Study Space be for your study sessions compared to using the usual main space on your regular device?
 - 5 (11 votes. 45.8 %)
 - 4 (9 votes. 37.5 %)
 - 3 (4 votes. 16.7 %)

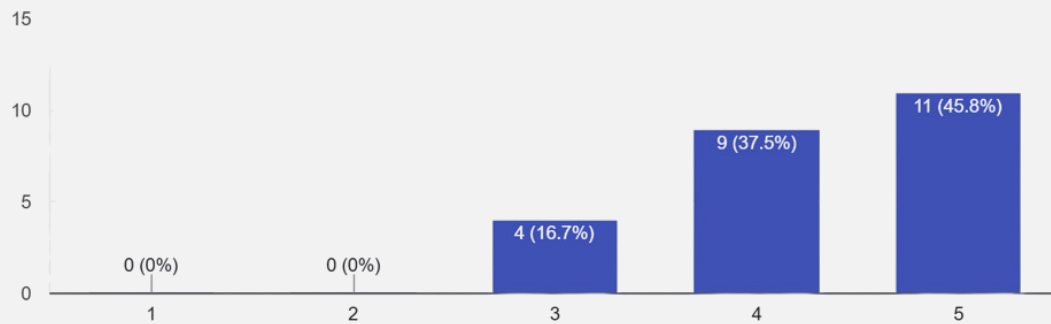


Figure C.3: Participants' Answers to Question 4.

Q 5. How important do you think Study Space would be for maintaining focus among your classmates during group study sessions at school?

- 5 (9 votes. 37.5 %)
- 4 (9 votes. 37.5 %)
- 3 (5 votes. 20.8 %)
- 2 (1 vote. 4.2 %)

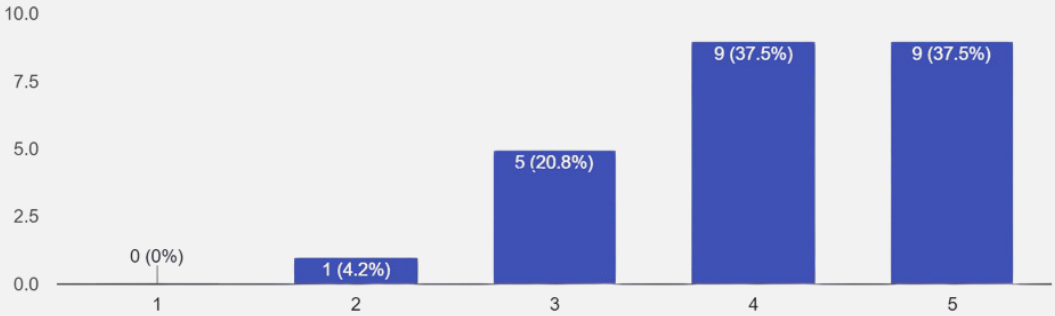


Figure C.4: Participants' Answers to Question 5.

Q 6. How effective do you think Study Space would be at benefiting from educational applications while reducing distractions when studying?

- 5 (9 votes. 37.5 %)
- 4 (10 votes. 41.7 %)
- 3 (5 votes. 20.8 %)

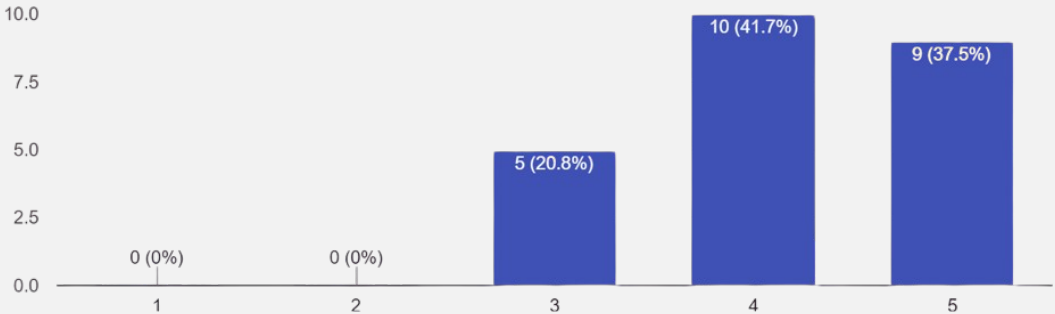


Figure C.5: Participants' Answers to Question 6.

Q 7. How much do you think Study Space would improve your focus during individual study sessions in a library or quiet space?

- 5 (12 votes. 50 %)
- 4 (11 votes. 45.8 %)
- 3 (1 vote. 4.2 %)

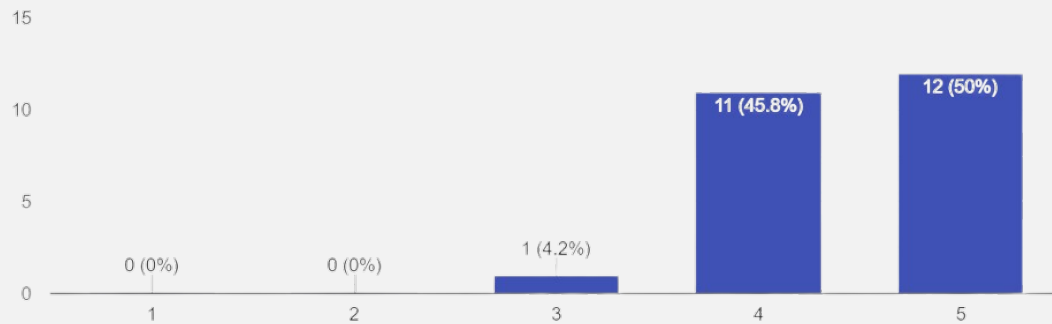


Figure C.6: Participants' Answers to Question 7.

Q 8. How comfortable would you feel using Study Space for extended study sessions at home?

- 5 (17 votes. 70.8 %)
- 4 (6 votes. 25 %)
- 3 (1 vote. 4.2 %)

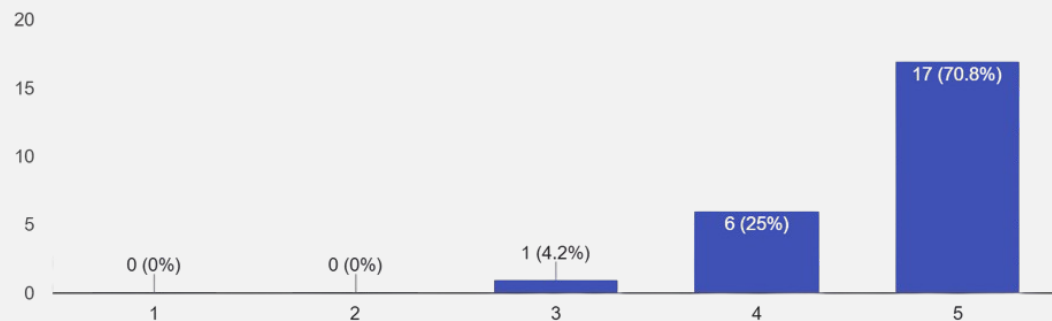


Figure C.7: Participants' Answers to Question 8.

Q 9. Are there any other thoughts / comments you have on Study Space?
Feel free to elaborate on your answers above.

- I believe it is essential for a person to stay away from their phone or any social media platforms and focus on books and sources that can reduce distractions. I also think that changing the study location from time to time can improve the focus.
- I like the idea
- yes to anything that stop shorts and tiktok
- helpful
- I think its a great idea and it will boost productivity alot
- good idea =)
- bra om alla kan hålla fokus utan mobil hela tiden i gruppstudier
- I like it. imean if just tiktok stops I will be happy
- will be good to click to block tiktok and social media
- No perfect idea
- good idea but I need exceptions like discord
- I like this idea, just make sure to actually include all applications and websites that can be used for learning and studying. one access denied to something students might actually need can make them use the main space again
- I will use it but same time I donot want to not have any notification at all
- good but if I can have some whitelist option for canvas and email
- this is a good idea, I hope to see it implemented soon
- This idea will probably boost the educational level greatly. Schools are struggling in how to integrate technology into learning and this idea might just be the right solution for that to happen
- good idea
- great
- I think it should to be very great idea.

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