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Designing a planning tool for courses about sustainability in middle schools

The creation and implementation of a give box station in a school setting



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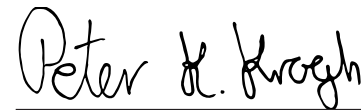
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Abstract

In this thesis, we have investigated the educational aspect for increasing the sustainable awareness and engagement of students in middle school. This is done as a collaboration between us as designers and the Department of Education and Sustainable Change (UBO) as they work with schools in the Copenhagen area. In this, we work with students in middle school as this project aims to develop a course for sustainability by implementing a give box station at the school. Guided by the aims of the City of Copenhagen as political visions seek to implement more Circular Economy for Copenhagen, we find a need to foster more support and engagement in young students for the subject. We developed empathy for the actors in our network through ethnographic methods as we sought to understand their matters of concern. Here we conducted workshops to understand the praxis and problems in the class setting. We found that the current course did manage to motivate or engage students in the program as the problematization phase failed. We found that different students need different methods of engagement to create motivation. As a means to address these concerns, we developed a concept that allows better collaboration between UBO and the teachers. This aims to provide a better foundation for the course and lead the students to better understand sustainability and their role in society. In this process, we have utilized co-design to strengthen the understanding and involvement of the future generation as we seek to problematize and motivate the future citizens of Copenhagen. This project aims at strengthening ways of engaging young actors in schools, as education and learning could be one of the factors aiding in protecting the future of our climate and planet.

Keywords: Sustainable Education, Circular Economy, Participatory Design, Matters of Concern, Staging, Climate Change.

Preface

We would like to thank our collaborators for their collaboration and support during our project. Thanks to Mie Damkjær Geertsen and Aske Emil Ditzel from UBO part of City of Copenhagen for keeping a positive and enthusiastic work ethic throughout the project.

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Thanks to Aalborg University for letting us use their facilities to study and work on the project during the pandemic. Lastly, and most importantly we would like to thank our supervisor Søsser Brodersen for the continuous evaluation and feedback throughout our project. Always positive and full of guidance we appreciate the constructive and fun talks we had with you. Highly appreciated!

Structure of the report

Introduction

In this section, we map our reason as to why we work to address the lack of circularity for the city of Copenhagen.

Problem statement

Our problem statement will guide our efforts as we seek to solve the issue at hand and provide a viable solution that handles the actor concerns in our project.

Methods

Here we present the selected methods used to collect and uncover knowledge in the field.

Theory

In this section, we elaborate on the selected theory used to enlighten the subject matter as we analyze the network and the relations that emerge within.

Desk research

With the methods described in the first section, we dive into the field and collect knowledge as we utilize actors and their knowledge to uncover concerns and problems in the field.

Analysis of empirical data

Using the selected theory we analyze the collected empirical material in order to formulate a concept solution.

Concept development

In this section, we develop our ideas and address how we plan on solving concerns for the project and the relevant actors.

Discussion

As we evaluate our process, we discuss our findings and reflect on the process and our work.

Conclusion

Finally, we end our thesis in a conclusion of our work and address future work.

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Our iterative design process

Throughout our project we have worked within an iterative project form, where we expand our knowledge, organize, refocus and narrow in several steps to reach a final and specific result. Our process has been divergent and convergent through the different phases.

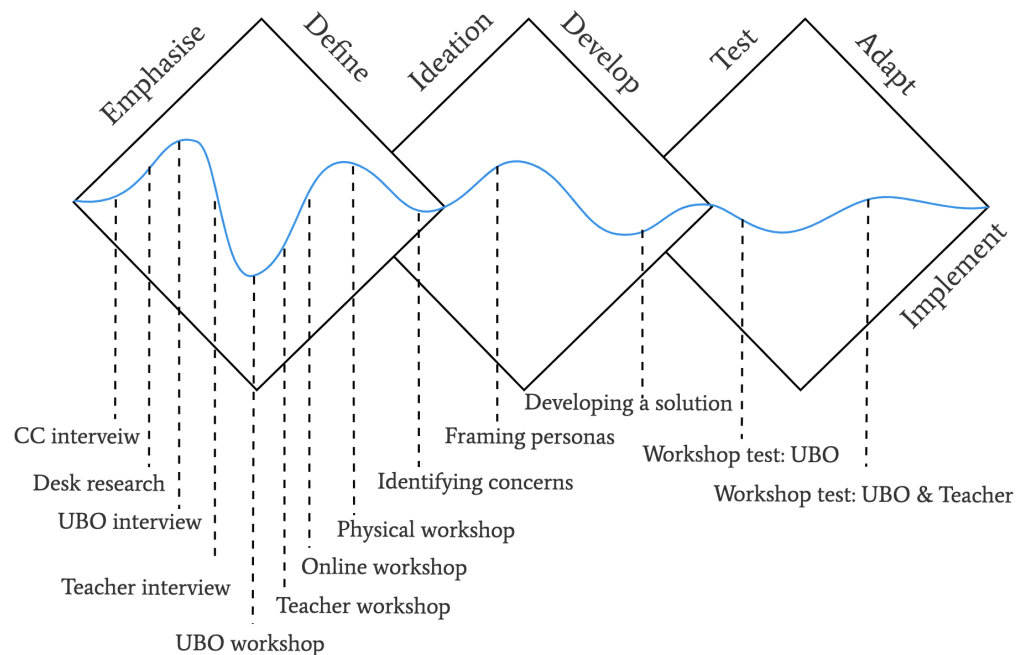


Figure 1: *Our iterative design process*

Taking inspiration in the five phases from Design Thinking and the design process (Brown, 2008) with the phases of Emphasising, Defining, ideation, development, testing, and adaptation, before implementation. As we start with the first phase of emphasizing where we conducted an explorative investigation, opening up our chosen field, aiming to understand its complexity. This is also where we begin with the exploration of the field, meeting the users and familiarizing ourselves with how our actors work and relate. Various techniques and methods were used to understand, structure, and prioritize our collaborative process with participants to develop and clarify their concerns, values, and goals. Next, we moved into a converging phase of defining by analytically challenging the understanding of the problem, formulating, and narrowing in on a more specific area, and formulating a set of requirements for the project. With this set of requirements, our ideation phase began. As we began to generate ideas in the ideation phase. We were then moved into the phase of conceptualizing, prototyping, and testing. All this would lastly lead us to the last step of the delivery of the project in the form of implementation as the solution must stand the test of the real world in the hands of the users. These last phrases are not part of this thesis as the testing phase was initiated just as the hand-in date approached.

This design process includes simple consecutive steps, often overlapping each other. In the same line, our process has not been linear, as we have moved iteratively back and forth around workshops, concerns, and ideas before finally arriving at a more finalized concept solution. This iterative process has provided us with a better understanding of the field and our relevant actors but has posed a challenge as aims and concerns sometimes were contradictory.

Appendix

During our project, we worked with worksheets as a form of knowledge sharing. We have selected the relevant supporting findings. As such our worksheets are attached as appendix and referenced in the text when needed.

AP 01: Interview script

AP 02: Affinity Diagram of interview data

AP 03: Affinity Diagram of Concerns

AP 04: Intro and task document 6.X

AP 05: Persona work

Abbreviation List

- Actor-Network-Theory - ANT
- The city of Copenhagen - CC (Copenhagen Municipality)
- Department of Education and Sustainable Change (Uddannelse og Bæredygtig Omstilling) - UBO
- Design Thinking - DT
- Obligatory Passage Point - OPP
- Participatory design - PD
- Sustainable Development Goals - SDG
- United Nations - UN

Introduction

The waste problem - A lack of circularity

The technological and scientific development has fostered significant economical and global health growth in almost all countries. This development has reduced child mortality and increased life expectancy, resulting in better conditions for survival and prosperity. Subsequently, the global population rose from approximately 1 billion in 1804 to 7,2 billion in 2014. The trend is expected to continue with a further increase to 9,6 billion by 2050 (United Nations, 2013). This population growth also brings more purchasing power, subsequently increasing the demand for more and more resources (Andrews, 2015). The World Bank estimated that the annual global waste production is expected to jump from 2.01 billion tons in 2016 to 3.4 billion tons within the next 30 years (Kaza, Yao, Bhada-Tata, & Woerden, 2018). By this, we see that our global material consumption poses a large and complex challenge, as the need for materials and resources are on the rise, but as they are not an eternal source, we face challenges for the future. As noted in the famous citation of the Brundtland report 1987, "Humanity has the ability to make development sustainable to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs." (World Commission On Environment and Development, 1987, p.16). For this reason, we need to address our consumption and waste handling strategies for our society, finding a way to let each individual take part in lifting the burden towards a better future.

Our consumption of Stuff and Objects

Data from the Danish ThinkTank CONCITO (2017) shows that the average Dane has a yearly CO² emission of 19 tons CO² (CONCITO, Madsen, & Nygaard, 2017). Shown below are the elements that contribute to the collected figure.

Due to our way of life and lifestyle, the Danes are rated to be the seventh most CO² emitting people in the world. On average, our purchases within our category of "Stuff and Objects", items like; cars, electronics, clothes, and other material possessions, are responsible for 5 tons of CO² per person per year. This is almost as high as food and housing emissions combined.

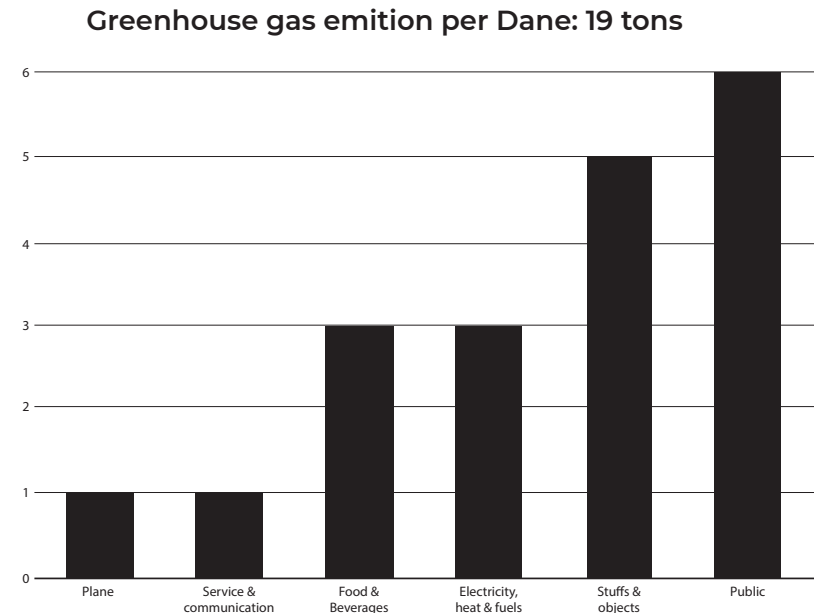


Figure 2: The CO₂ emission of the average Dane (CONCITO, Madsen, & Nygaard, 2017)

Concito (CONCITO, Madsen, & Nygaard, 2017) estimates the global emission per person should be reduced to 2-3 tons per year if we are to limit global warming to 2 degrees by 2050. This points to the Danish lifestyle being unsustainable as it is. It is proposed that it is necessary for us to change our perception of the good life being associated with material wealth and resource consumption, if we are not to jeopardize the hopes of the future generation living a good life on equal terms (CONCITO, Madsen, & Nygaard, 2017).

The City of Copenhagen and the vision of the future

When it comes to resource consumption, the City of Copenhagen is ranked twice as high as the EU average per capita. Every year, 42.000 tons of waste are handed in at recycling stations in Copenhagen. Despite being handed in as waste, a lot of the products and materials are still functional, of good quality, and able to enter in recycling or repair programs (City of Copenhagen, 2019). Even though most materials handed in for recycling are being handled and recycled, there is still a lot of lost potential. The citizens of Copenhagen have limited access to discarded materials in recycling stations, but some stations have established give box stations also known as swapping stations. Here users of the recycling station can place products for others to take, free of charge. This option is frequently used by visitors of the recycling stations. Here individuals can give items away to others or scouting for new useful items or fun new objects that they themselves can use. Observations show that smaller objects are the most commonly placed in the give box station. This includes clothing, books, kitchen tools, and decorative objects for the home (City of Copenhagen, 2019). The report also notes that citizens of Copenhagen are requesting more swapping options, in such, highlighting the need for more give box stations in the city. In the report titled “Denmark Without Waste” released in 2013 (The Danish Government, 2013), the Danish government launched its vision for a resource strategy that focuses on recycling and better waste management. The practice of recycling resources entails that waste has been generated in the first place. The strategies by the Danish government are thus highlighted in the report, illustrated by the six themes below. The report also focuses on the fact that the change must be anchored in society, and in order to

support individuals in actions towards this change. It must be easy to make green choices (The Danish Government, 2015). In the report Circular Copenhagen from 2019 (City of Copenhagen, 2019) different strategies are presented in 6 topics, they consist of;

Theme 1: Increased sorting

Theme 2: Development of sorting opportunities

Theme 3: The Implementation of more give box stations

Theme 4: Copenhagen advances circular economy

Theme 5: Better recycling of business waste

Theme 6: New technological solutions for waste management

Theme 3 and 4, focuses on the development of better circularity, and one subtitle, especially, points to the notion of including the younger generation in the development of better habits and knowledge for the future: 4.5 “Children and youth learning and participation in waste reduction and waste management” (4.5 Børn og unges læring samt deltagelse i affaldsforebyggelse og affaldshåndtering). We find this particularly interesting as the next generation of citizens will be one part of fulfilling the future agenda for sustainability.

Sustainable Development Goals

The Sustainable Development Goals (SDGs) formulated by the United Nations, allows us to frame the global challenges at hand and the visions of working towards a more sustainable future by 2030 (United Nations, 2015). Even though the SDGs are 169 individual goals in no specific order of priority, we look to these as a supportive argument for this report.

We have chosen to work within Development goal 13 *Improve education, awareness-raising, and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning*, and 12 *Ensure Sustainable Consumption and Production Patterns*. As these goals are within the scope of our collaboration partner for the project as it facilitates the focus of the project and aims to guide our contribution.

In order to evaluate the current status of the SDGs, we draw on a source that aims to determine the progress or lack of such, in each of the SDGs (Ministry of Finance, 2017).

In this, we see a strong lack in Goal 12. *Responsible Production and Consumption* and Goal 13. *Take urgent action to combat climate change and its impacts*. This indicates that we need more action and effort in these areas in order to reach the goals for the future.

We also note that sub-goal 13.3 *Improve education, awareness-raising, and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning*, leads us to the educational aspect of taking action for better climate change education, which is also a lacking area (“Transforming our world: the 2030 Agenda for Sustainable Development | Department of Economic and Social Affairs,” n.d.).



Figure 3: SDGs progress & trends (Own illustration inspired by Sachs et al., 2020)

Working with education

Young people present a huge resource as they are key actors in the development towards reaching the 2030 Sustainable Development goals (Ministry of Finance, 2017). Action is needed in promoting and enabling learning environments that foster the involvement and participation of young people as the shaping of a more sustainable world is reliant on us all. Development through education, which aims at informed and competent individuals, can support the future of our society (United Nations, n.d.). As such, the future of our planet is in part placed in the hands of the future generation. With population count increasing across the globe, constructing a sustainable paradigm and a system that can support us now without costing us the future in the process, is becoming more and more pressing.

Our Collaboration Partner

For this project and our thesis work, we have established a collaboration with the “Uddannelse og Bæredygtig Omstilling”, also known as UBO (Department of Education and Sustainable Change). UBO is working with the education of young students in the field of sustainability and their role in the agenda for Copenhagen (City of Copenhagen, 2019). Working within ministerial requirements UBO is currently working within the scope of the Circular Copenhagen report (City of Copenhagen, 2019), as they are looking into supporting the resource and waste plan for the city.

As UBO is a sub-department of the Technic and Environmental Department, they are also funded by this department. The Technic and Environmental Department are working on increasing recycling and circularity for the city of Copenhagen. Here they are working to increase the

circularity of materials and products for Copenhagen and to support the agenda of CC. To this end, they also focus on education and learning about sustainability, as kids are the future citizens of Copenhagen, and thus should be equipped for making sustainable choices and handling the environmental challenges at hand.

UBO works with the formulation, structuring, and expansion of learning offers for kids and students from 0-18 years in Copenhagen (“Uddannelse og Bæredygtig Omstilling,” n.d.). Their work is centered around themes within nature, environment, climate, science, city development, STEM, and UN development goals. This is done by offering learning programs designed to help teachers handle topics that might otherwise be unexplored, providing support and hands-on educational material for the course, thus making it easy to bring education on sustainability and transformation to the school curriculum. Their educational programs focus on the pedagogical, practical, and educational aspects of sustainability, as they are trying to involve and influence schools and students to embrace sustainable agendas. The ambition is to develop competencies and values for sustainability with the ambition of fostering a sustainable future for Copenhagen by supporting the development of its future citizens (“Uddannelse og Bæredygtig Omstilling,” n.d.). As our collaboration partner UBO is working in the framework of the City of Copenhagen, they are taking on the task of constructing and executing a series of hopefully successful projects involving young students in primary school. The aim of these projects is to teach and educate students about the sustainable challenges at hand and to get them involved in the discussion and action towards the challenge. They are currently developing a course designed for middle schools, where students and their

teacher are tasked with building a give box station on the school premises. The idea is for the students in the class to develop an understanding and interest in sustainability. The project also aims at creating ownership for the give box station, with the aim that the station will create a flow of materials between users. This course is rather new and our collaboration with UBO aims at supporting their goals as we work to understand and help them strengthen the course and the solution that they are working towards.

For this project thesis, we work within a collaboration with UBO under the agenda of CC for a more circular economy of products. We are aiming to further push and develop the shared sustainability agenda in Copenhagen by diving into the field of education and the inclusion of young students to lift the future agenda of sustainability. In order to do so, we will now introduce our problem formulation and sub-question for this project.

Problem Formulation and Research Questions

Our collaboration focuses on developing a course that includes tools for students and teachers that can help educate, inspire and move the collective towards the goal.

“How can we navigate actors’ concerns as we seek to foster progress towards better education about sustainability in middle school? ”

In order to provide an answer to our research question, we can guide ourselves with a number of sub-questions that can help us in our process of understanding and finding a solution.

- What actor relations are we working with?
- What challenges exist in the network?
- What challenges exist in education for sustainability?
- Who can help us solve the challenges?
- How can we put students’ ideas to use?
- How can the students be involved in designing a solution that also works for them?
- How can we design a scalable solution which fits others in a similar group?

The course description in collaboration with UBO

As our collaboration with UBO began we were introduced to the initial thoughts of the project. By working with schools, teachers, and students in this course UBO seek to establish a physical and functional give box station (Byttestation) located on a school premise such that all students, teachers, and parents (related to the school) can give toys, clothes, books, and any other material products to another wanting child or person. The concept, design, functionality, rules, and maintenance of the give box station should be developed and specified by the 6-grade class involved, as they should be in charge of the project. This aims to guide and show them a number of different skills and steps in a design and project process, such as collaboration, communication, problem-solving, ideation, prototyping, and implementation. In this way, the project aims at supporting the goal of 1) increasing circularity for the future and 2) supporting the educational aspect for sustainability.

The course will target middle schools located within the Copenhagen area and are geared towards the course of Crafts and Design in middle school. This course is a relatively new course in the school curriculum, as it has replaced the pre-existing woodcraft and art courses. The goal of the new course is to work with design and design processes, in order to build the competencies of the student in the spirit of innovation and entrepreneurial workings. In the educational subject, Crafts, and Design, students are tasked with developing craftsmanship and competencies for design, manufacturing, and evaluating the functional and esthetic values. Students should acquire knowledge and competencies for craftsmanship, materials, and design processes through praxis work. This should also provide an

understanding of material culture with the understanding of resources, environment, and sustainable aspects of material use, and strengthen the innovative and entrepreneurial competencies of the students ("Faget håndværk og design," 2018).

As we entered the project collaboration with UBO, they had developed the goal for the course and formalized it as a research question, which became a guideline throughout the course we then aimed to develop for the school.

This was stated as: ***"How can we build a give box station with the largest amount of flow?"***

Preliminary summation

We all have a common responsibility to protect and limit the consumption of resources. Our current path and trajectory are not sustainable for the future. The repercussions of the slow-moving paradigm level that is climate change might not show enough to influence our everyday life and push for change before it is too late. We all have a common responsibility to protect and limit our use and wasting of the world's resources. For this in order to improve our conditions for creating a sustainable future, we aim to bring about the best possible conditions for that to be a reality. To this end, this project aims at involving and motivating teachers and students to take action, aiding in the creation of ways that they can make a difference.

For this project and our thesis work, we have established a collaboration with the "Uddannelse og Bæredygtig Omstilling", also known as UBO (Department of Education and Sustainable Change), as they work to formulate, structure, and expand learning offers, centered around

themes within nature, environment, climate, science, city development, STEM, and the UN development goals. The department aims at kids/students in the Copenhagen area. This is envisioned as offering learning programs designed to help teachers on topics that otherwise might be unexplored, providing support and hands-on educational material for the course, thus bringing education on sustainability and transformation to the school curriculum.

At this stage, we now need to explore the field and dive into creating an understanding and empathy for the relevant actors in the field. For this, we will introduce our methods and theory that we will use in order to explore, understand and analyze the field. These methods and theories have supported our work and provided us with the foundation to move forward.

Methods

Design methodology

For our project, we are working with Design Thinking (DT) as it frames, categorizes, and structures our work and our process towards developing a solution. By drawing on the Engineering Design Methods (Cross, N. 2008), as in focusing on the development of a product by the procedures, processes, and practice of design, we provide a structure to navigate the phases of designing and support us in arriving at a successful end result. This process also helps us to identify needs and criteria that we must consider when designing a solution.

The DT framework works with steps to emphasize, define, ideate, prototype, test, and finally implement. This framework has structured our work as the iterative triple diamond in the beginning showed. Here feedback cycles, refinement, and evolution of the ideas are part of narrowing the problem space into a final and suitable solution (IDEO, 2012). DT is defined as an analytical and creative process that works to engage its designers in the process of designing for the user's needs. As these phases delay the search for the solution, it creates the possibility to understand user needs by utilizing learning through iterative prototyping and feedback cycles. This demands a multidisciplinary collaboration and an iterative experimentation process to achieve desirable, user-friendly, and economically viable solutions (Nedeltcheva & Shoikova, 2017).

Desk research

In order to understand the field of education, engagement of students and teachers, we went through a process of desk research to gain understanding and knowledge of what was known and written in the area in focus. We reviewed reports,

articles, and videos containing search keywords like; STEM, Sustainable education, future citizens, motivation, education, innovation, and problem-solving. This also helped us to form the basis of our literature review and to support and discuss our findings later in the report. We also wanted to gain an understanding of the field of circularity, waste, and material streams. For this, we searched for reports, documents, papers on the topic of waste management, circular cities, swapping stations, and give box, circularity, and circular economy. From this we gained an understanding of similar projects, reviewing their recommendations, which supported the mapping out of our progress for our project.

Participatory design

We have chosen to work with participatory design as it builds on the premise that people who are going to use a product or solution should be involved in designing it (Namioka, A. and Schuler, D. 1993), as this process allows for a focus on the values and democratization aimed at creating a better design (Greenbaum, J., and K. Halskov. 1993). We can view participatory design as a methodology, as it is able to draw on research methods such as ethnographic observations, interviews, and analysis of artifacts (Spinuzzi, C. 2005). This iterative participation process can be considered political and ethically oriented as it aims to bring a collective design to life, by taking the concerns of the participants into account. In this way, the participants are regarded as both the end-users and as the experts. Participatory design also entails co-design as user involvement is needed in the process of designing by utilizing the skills of the participants in the process of iterative development of insights, prototyping, evaluating, and implementing new solutions (Evans & Terrey, 2016). The underlying belief is founded on the notion that engagement with citizens in the development and delivery

of products or services will lead to improved fit and greater responsibility for the outcome (Parker, Heapy, & Demos (Organization: London, 2006). By working interdisciplinarily with a set of diverse experts, such as researchers, designers, and customers/users - who are “experts of their experiences” - a cooperative and creative process can take hold (Visser, Stappers, van der Lugt, & Sanders, 2005).

Staging Negotiations Spaces

In the concept of participation, we find negotiation spaces, represented as the space in which actors are invited to frame problems, events, circumstances, and even solutions, often aided by design games, mock-ups, or other physical or materiality aiming at drawing the appropriate thinking and reflections. By involving numerous and often a diverse set of actors, the design projects can become complicated as the negotiation process involves addressing different and even conflicting views and values, which demand that the designers are able to navigate between the conflicting aspirations and concerns of the involved actors (Brodersen, S. & Pedersen, S. 2019). Navigating these matters of concerns presented by actors entails an important aspect of the participation process, as recognizing matters centers the work required in the aims of moving towards putting things into existence (Andersen, Danholt, Halskov, Hansen, & Lauritsen, 2015).

As facilitators, we have to stage and navigate the collaborative design process for the participants. In this, we find the staging and facilitation of spaces for negotiating the Matter of Concerns with relevant actors, in which the complex, and often surprising concerns could be put forward or drawn from the involved participants as opened by the process of discussion, negotiation, conflict, and compromise

(Storni, Binder, Linde, & Stuedahl, 2015). This staging is built on the choices and reflections of the designers where their judgment aims to bring value to the design process (Brodersen & Pedersen, 2019). The Matter of Concerns can be represented by materiality which aims to visualize and represent actors' individual concerns, as well as the overall collected project concern. This can take the form of sketches, drawings, prototypes, and other objects that can allow us to follow negotiations from one space to the next (Brodersen & Pedersen, 2019). We have used the idea of negotiation spaces to frame the setup of our workshops. As we have been working with young students, the staging needs to be set in a way they understand, which is easy for them to navigate and collaborate in, as we wish for them to be part of designing a solution that they will use. We benefit from expert knowledge in the design phase, but to make sure the process is being done right we need to act as navigators in the negotiation spaces (Pedersen & Brodersen, 2020). In the effort to uncover and negotiate matters of concern with actors, we will utilize the construction and use of negotiation spaces to navigate democratically among various actor's matters of concern.

Ethnographic research

We initially aimed at conducting our thesis using an ethnographic research methodology. We wanted to gain an understanding of and insight into actors by observing their actions in their environment. Immersing ourselves into the community, everyday settings, and context of our actors would allow for a view from the inside, which would, in turn, allow us to see problems or challenges, which might otherwise have gone unnoticed. The belief that particular behaviors can only be understood in the everyday context in which they occur is our primary driver, as we want to

describe how people actually behave, not how they ought to behave or how they see themselves (Schuler & Namioka, 1993). Sadly, this method has been complicated by the ongoing pandemic, with the restrictions limiting our ability for physical presence in the field. Our actors moved to an online world, and so did we. Despite the restrictions we still managed to conduct one observation online and two in a physical classroom with a 6-grade class, allowing us to dive into their world a bit better.

Semi-structured interviews

During our project, we needed to gain an insight into the field in order to gain an understanding of and empathy for the actors and their problems. For this, we in part used semi-structured interviews as this style made for an open and informal dialogue. This allowed us to steer the conversation and follow the train of thought towards interesting topics related to the initial questions. We made use of a script (see appendix 01) with a set of predetermined subjects and questions where the answers from the participant guided our follow-up questions as we tried to dive into concerns that might lay outside our script.

Due to the ongoing pandemic and restrictions on physical meetings, we conducted all our interviews online. We made use of Teams, Google Meet, and Discord as means of interacting and communicating with the participant.

Roll the snowball

Referring to the method of gathering more and more information, like the rolling of a snowball, the aim of this method is to inquire further information from participants as they might be able to contribute with leads, knowledge,

and/or information that could add to our project. By prompting for leads we increased the chance of including other relevant participants. In this way, we could expand our network by an inclusion process that in the end would have no more new participants to add (Lindegaard, H. 2008).

User knowledge

When we think of knowledge, we often think of things that are written down, defined, categorized, systematized, or quantified, but participatory design also works to explore the users' tacit knowledge. Often located in the invisible aspects of human activity, it is typically difficult to formalize and describe as it is regarded as being implicit rather than explicit, and holistic rather than bounded and systematized. It is what is known, but unable to easily be articulated (Brandt, Messeter, & Binder, 2008). Though some tacit knowledge can be formalized, it might often be incomplete. Knowledge is seen as layered and too subtle to be fully articulated. Thus, action-centered skill has always been learned through experience as actions work better than words when it comes to learning and communicating certain skills and knowledge (Zuboff, S. 1988). By establishing a common "language" we connect the worlds of researchers, designers, and users together (Spinuzzi, C. 2005), this can allow for a better flow of knowledge between participants.

Affinity Diagram

In order to create an overview and start analyzing our collected data, we have made use of an Affinity Diagram to sort the gathered empirical data and observations notes and quotes. Interviews often produce a lot of information, which needs to be processed and analyzed in order to draw out the findings and knowledge that is relevant for the project. The Affinity Diagram method allows for this overview and

categorization of statements which can make the main issues emerge from the context. The main aspects and quotes derived from interviews and statements are placed in a plain large field to be sorted gradually into different clusters, which can emerge bottom-up from the data itself (Holtzblatt & Beyer, 2016). This enabled us to create categorising clusters of common elements which creates an overview that provides us with a visual representation and organization of the topic and crucial aspects of common points and key elements of relation (Beyer, H., & Holtzblatt, K. 1999).

Materiality

In the process of staging Negotiation Spaces, props such as design games, mock-ups, and prototypes can be used to facilitate a common understanding and working focus (Koskinen, Brandt, Binder, & Hellström, 2005). Hence, we rely on objects to establish a shared language between actors and to allow communication of knowledge and meaning to foster mutual learning (Carlile, 2004).

Boundary objects

One such object is noted as a Boundary Object as it holds the ability to be flexible with different worldviews and rationalities, going across boundaries and allowing collaboration despite different backgrounds, understandings, and meanings attached to the boundary object (Star and Griesemer 1989). Regarded as being both plastic and able to adapt to local needs and constraints, as well as sturdy in its ability to maintain a common identity across sites. This ability provides a weak structure in common use and a rigid structure in individual use, allowing for different meanings in different social worlds, yet maintaining a structure common and recognizable enough to foster means of translation (Carlile,

2004). Holding the capacity of an idea the object assists in the interactions between actors, and can be in the form of field notes, maps, pictures among many other objects. We have used Boundary Objects in our workshops with students and with UBO as they give us the possibility to tangibly present and hold ideas, allowing us to talk about a subject or element and the aspect.

Intermediary objects

Intermediary Objects consist of materiality which facilitates negotiation between actors going from negotiation to negotiation, continuously advancing in the level of refinement (Brodersen and Pedersen, 2019). Often used in the case of negotiations and to stage the role of materialities, the intermediary aspect allows for tensions and controversies to be discussed (Blanco and Boujut, 2003). Intermediary Objects allow meanings to be embedded in the object which can then move through several iterations (Vinck, 2012). Working as a shared ground between actors for discussion and creation of new meanings, it acts as a central object incorporating new meanings which gives the object shape and properties. Meaning can travel between interactions by the object as it can evolve with each interaction as further investment and modifications can be added (Vinck, 2012). Thus, allowing knowledge to travel between different actors as it aims to establish a negotiation medium between them (Blanco and Boujut, 2003 & Brodersen and Pedersen, 2019). An Intermediary Object can take the form of design games, prototypes, concept drawings, and mock-ups (Boujut & Blanco, 2003). Intermediary Objects have been valuable for us throughout our workshops, as they allow for meanings and ideas to travel attached to materiality from workshop to workshop, and letting us follow the negotiation as we narrow in on the important parts.

Design games

To facilitate design dialogues with actors we used design games to establish context and invite for co-discovery in the creation of new and shared design representations. Design games a format for means of collaboration (Brandt, Messeter, & Binder, 2008). In this, objects can be used to create and explore configurations, and help participants to focus and evoke new or tacit thoughts to be shared. As design games can take many forms, so can the outcome of the game. Some explore problems and possibilities through user studies, others address the initial specification of a design program, others aim at a broader mapping of the potential design space (Brandt & Messeter, 2004). Grounding the game in the praxis of the intended user/participant can make it easier for participants to relate and to make sense of objects and relations. Design games gave us the possibility to evoke interaction and collaboration between actors, focusing on actor experience and knowledge sharing in our design process.

Online workshops

Most of our projects were conducted online, due to the pandemic and restrictions. For this reason, we have mainly utilized online tools during our meetings, primarily talking and interviewing in Teams. We often structured our thinking with online tools, such as Miro, Mural, and Google docs, as these provided us with a place to interact and to configure common talking points and materialities. This involved post-its notes, quotes, illustrations, pictures, and interview data.

Personas

Creating fictional characters can be an effective tool to engage team members in product design. Personas contain information about users and their personalities derived from ethnographic studies such as interviews, observations, and a broad range of qualitative and quantitative data. This allows for focused attention on solutions in a design, as personas provide a shared basis for communication, reflection, and fitment. The design process can focus on the users and the work contexts through the fictionalized characters and their traits (Pruitt & Grudin, 2003). By building on our collected interview data and workshop data, we have made use of personas in order to formalize traits and strategies for engaging each persona.

Theory

Actor Network Theory

The analytical framework of Actor Network Theory (ANT) provides a vocabulary to discuss and consider actors and objects within the dynamic network-in-the-making and allows for a discussion of potential conflicting matters of concern in the negotiation processes (Latour, 2004). The ANT framework provides a lens and vocabulary for understanding the network and relations that we work within. A non-hierarchical distinction should be made between human and non-human actors as the framework seeks to map out groups of actors, their identity, their interconnected relation to each other, and their roles as they move towards a common goal (Callon, 1986a). It is in the relations between human and non-human actors where interactions take place, and where it can provide us with the ability to strategically navigate the network and the design process (Callon, 1986a). In this, actors are noted to have goals, interests, and agendas of their own. As actors act, they influence the network around them, in turn affecting other actors and their relations (Callon, 1986a).

The process of identifying key actors and their inter-connective relations of human and non-human actors (Callon, Law, & Rip, 1986; Storni, 2015) allows us to map actors and through the translation of vested interests, we can visualize relations allowing for analysis of the processes of creating a heterogeneous network. The four moments of translation formulates the stages actors should move through in order to make lasting changes in the network.

The 'four moments of translation' formalized by Michel Callon (1986a) entails a translation process as a result of *problematization*, *interessement*, *enrolment*, and *mobilization*.

Problematization:

By defining relevant entities and their associations, "*The problematization describes a system of alliances or associations between entities, thereby defining their identities and what they want.*" (Callon, 1986a: pp. 206). The problematization forms a problem statement that actors can support and work to find a resolution for.

Interessement:

By promising resolution to the problematization, actors can become interested in gaining something from the process, in terms, locking actors into their roles and aligning with the Obligatory Passage Point (OPP). A reinforcement of relations between actors where each will take ownership of its part in the project conforming to the collected aims of the network.

Enrolment:

By allowing actors to take ownership, an establishment of actor roles can arise in the network. Functions are outlined and important alliances are balanced. Spokespersons who act on behalf of several actors in the network allow for an active process of working towards the OPP. The integrity of the network relies on the spokesperson's ability to act on the behalf of the alliance.

Mobilization:

By ensuring the spokespersons represent the collectivities and that the new roles remain stable, mobilization is achieved (Callon, 1986a). When 'one voice represents the crowd' a common understanding between actors can form, and we approach a stable heterogeneous network. Researchers can withdraw from the network as the enrolled actors now contribute to the stabilization of the network.

The four moments of translation are not necessarily linear and will often overlap or interfere as stability with all actors is not a guarantee. The individual interest of actors within can change and disagreement can form conflict. Similarly, there is a chance that the spokespersons will not be followed by the actors they represent. If so, the translation process could fail (Hansen & Clausen, 2017; Callon, M. 1986a).

Matter of Concerns

Through the moments of translation, the ANT framework allows us to discuss potential conflicting *Matters of Concern* as they are important for the negotiation processes between actors involved in the network. As designers, we are tasked with designing spaces for these negotiations to take place (Brodersen, S. & Pedersen, S. 2019). We will investigate and discuss this *Matter of Concern* of the different actors represented in our work, as we aim to understand what might move them through the four moments of translation. We will do so by problematizing and interesting the actors by addressing their Matter of Concern.

Programs and Anti-programs

In the work of actors and agendas, we also find the notion of programs and anti-programs, as being actors' intentions working with or against each other (Latour, 1992). This is illustrated in the example of the hotel key scenario, in which the front desk has a program of action in which they want the key back from the guest, but the guest holds anti-programs concerning the issue of leaving hotel keys at the front desk (Latour, 1992).

Desk Research

In order to grasp and begin to understand our field and to scope our project, we conducted desk research with the aim of finding relevant material. This has helped us navigate and structure our work throughout the project.

Mitigation and adaptation to Climate Change

In the battle to address climate change, there are two main strategies: *Mitigation* and *Adaptation* (Anderson, 2012). Mitigation mainly focuses on the slowing or lowering of polluting factors. This is a temporary solution since it becomes a challenge to live with less and within limits. Some effects of climate change will still make themselves visible, despite efforts to mitigate the issues of greenhouse gases. The strategy of adaptation aims at reducing the vulnerability of our lives and the systems exposed to the challenges of climate change. This is no simple task as it demands the innovative adaptation of many different areas. The strategy is calling for problem-solving skills and creative thinking to grasp and work on the complicated strategies and solutions in response to climate change (Anderson, 2012). In this, we can highlight two ways of handling our climate challenge. One is to focus on individual behavior change, where the individual must take actions by lowering consumption, acting more responsibly. This approach is contested by the argument that climate change is a systemic problem, thus beyond the individual's control and thus something we must also adapt to. Here education is thought to be one of the factors that can help shape our future world, as it presents a pathway to future change (Gonzalez-Guardiano, E., & Meira-Cartea, P. 2010).

Adaptation - The role of education

As the future of climate change is unpredictable, the challenge is adapting to an uncertain future. Society is slowly changing, as generations grow older, and the younger generation takes over. The future will in a large part be determined by the minds of the next generation. Hence our collective path towards a more sustainable future, can in large part depend on how we educate the next generation (Pramling, Doverborg, & Samuelsson, 2016).

As the implications of a future shaped by climate change are uncertain, mitigation and adaptation strategies might form our response to the changing conditions. To build adaptive capacity and resilience for the future is considered vital to lower the risk and vulnerability for our future (Krasny & DuBois, 2016 & UNESCO, 2011). The educational sector offers opportunities for our future handling of the rising challenge of climate change, both for mitigation and adaptation strategies. Education is a critical component in our adaptive capacity as it fosters the skills and knowledge needed to learn, preparing for and responding to specific challenges. Education can provide the knowledge and skills needed for making informed decisions about how to adapt individual lives and livelihoods as well as ecological, social, or economic systems in a changing environment (Anderson, 2012).

Gaining capacities of knowledge, skills, dispositions, and values can prepare students to deal with uncertain future challenges of climate change mitigation and adaptation. Education should go beyond technical solutions including socially transformative strategies and approaches that harness creativity and empower students to be able to act (Lotz-Sisitka, 2010). Our collective preparedness for climate change is a challenge, but we can rely on human creativity,

our ingenuity, and our ability to solve problems of the future. Such skills are in part relying on our curriculum and learning within our educational spaces. Hence it could be in these spaces that we find the opportunity for changing the future (Stevenson, Nicholls, & Whitehouse, 2017).

Design Thinking in Education

For this, recommendations are to incorporate design thinking, systems thinking, and teamworking skills, all of which are noted to enhance problem-solving capabilities to some degree (Rotherham & Willingham, 2009). There seems to be a notion of concern regarding the level of education students receive, as the task of preparing students to succeed in the world by providing them with opportunities to interact with content, to think critically, and to create new information, seems to be lacking (Razzouk & Shute, 2012). Teaching students to think like designers, may aid to better prepare students to deal with difficult situations, in school, their career, and later life (Kagawa & Selby, 2010). Likewise, the praxis of performing 'out-of-the-box' thinking should be addressed in education (Glasser, H. 2007), as such skills and tools concerning inquiry-based, reflexive, creative, and a participatory approach, can support competencies adaptable for new uncertain or poorly-defined situations in the future (Wals, 2011).

Climate Change Education

Climate Change Education is about developing relevant skills and knowledge, developing critical thinking, problem-solving and collaboration skills, scientific literacy, knowledge on climate change, sustainable lifestyle and consumption, disaster risk reduction and preparedness, and green technology. Thus, fostering the ability to adapt and adjust to the challenges of their current life as well as

the future (Anderson, 2012). One focus that is highlighted in literature, is the importance of developing critical thinking, problem-solving, and collaboration across subjects. Critical thinking and problem-solving require issue analysis and decision-making, identifying options for change, and using information to create an action plan to address problems (McKeown & Hopkins, 2010). Enabling students to think critically and creatively can therefore allow us to adapt to a different future (Anderson, 2012).

“Empower and motivate learners to become active sustainability citizens who are capable of critical thinking and able to participate in shaping a sustainable future” (Rieckmann, 2017, Page 54)

In the same vein, we find UNECE (United Nations Economic Commission for Europe) frames the strategy for Education of Sustainable Development as the task of equipping people with knowledge, skills, understanding, attitude, and values, compatible with sustainable development. Thus, these two statements support the relevancy of our project and the aim of educating students for sustainability (United Nations, 2012).

The Role of Teachers

The complexity of climate change and climate science renders it a challenging topic to teach. Cases point to a limited understanding among young students, as the discussions are often reduced to factual information about climate science, seeming distant and abstract (Shepardson, Niyogi, Choi, & Charusombat, 2009). Other teaching strategies involve building on the formation of critical thinking skills to further the understanding of climate change, while others

aim at teaching problem-solving skills to foster projects for mitigation or adaptation to climate changes (Hudson, 2001). These programs aim at addressing more than knowledge and attitudes about climate change, as they are designed to build skills and empower learners to engage in action, to assess challenges and solutions. The educational task relies on teachers who aim to help students succeed by supporting their development and their skills (Monroe, Plate, Oxarart, Bowers, & Chaves, 2019). The goal as educators should thus be to equip students with beneficial skillsets which render them capable of succeeding, both in school and in life (Razzouk & Shute, 2012). Some problematization arises from articles pointing to the notion of educators focusing on traditional learning goals like math and reading, often with the goal of performing well on standardized exams, but leaving some students disengaged in the process (Razzouk & Shute, 2012).

To inspire and motivate students, connections should be made to everyday life, making it familiar and relatable, and by encouraging and inspiring individuals to take personal action to face and mitigate climate change (Lorenzoni, Nicholson-Cole, & Whitmarsh, 2007). The education of young students needs to align with the opportunity of each child to connect meaning by their own experience, instead of merely repeating facts. At this point, knowledge becomes integrated as it connects with preconceived ideas and knowledge (Pramling, Doverborg, & Samuelsson, 2016). Individuals need to be engaged in questions that mean something to them, as knowledge is grounded in their own experience and feelings (Emilsson & Johansson, 2018). The formation of knowledge among children is often synonymous with process creativity, play, and attention to reality, and should be incorporated in the learning process. Regarding

children as learning individuals in their play, they have to be allowed to apply their perspectives, ideas, and fantasies into whatever is introduced in their praxis (Samuelsson & Carlsson, 2008). Active learning should be connected to local problem solving, as hands-on educational activities with a local focus seem to create successful learning outcomes, especially when integrated into a regular school curriculum (Pruneau, Gravel, Bourque, & Langis, 2003).

The school can be regarded as a place where norms are created and reproduced. This is done in part through the teacher and the social construction and processes which exist in subtlety. Therefore, it is important for the teacher to be critical of norms and their creations, as they can be the creator of such through their everyday work. They must be conscious of what and how they can be changed (Garsdal, 2020). It should be regarded as a common ambition for schools and teachers that young kids develop a critical understanding of their surroundings and of the world, as they might gain insight into new ways of living, ways of work, and ways of contributing to society. The experience of success with projects that change and improve their surroundings is important, as it might showcase the possibility of responsibility and positive contribution to a common good (Garsdal, 2020). In literature, there seems to be a notion of some educators to neglect the development of skills and competencies in students that tackle real-world problems, thus leaving them ill-prepared to tackle complex problems later in life (Razzouk & Shute, 2012).

Experiences and knowledge summations from bachelor assignment about learning

Adding to the notion of students being ill-prepared for later life and stressing the importance of supporting young students' development of the aforementioned qualities, we have taken note of the work done by other students in the field of education and creative work. In a bachelor paper (Olsen, Lindeburg, & Ravn, 2018) they identify some concerns raised by teachers in relation to the education and skillsets of some students.

"The students have trouble with imagining and creating something that is not specified in the assignment" - (Olsen et al., 2018. Page 39).

They go on to note that this is a recurring theme across several schools. Similarly, teachers encounter problems with students' abilities to understand and work with new tasks, as it becomes difficult if the assignment or task is not made clear and explicit. Teachers highlight that there tends to be a decline in students' abilities to think out of the box and try new things for themselves. The report concluded that working process-oriented can lead to a higher degree of trials and errors as more exploration can be done, thus leading to greater learning. Combined with making learning fun and engaging for the students they aimed at increasing the chances of educational success for their project (Olsen et al., 2018).

The Agenda in Copenhagen

In the document Circular Copenhagen 2024 (City of Copenhagen, 2019) we also see the focus on education, this time in the trend of mitigation with waste reduction measures and learning. In section 4.5 "BØRN OG UNGES LÆRING SAMT DELTAGELSE I AFFALDSFOREBYGGELSE OG AFFALDSHÅNTERING", they regard kids and young people as a sizable part of the population in Copenhagen as an estimated 70.000 kids are schooled in institutions in Copenhagen, and as such, they bear some of the future responsibility in reaching the waste reduction and increased circularity goals set by the CC. The document highlights the importance of developing resource consciousness through education in waste management and circularity. The ambition is that resource consciousness and waste sorting becomes a topic of concern among citizens, which will, in turn, spark behavioral change. As a result of this increased awareness and education on the topic, an ambition for the future citizens of Copenhagen to develop better sorting and waste reduction habits. The overall goal is to reduce CO² emissions and increase circularity streams for materials with the focus of a circular economy. To create the possibility for this development, the City of Copenhagen is in part pushing for the use of STEM education.

The push for STEM education

STEM is a combination of Science, Technology, Engineering, and Mathematics, aimed at strengthening students' abilities to work within an interdisciplinary setting (City of Copenhagen, n.d.). STEM also provides the students with skills for the 21st Century, as knowledge and understanding within adaptability, complex communication, social skills, problem-solving, self-management, self-development, and system thinking are in focus (National Research Council,

2010). STEM learning can foster encouragement of students even on different levels as it allows for different challenges for the student depending on the skill level (English, 2017). Besides the educational advantages of working with STEM learning strategies, CC is trying to push for more STEM learning strategies as they attempt to create curiosity towards education within the STEM areas. The goal is to increase the interest by 20%, to spark interest for young students to choose and pursue more science-based education (City of Copenhagen, n.d.).

Noted by The Educational Ministry (2018) is that more kids and young students should develop interest towards nature subjects in pre/middle school, and choose nature science in high school, leading to later STEM-educations. More kids should develop talent for subjects of science and vocational STEM education (The Danish Government, 2018).

Mitigation - Increasing Circularity in Copenhagen

Moving on to the mitigation part of our project, with the aim of reducing our environmental burden on the planet, we will introduce findings in regards to the establishment of a give box station in Copenhagen. This give box station will act as a central point for our work, as it presents the challenge and solution that should be developed and implemented in collaboration with the school, the teacher, and the students. This is part of the solution proposed by our collaboration partner UBO.

Moving products and materials up the Waste Hierarchy

As almost every commercial product has been created using energy and resources in the manufacturing, packaging, and transportation of the product. The product should not just follow the traditional take-make-waste default life as this is an unsustainable praxis. A long chain of underlying energy and resource use is not visible to the consumer.



Figure 4: The Waste Hierarchy

We are often not aware of the journey the product has undergone prior to reaching us. This hidden resource consumption does vary from product to product, but the principle of material loss is still the same. In this, we can introduce the Waste Hierarchy as it depicts the five different stages of waste separation. Here the tree lowest are in the traditional take-make-waste as products are often discarded at the end of life. The lower stages dictate that materials end their life by incineration as a form of energy extraction and/or as landfill deposit. The idealistic option is to reduce consumption thus preventing materials from entering in this system in the first place, but since this is an unrealistic idea there are other options, we must consider. In the reuse phase products and materials are directly reused in pure form. If the product or materials are damaged or unusable in its current form, they can move to the next step to be recycled. Here products are separated into different material forms and recycled to make new products by entering into production again. If products are unwanted and unable to be separated into material components, they will move down to the recovery phase. Here the goal moves from material circulation to energy recovery often by burning and collecting energy. Anything left from the incineration process will become landfill, as will harmful materials, resulting in wasted potential (Ferrari, Gamberini, & Rimini, 2016).

The issue of what is regarded as waste?

What can be waste for one person, might not be considered waste for another. The material or even product might have lost its value from the original owner's point of view, but this does not deem the product worthless. The product may still function as intended, it might need repair, or it might be good for something completely else. Here value can be

found in the product from a new set of eyes, and the material might be given a chance to prolong its life in the use phase, as opposed to being discarded and destroyed.

Circular Economy

Circular Economy describes several models which aim to minimize the use of raw materials by constructing material loops (Ellen MacArthur Foundation, 2013). This is opposed to the concept of Linear Economy where resource consumption follows an unsustainable 'take-make-dispose' pattern. The goal of circularity is to minimize, or even eliminate, further material consumption, as continual use of resources can take place through loops of several levels of regenerative circular approaches.

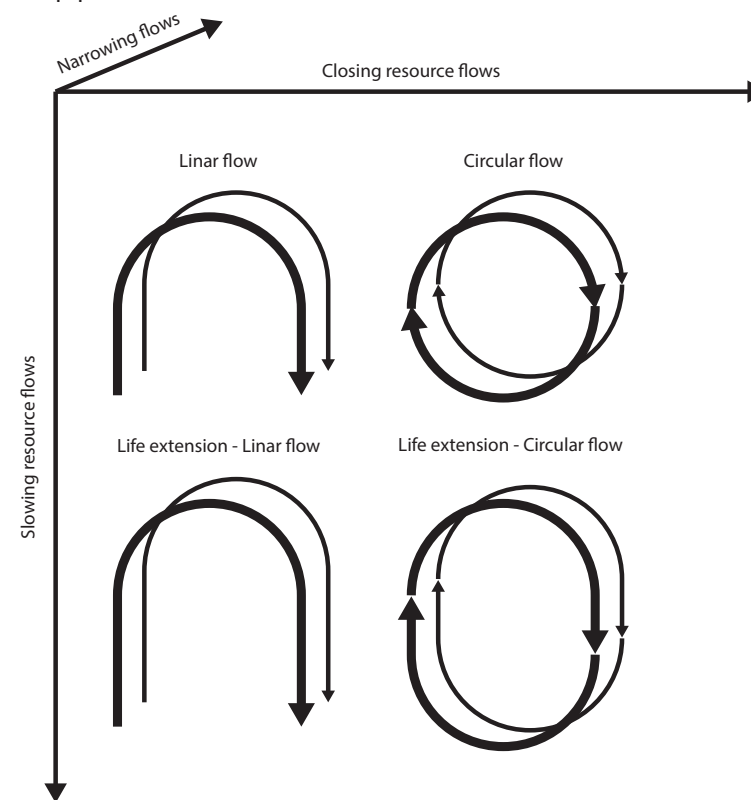


Figure 5: Circular economy loops (Ellen MacArthur foundation, 2013)

Multiple strategies exist in Circular Economy as it can be divided into three circular approaches in the form of *narrowing*, *slowing*, and *closing* of loops. The *closing* of loops entails a saving of material, labor, energy, and externalities, such as GHG emissions, water use, and toxic substances. The strategy of slowing the loop aims at extending the time in the use phase, thus extending the life of the product. Materials are prolonged and the inflow of virgin materials is avoided for a longer time. The *narrowing* is related to the concept of resource efficiency. Products are produced more efficiently, using fewer resources hence limiting waste and raw material use. This *narrowing* of a loop can apply for all models (Ellen MacArthur Foundation, 2013). For our purpose, we focus on the technical side of the circular economy diagram, and as materials and products exist in the realm of technicalities we focus on this as well. We also work within the strategy of slowing the loop and thus the flow of materials.

The Current waste structure

In the production of many products and materials today, Linear Economy is the traditional and unsustainable way of thinking. In Linear Economy, the products follow a simple 'take-make-waste' structure, where products often see a short life before ending up as waste. As the conventional linear economic model has flourished in the conditions of resource abundance, we now face the challenges of the future scarcity of materials. The City of Copenhagen has slowly increased its measures towards establishing a more circular economy for materials, like the establishment of recycling stations across the city, often free of charge for private users. This has led recycling to move from 27% in 2010 up to 45% in 2018 (Circular Copenhagen 2024). The goal is to increase recycling to 70% and triple the amount of reuse. By taking circularity measures and establishing facilities, CC

aims at increasing the circularity from 2,000 tonnes in 2016 to 6,000 tonnes by 2024. A majority of Copenhagen citizens are to use the sharing, giving, or reuse schemes in order to reach these goals (Circular Copenhagen 2024).

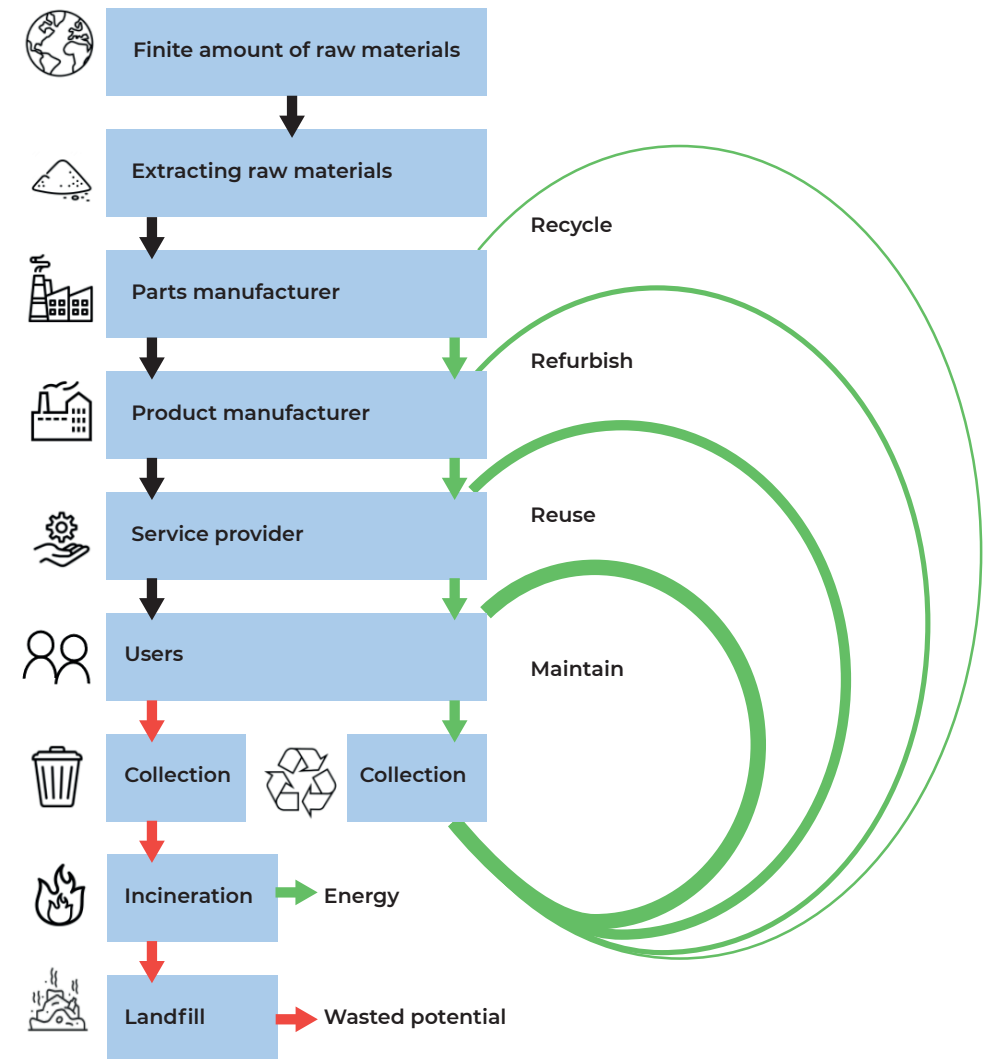


Figure 6: The Linear and Circular flow for materials (Inspired by Ellen MacArthur Foundation, 2013, page 24)

In order to visualize the benefits of establishing more give box stations, we make use of circular economy as its terminology allows us to elaborate on the material flow in the network.

As we move from the Linear Economy model to the Circular Economy model, we can map the flow by illustrating the product and material flow as we aim at closing and slowing the flow of products by establishing a give box station. Most people have clothing, and other items that they no longer use, these things may have little value for the owner but are not easily sold. The options of giving it away or discarding it are then left. Instead of discarding the item, it can be given to another wanting person. This prolongs the life of the item and might save another person from buying it from new, thus saving production, packaging, transport, and money. A give box station allows the products to gain new life as they are maintained in the closed-loop, thus prolonging the life of the product, and limiting the need for new materials and excess energy use in the near future.

This is of course, entirely dependent on people choosing to use this option. If the user makes the right choice and gives the product a chance for a new life, this will be beneficial for us all. The challenge here becomes how to motivate, create awareness, and create the urgency that might be needed, in order for the project to succeed. To accomplish this, we have to look at the factors driving the mindset of the users. In our case, we are working with young students and teachers and will begin our process of gaining empathy and understanding, by diving into the actor world related to our project.

Give box station in Copenhagen

To make this option of passing one's unwanted item on to another person available, CC has since 2016 established a number of give box stations around the city in locations accessible to the public. CC supports the development of making the giving of items a possibility for its citizens, pushing the agenda for more material circularity by an



Figure 7: The three give box stations, located in Copenhagen (NABOSKAB, 2016)

increased amount of circularity for materials, through service enhancements and give box stations placed in local areas in the city (Naboskab, 2016). Hence supporting the ideology of Circular Economy.

Often constructed as a room or closet it holds space and room for items to be placed and displayed. The give box station is already a tried and tested the idea in cities like Berlin and Amsterdam. This has led to the test of 3 give box stations in Copenhagen back in 2016, designed to last 6 months. These 3 give box stations were created by NABOSKAB which is a consultancy working on green/sustainable projects in Copenhagen.

What is given away?

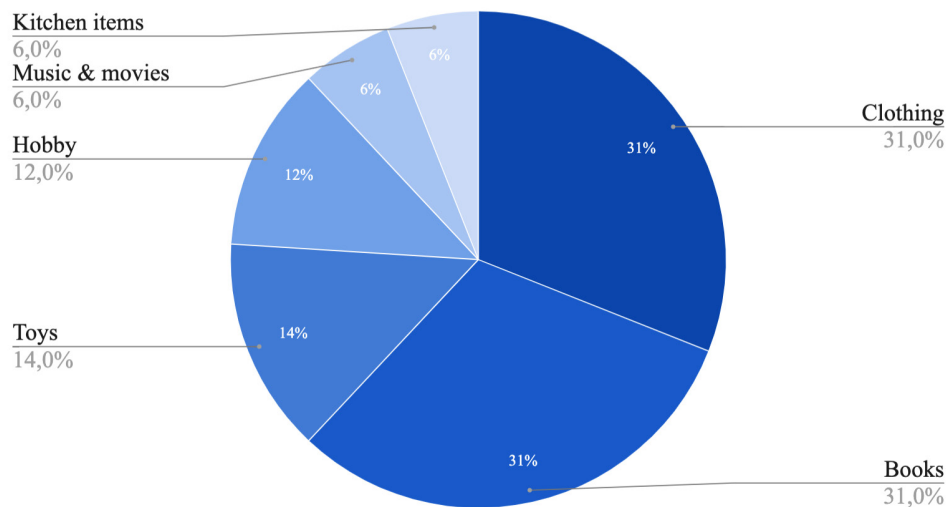


Figure 8: What is given away, an overview of fractions (NABOSKAB, 2016)

Saving products and materials

The flow of items through the best performing give box station was estimated at an impressive 164 kg of items per day. Over the period of 168 days, this amounts to a total of 27,5 tons of items swapped. Items that are not gifted through the give box station are electronics, tools, and other items of greater value. These items were not observed in the time frames, but it could be because they are more desirable for many, and thus are not there for long.

User groups

The give box stations have been used by almost every citizen group: students of all ages, families with kids, elderly, single parents, and homeless, though there is a majority of female users. The group that was observed to use the swapping station the least or not at all was “young men in the age of 20-30”.

A change in habits and consumption

Through a survey with the users of the give box stations, NABOSKAB found that items that went to the give box stations, could in most cases have gone to recycling stores. Even so, users also stated that the give box station offered a great alternative as it makes the option more accessible. Often items are rejected by the recycling stores, as users call them “picky”.

Recommendations from the project

Placement is important, high visibility, well lighted, and located in a place where other people are close, making a commuted location where people often pass by the best choice. Function and user-friendliness should also be a priority. There should be clear sections making it easy for users to place items in an orderly fashion. Hangers or a place to hang clothes are also a must. Maintenance is important, as dirt, old items, and trash will build up. This calls for cleaning of spaces and items. There should also be a plan for what to do with unwanted items. It is advisable to also remember the homeless as a user group, here one should aim at inclusion. Guidelines and rules for items and use of the station should be specified and clearly visible. Specifying what/if it is allowed to take without giving. The give box station could also inspire and serve a multifunctional purpose by collecting glass or other materials for recycling. Aiding in the campaign of putting focus on proper sorting (Naboskab, 2016). This information as well as recommendations from NABOSKAB was used in our collaboration and our talks with UBO who helped us to solidify the challenges and the questions that still needed answers, leading to the formulation of the course steps for the give box station and course design with UBO.

Preliminary Summation

Faced with future and current challenges of climate change, we must work to mitigate and adapt to our uncertain future. As the future is partly determined by the minds of our younger and future generations, our collective path vastly depends on how we educate the next generation. Here literature points to the educational sector, as it offers untapped opportunities for responding to the challenge of climate change both in regards to mitigation and adaptation strategies.

As mentioned, teachers encounter problems with some students' abilities to understand and work with new tasks, if the assignment or task is not made clear and explicit. There tends to be a decline in students' abilities to think outside the box and try new things for themselves. Literature points to a call for the development of problem-solving skills and creative thinking, in the process towards empowering students' abilities to act. To this end, recommendations are made to incorporate design thinking, systems thinking, STEM, and teamworking skills, to enhance problem-solving capabilities. This is in part accomplished through a "learning by doing" approach, as connections should be made to everyday life, making it familiar and relatable, and as such encouraging and inspiring individuals to take personal action.

The document Circular Copenhagen 2024 (City of Copenhagen, 2019) highlights the importance of developing resource consciousness through education in waste management and circularity. The ambition, for all citizens, is that resource consciousness and waste sorting becomes a topic of concern and for discussion in order to create a behavioral change. Also supported by the strategy of Circular Copenhagen 2024 (City of Copenhagen, 2019), we also see the focus on education, this time in the trend for mitigation with waste reduction measures and learning. In section 4.5 "BØRN OG UNGES LÆRING SAMT DELTAGELSE I AFFALDSFOREBYGGELSE OG AFFALDSHÅNTERING", they regard kids and young people as a sizable part of the population in Copenhagen as an estimated 70.000 kids are schooled in institutions in Copenhagen, and as such, they bear some of the future responsibility in reaching the waste reduction and increased circularity goals set by the CC. As our collaboration partner UBO is working in the framework

of the CC, they are taking on the task of constructing and executing a series of hopefully successful projects involving young students in primary school. The aim of these projects is to teach and educate students in the challenges of sustainability at hand and to get them involved in the discussion and actions towards solving/working on the challenge.

The give box stations put in place by NABOSKAB through earlier projects, create a great alternative to the recycling station and makes the option for direct reuse more accessible to the citizens of Copenhagen. Providing the ability for more circularity and offering benefits to its users in the availability of resources and products.

We now face the challenge of how to best support and aid the programs of CC and our collaboration partner UBO, in reaching the goals of fostering a future generation where increased circularity is a given.

Empirical Work

Meetings with The Department of Education and Sustainable Change (UBO)

During our project we held several meetings and workshops with our collaboration partner UBO, our contact to this department was Mie Damkjær Geertsen, but a number of other employees also work in UBO, making the shared goal of the department. in order to understand the design challenge at hand. These meetings and workshops served to navigate concerns from UBO and to plan and develop ideas for the project of creating a course for schools that could implement a give box station at their school.

UBO is working on goals and to fulfill the political agenda for circularity and to create sustainable educational courses for schools to prepare students to take action and be part of a sustainable future. UBO started the project to include and work with schools in 2019 and have held the course on developing a give box station with one school before, which have resulted in the development of a give box station placed on the school premise of Randersgade School in Copenhagen. In this, we faced the challenge of navigating the planning and execution of an educational course, in this case, designed for 6-grade classes.

The course UBO is providing has been challenged by the pandemic, as schools have been closed and teaching has taken place online, which has posed some new and challenging circumstances. When the project moved from physical to online, the uncertainty of school regulations still being vastly unknown and unstable (as no one knew when the students were able to return to the physical classroom), was mentioned as a concern.

The important aspect of the project is when the give box station is in use. It is here that the true functionality comes to life. Through our meeting and dialogues with UBO, we arrived at some unanswered question for the project:

- How to keep the interest and flow going over time?
- How do we engage and motivate students?
- How do we collect and work with all their ideas?
- How can we make the students take ownership for the project?
- How can we give teachers tools to work better with sustainability?
- How can we use the project to educate students in STEM?

Some challenges are already known as UBO has conducted the project before:

- Hard to activate the creativity of students, they say things they know, but often lack knowledge to inspire thoughts.
- Assignments should be very concrete and simple, students have trouble understanding even simple tasks as some need more guidance.

As our talk with UBO also led us around various concerns, actors, and relations, we were able to start mapping our actor-network, as we could then navigate the important relations and actors that we needed to include, in order to proceed.

In order to understand how far the relevant actors are in the four phases of translation, we need to dive into the field and engage with actors in order to figure out their Matter of Concern for the agenda at hand.

Finding participants

In order to find participants related to our subject, we reached out to teachers on Facebook. We entered different Facebook groups for teachers in many different subjects and levels, mostly focusing on primary school teachers as these were the targeted users by the project set by UBO. In these Facebook groups, we made posts and requests for interested participants to contact us and take part in our project. As a result, we got into contact with several teachers who wanted to help by partaking in interviews and workshops. In terms of collaboration partners for testing the course, UBO had sourced a class and a teacher that had agreed to follow the course and introduce her students to the topic of sustainability.

Interviews with teachers

Through the project we conducted interviews with teachers to gain a greater understanding of the field, this allowed us to explore their views and thoughts of what is important in education and how they themselves conducted it in praxis. The primary goal of the interview was to provide us with a fundamental understanding of what is important when working with students. At the same time, we hoped the interview would point to the Matter of Concerns of the teachers. The interviews were held as semi-structured interviews on the video meetings platform Teams. The sessions were conducted one by one and allowed us to conduct a relaxed semi-structured interview with the respected participants, navigating the conversation, diving into topics, and questions which we had made in advance see appendix 01. A quick overview of our questions focused on: How they tended to educate their students? What to be aware of? How to motivate students? Which tools and methods they often used?

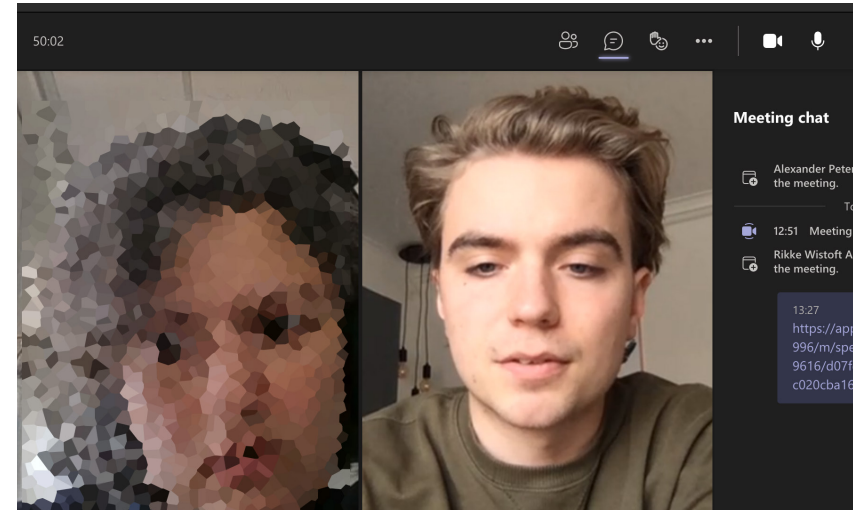


Figure 9: Interview with teacher

We were also interested in learning about the online vs physical format from the teacher's perspective. The challenge of moving and restructuring from physical to an online medium was bound to pose some challenges for the teachers, as well as for the students. As we are trying to support the challenges of involving more young students in the field of sustainability, we also wanted to dive into what motivates students. This also led us into conversations about challenges and concerns that the teachers had for the students, including challenges faced in regards to teaching on topics that the students have no interest in.

We conducted seven interviews with teachers, diving into the topics seen in appendix 01. The interviews provided us with a lot of new information, suggestions, and comments, but all this data was messy and unstructured. So, in order to gain a better overview, we created an affinity diagram. The transcribed data was put into post-it notes on an online interactive whiteboard called Mural, see appendix 02. This allowed us to organize and make sense, structure, and an overview of the statements.

Affinity diagram



Figure 10: Affinity diagram constructed with interview statements from teachers

The interview statements gave us an idea of what the participants found important. Even with the open and very initial interviews we conducted, we found some interesting statements that we deem to be of importance to our project. We highlighted those in our affinity diagram by orange and red for problems. Blue became topics, and yellow are statements.

Some examples can be seen below:

- “It can be challenging finding new and inspiring ways to motivate the students.”
- “It is not easy to make fun projects online.”
- “The students can easily hide behind a black screen.”
- “As a teacher, you design the teaching course, it can take a lot of time the first couple of times as preparation is demanding.”
- “We are missing a collective portal with tools and online activities.”
- “Some teachers are more engaged than others.”
- “Kids are excellent at knowing where the line is and if it’s free play, just by judging their teacher.”
- “The goal is to show them the discovery moment, let them realize.”
- “Sustainability is often distant from the students every day.”

Talking with teachers, we also found that there was a major concern and priority for mental well-being, as the lack of social interaction had led to students becoming unmotivated and bored. Teachers raised frustrations about this challenge of keeping students social online, as this affected the learning and educational aspects of teaching a lot. For this reason,

some of our teacher contacts had to turn down our offer for collaboration as the balancing of well-being and learning was already challenging for them and their students.

As we went through the topics and questions we also discovered some concerns raised by the teachers in regard to teaching in the format of the project at hand. This allowed us to add the teachers’ matter of concern in the network as they are important to address and take into consideration in the process. Our interviews and quotes indicate that the teachers are showing two types of concerns: for themselves and for their students.

Matters of concern for teachers

Regarding students

- It can be hard to motivate the students
- Making sure each student gets supported
- Creating topics, the students can relate to
- Working with the interests of the students

Regarding teachers (themselves)

- Completing the course learning goals
- Creating a great learning environment
- Fostering and maintaining social relations online is challenging
- Hard to make sustainability simple and understandable
- A lack of tools available online, everything is scattered

These insights were collected and added to our working matters of Concern list in appendix 03, which we will summarize at the end of this section.

The former give box station course - Gaining insights

We wanted to look into the projects that had been carried out beforehand, in the physical classroom, in order to gain experience on how to work with the project in an elementary school classroom setting. We, therefore, got in touch with a teacher, who had already been through the project with her class and had successfully created a give box station located on the school premises. This project was carried out last year (2020) which allowed us to dive into the established function of the solution and gain completely fresh insight into the current use. The project was carried out at Randersgade school, where a 6-grade class was put in charge of it. Throughout the project, they worked with the SDGs and the different levels of recycling, where they went through and solved the different challenges posed in the process of the project.

During the ideation phase of their project in designing the best give box station, the students came up with a lot of ideas. One suggestion that came up was for a pineapple house design. There were many other abstract and imaginative ideas but were sadly a bit out of reach for the project's format. This posed an issue as they were not able to benefit from all the imaginative ideas, and a lot was lost in the process.

When finalized, the give box station was placed in the schoolyard under a large tree and was presented for the school and teachers. Even a local newspaper was at the grand opening, which helped to highlight the importance, innovation, and relevance of the project for the students.



Figure 11: The give box station on Randersgade school, (Thomas Frederiksen, 2020)

At the opening, other students were lining up to come, take a look, and to find something new. In this way, the kids experienced that they have the agency to create something that could make a difference and be useful to themselves and others.

Over time, due to weather, wind, and bird droppings from the tree, the give box station has seen better days. The wood is moldy and stains from nature make for a very unappealing sight.

There is a need for it to be revised and brought back to life. The teacher noticed that the flow of materials slowed down in a radical way over time.

"It is a shame that the give box station is in such bad condition. Kids might get the impression that this is just something we played with. There is a need for this to be carried on and seen as something important." (Vibeke, 2021, teacher at Randersgade School.)

There is thus also a lack of responsibility for the give box station as in who is going to keep order and maintain it.

The approach of working with real problems, issues that the kids can grasp and understand, is important. They have had good experience with other problem-solving programs, as the kids had an earlier project with a challenge by Copenhagen Zoo to help them get more young visitors. This created fun problem solving and they developed a concept of an app as a solution. Hence, in order for a project like this to succeed beyond the completion of the give box station, it is important that the problem is authentic for the students, as this can entice participation.

To summarize:

- They were not able to benefit from all the imaginative ideas
- The flow of materials slowed down in a radical way over time
- The give box station suffered from a lack of responsibility and lack of caretaking
- There is a need for this to be carried on and seen as something important
- It is important that the problem is authentic for the students

These challenges were noted in our affinity diagram of concerns, see appendix 03, and will be collected through the project in order to gather a better understanding of the problems we encounter.

Creating negotiation spaces - Creating a workshop

As we dove into the elements and concerns of the project, we created negotiation spaces that held and presented our initial ideas for the project and for the course. These ideas were based on meetings with UBO and were constructed on the online platform Mural. This platform allowed for participants to join, alter, post, and change the materiality on the online board. We have used the idea of negotiation spaces to frame the setup of our workshops. As we have been working with young students, the staging needs to be set in a way they understand and can navigate, as we wish for them to be part of designing a solution they will use. In this line, we benefit from expert knowledge in the design phase, in this, we need to act as navigators in the negotiation spaces (Pedersen & Broderson, 2020).

Workshop with UBO

In order to understand the ambitions and challenges of the project, we organized a workshop on an online platform. Here we could use parts of the project elements as talking points in our effort to discover and draw out thoughts and challenges, in regards to the process of the project. One major talking point of the conversation and in the experience of UBOs prior projects working with students was the element of motivation, or often the students' lack of motivation to participate. The question then became "What could motivate students?"

The initial course set up

As we gathered recommendations from the 2016 report by NABOSKAB, we saw that placement of the give box station is important. A commuted location should be prioritized as should function, user-friendliness, and maintenance. There is a need for clear sectioning, like hangers and boxes, making it easy for users to place items in an orderly fashion. Maintenance is important as trash will build up, leading to the need for periodic cleaning of the give box station as well as a plan for what to do with unwanted items. There should also be clear rules and guidelines for users to follow.

In designing our course layout, we followed the steps of design thinking: problematizing and emphasizing for users, ideation, prototype, and finally delivery. This was done in order to provide the students with an experience for the flow of a development program.

By collaborating with UBO we ended up with the following initial course structure:

The Course Structure

Problematise

- 1: The first course day was planned with the focus of understanding the problem and the goals of the course.

Ideate

- 2: The second course day was to decide where the give box station should be located and who should use the facility, along with establishing initial rules for its use. This is important as UBO didn't want the station to become a trash dump for old and broken items.

Prototype

- 3: Course day three consists of an exhibition field trip to South Harbor recycling center (Sydhavnens Genbrugscenter), as they can provide recycled materials for the project.
- 4: On day four we start the designing and building of the give box station, with the available materials and deciding which items should be able to be placed.
- 5: Day five is for assessing the challenge of involving the school and the community. We also need to determine what to do with old items which did not get taken, and what rules should be chosen.

Deliver

- 6: On course day six, the give box station should be finished and presented to the school or other classes.

Setting up an online workshop

As schools were locked down in 2020, teaching had for the past year been conducted online. We initiated our project with the aim of conducting online workshops with the students on this basis, as there were no physical classes at this point in time. Our initial idea was to take part in the Teams class held by the teacher where we would use PowerPoint as the media for introducing the course with UBO. In this PowerPoint, we could also explain and show the program for the day as well as give the students small assignments.

During our planning sessions with UBO, we introduced the tool Mural (mural.com) and showcased the possibilities it offers in its ability to act as an online whiteboard, where one can move, place, draw, post pictures, and post-it notes. Mural could act as a tool to allow students to take an active part in online assignments or workshops, as the physical aspect and online creative element needed a place to be expressed. In order to make the class familiar with the program and to create continuity in the course, UBO would also use the software in their first intro workshop with the students in the class. The students would then be given small assignments that they could solve online both alone and in groups, dependent on the task.

As we now had planned the steps and the structure of the course with UBO in the Initial Course set up above, we now needed to find the elements that could fulfill the goals for each step of the course. To do this, we held a collaborative session with UBO where we planned the course and made tasks on the online whiteboard in Mural.

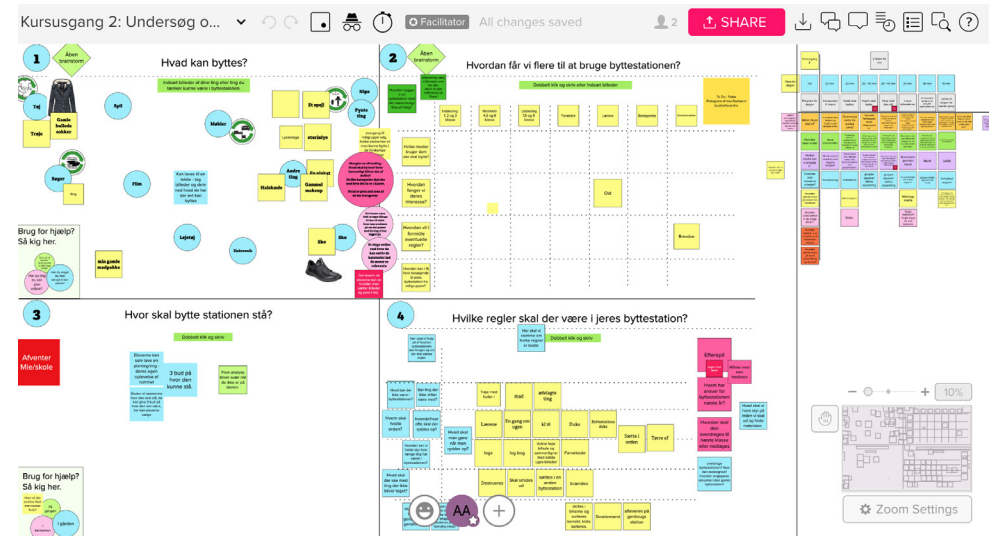


Figure 13: Workshop with UBO, screenshot

This online workshop and structuring resulted in the development of the first Problematize and second Ideate step of the course plan from the course structure.

The workshop resulted in a set of questions for further work on the topics of:

- How should the course be structured?
- How to motivate and engage students?
- How can sustainability be taught to young students in an understandable manner?
- How can circularity be taught to young students in an understandable manner?
- Tools for the teachers?
- Tools for the students?
- How can we reach the parents?

Planning and setting up the first course day as an Online Workshop

We created six small tasks, as part of our online workshop in Mural to provide the 6-graders with an introduction to the topic, and to activate them as they needed to take part in the tasks during the framing of the problem. As the first step is to formalize and explain the idea of what sustainability is and why it is important, we made tasks that tried to address this.

As UBO had worked with the introduction to the course once before, they had an idea of what could be introduced and how they could explain the concept and importance of sustainability to the students. They would start with an introduction explaining what sustainability is and how it is going in the world, this would transition into the workshop where students could become more engaged as they needed to answer on the tasks. The workshop with the students was planned to take a whole course day, from morning to afternoon.

Task 1: SDG Guessing

The aim of this task was for the class to gain an understanding of how well Denmark is doing in reaching the SDG's. Here students would be tasked with guessing how well the SDG's were going. This would be done by color and voting, where red (really bad), orange (bad), yellow (okay), and green (good) were the choices they had, see Figure 14. Students should then pic in regards to how they thought Denmark was performing. For this, we used the voting function in Mural which would count the votes of students for each color as UBO would ask and talk about each of the SDGs. We would then compare the students' result of votes to an estimate of the status of the SDG's in Denmark by (Sachs et al., 2020) as seen on Figure 3 on page 12. This allowed us to frame the conversation with the class as to what needed more work in terms of sustainability for Denmark.

Task 2: CO2 Amount

The students would be presented with an introduction to the concept of the CO2 footprint of an average person in Denmark, of the 19 tons per year, per person, the class would then have to guess how much CO2 is coming from the objects and things in our everyday life, such as (clothing, books, electronics, and other items). We hoped that this task would help make students understand how many tons of CO2 is coming from consumption of products in our everyday life.

Task 3: Pairs of Shoes

The students would be tasked to count and make a note of how many pairs of shoes they owned. The idea was to show that we often have way more items than we actually need and use, and thus provide the students with an idea of the overconsumption dilemma that we are all a part of.

Task 4: Waste Hierarchy

To provide an understanding and to explain what happens to the items we discard, we would introduce the waste hierarchy for the students. Here formed as a triangle, the students had to help us assemble the waste hierarchy triangle by placing the correct categories in the correct slot level.

Task 5: Product Production

In this task, the students would be working in groups of 4, as they had to figure out how a selected product is produced and what resources are part of the product and production. This was to showcase the underlying processes of production that go into our everyday items. In order to provide information and help to the students, we provided a link to a web page where they could find their assigned product and the production phase along with the information they needed. The groups would then have to present their findings for the class and us in a small 5 min presentation to share their findings. Here the aim was to get them to collaborate and to research and discover a topic.

Task 6: Find 3 items

As we now hoped that students understood the effect of items better, we wanted to involve them in the project of the give box station. Here the students were tasked to find three things at home, which they in theory could bring to the give box station. This was to gain an understanding of which items the class might find useful to give to others. For this task, we created a flow chart as a guide to help the students find something to give.

These six tasks were prepared in collaboration with UBO and made ready for our course day with the class. Here we would test and observe how the online workshop with the 6-grade class and its teacher would function and what elements might need restructuring.

Verdensmålene - hvordan klarer vi os i Danmark?



stem på én



Sådan klarer DK sig (2020)

En gennemsnitlig danskers klimaaftryk er 17 ton drivhusgasser (CO₂e) om året

Hvor mange ton CO₂ tror du kommer fra "ting og sager"?
(tøj, sko, møbler, elektronik, pynt, hobbyting, osv.)

Skriv dit
gæt på en
punkt

Klassens samlede forbrug af sko

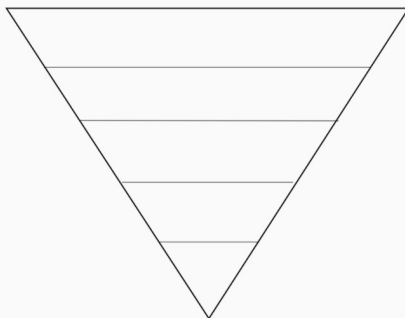
Hvor mange **par sko** har du?
(inkl. sandaler, klipklapper, løbesko, stilleter, vinterstøvler, mm)

Skriv til
hvert par
på en
punkt

Afstemning

Figure 14: Cut out from the mural board (From left: Task 1,2,3)

Affaldshierarkiet (hvad er mest bæredygtigt?)



stem på én



Den økologiske rygsæk

- Gruppe 1: Mobiltelefon
- Gruppe 2: En bomulds t-shirt
- Gruppe 3: Bamse
- Gruppe 4: Fodboldshorts
- Gruppe 5: Sodavandsdåse
- Gruppe 6: Syltetøjsglas
- Gruppe 7: Uldswear

Opgavebeskrivelse (I har 45 min)

1. Brug dette link og find jeres ting:
<https://mindthetrash.dk/kredsloeb-oversigt/>
2. Udfyld tilsendte PP skabelon - alt nødvendig info findes i link
3. Forbered fremlæggelse i grupper (max 5 min - alle taler)

Ting der kan byttes hjemme hos dig

Find minimum 3 ting du har der hjemme, som kan byttes i en byttestation.
Tag et billede af hver ting og upload på din computer!
Billederne skal bruges næste gang.

Brug eventuelt denne guide

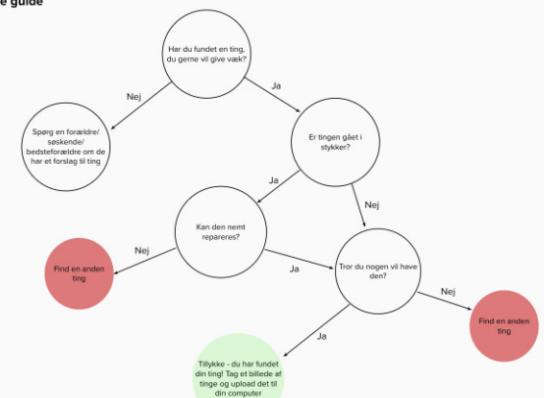


Figure 15: Cut out from the mural board (From left: Task 4,5,6)

The Online Workshop with the 6-grade class of Guldbergsgade school

The purpose of this first workshop was for the students to become aware of the problem, and to give them knowledge of and insight into why sustainability should be a Matter of Concern to them. The workshop was mainly facilitated by Mie from UBO as she was our connection to the 6-grade class.

On this day we meet online on Teams, with Rikke and the 6-grade class of Guldbergsgade school Copenhagen, here the presentation began with an introduction of the goals for the project and the program of the day, along with the hope of what the students would have learned by the end of the day.

In this presentation, the role of the student was also presented, telling them that they would become the class in charge of building and managing the use of the give box station that they would create and build for the school.

This workshop started with UBO and Rikke presenting and explaining for the students in 6.X. Here a lot of students did not have their webcam on and did not respond when they were checked off on absence by their teacher Rikke. As we, in collaboration with Mie and UBO, had prepared a range of activities on the online Mural page, the kids were given access after the first presentation to the course and the plan for the day. After the introduction, the whole class was given a link to Mural where Mie explained the program and the intended tasks for the day. As the students gained access to Mural, they started to explore the program and the page. They quickly figured out how this new program worked, even though none of them had used it before.

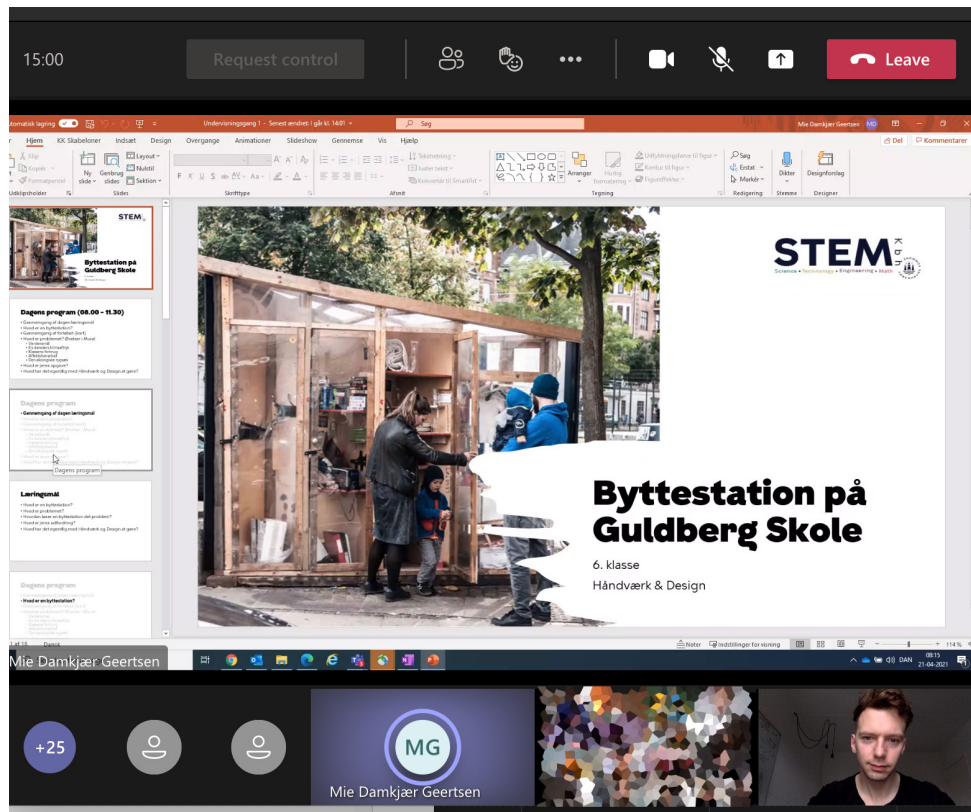


Figure 16: Screenshot of our meeting with the 6-grade class - PowerPoint presentation

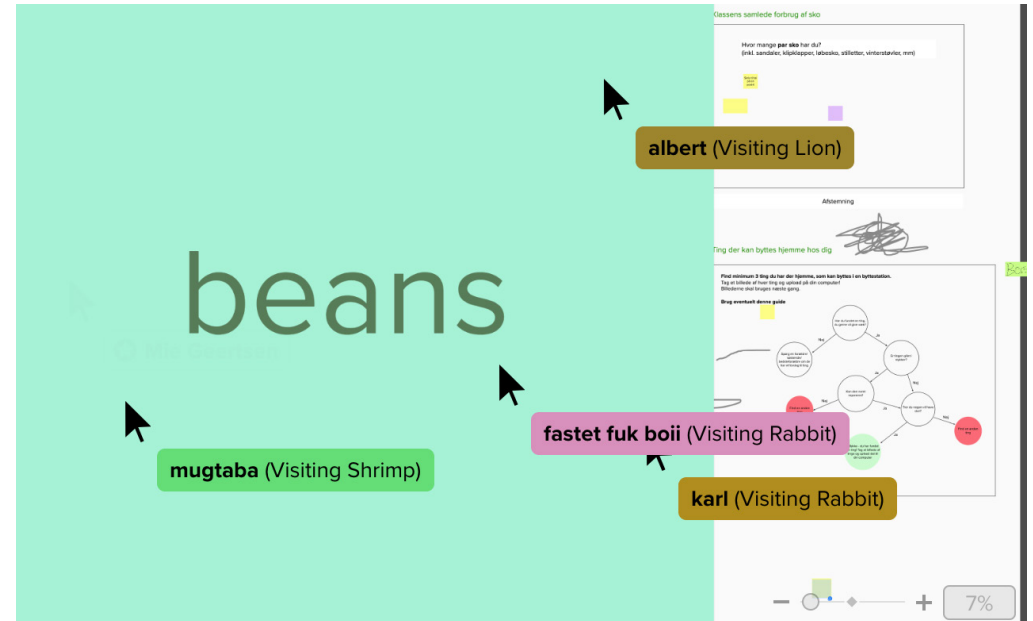
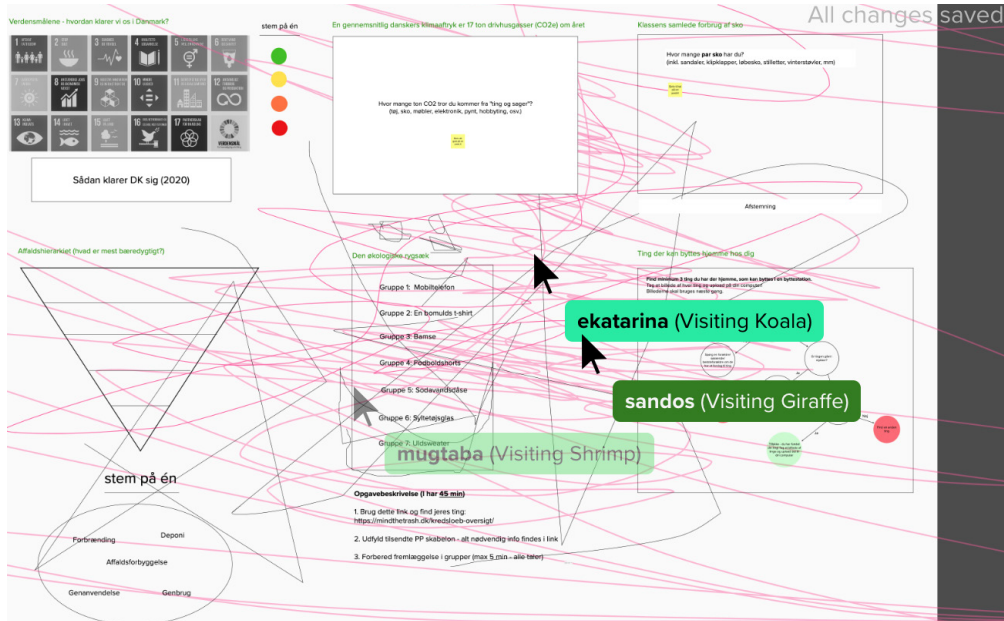
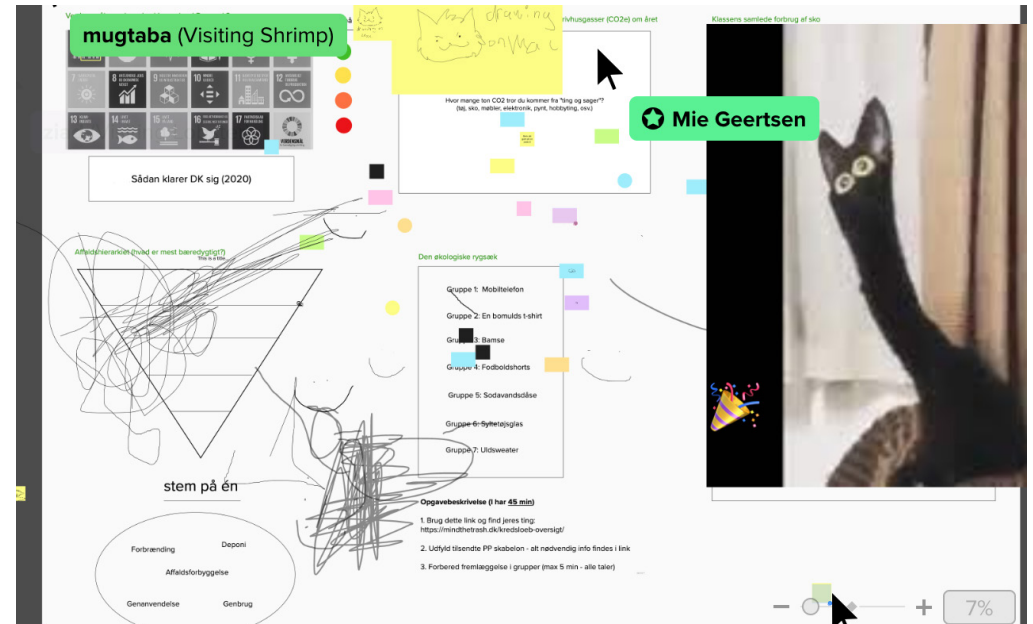
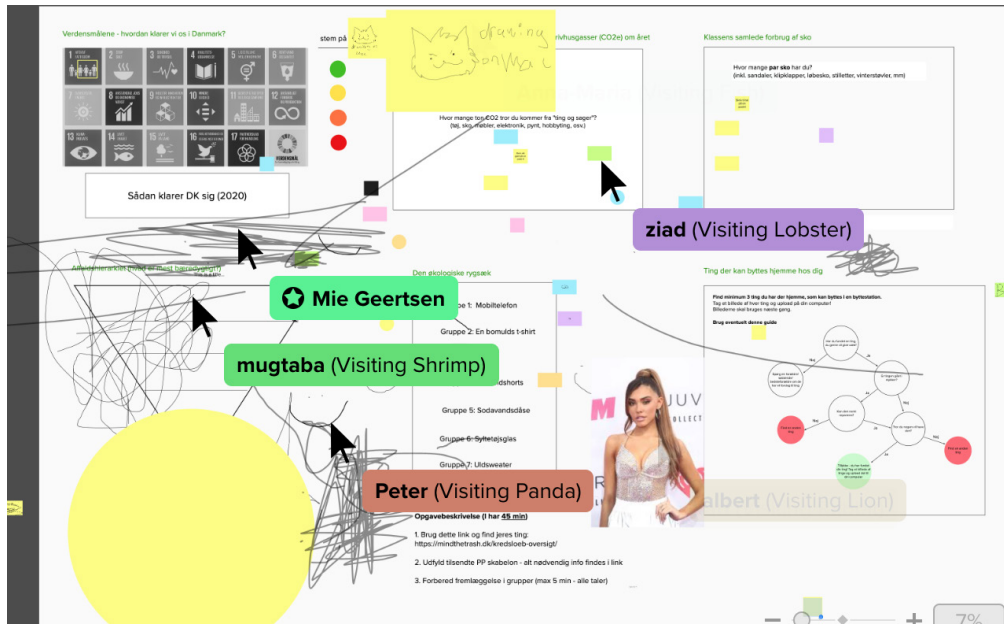


Figure 17: Screenshots of the class interacting with Mural and our constructed tasks

This resulted in a chaos of drawings, pictures, and “memes”, and the page began to fill up with the elements created by the students. This was, unfortunately, on top of the tasks intended for the workshop. Here Rikke tried to control the students asking them not to edit any more in the Mural page. This did not help, and the explorative students made even more fun drawings. We had expected the students to be explorative and to try new things, but we did not expect them to become this hard to control. Even the class teacher had difficulties managing the class in this environment. More and more drawings were made by the students, and some found a way to lock items, making the page unusable for us as facilitators and designers. This made the tasks impossible to solve as none of the students were able to see the constructed tasks that were now hidden below the drawings.

It turned out that the students took this new media as a chance to do what they wanted to do, and as a result created chaos over the elements prepared for the course. Adding to the chaos and the unmanageability of the situation, the students were able to choose a nickname, making it impossible for the teachers to identify who was doing what. This resulted in the class being told to close the page and go back into teams as we then moved on to another task outside Mural.

Moving on to task 5: Product Production

As the online Mural page did not work as intended, we moved on to another task as we tried to come up with another solution for Mural. We moved on to task nr 5, mentioned earlier on page 50, where students should look at production and resources for a selected product. This would make the students have to work in groups in order to solve the task. Each group got an object and 45 minutes to prepare a 5 min presentation. To avoid conflict, the groups were created and sent into different breakout rooms in Teams by their class teacher. Their teacher Rikke was able to move between the groups, but we had to stay behind as we were not from the same organization in Teams. The students were started with the task and Rikke talked with us for a bit before moving to the breakout rooms created in Teams. 45 minutes later, the groups returned to the central Teams conversation. The groups started to inform us that they were not able to perform the task, as they did not manage to open and create a PowerPoint page. None of the groups got any work done, and no one presented anything. This was disheartening as it meant that the students were facing a lot of challenges working online. Even though the technical aspects offer a world of possibilities, it also presents a lot of difficulties, which seemed to hinder the work and constructive output of the students in this case.

The class day ended with us talking more about sustainability and trying to explain task 6: where they should find 3 items that they could give to another person. In this, students got 10 minutes to find some items at home. When returning, none of the students had found anything, but made comments such as: “I like all my stuff”, “There is not anything I want to give away”, “I have asked my parents, and they don’t have anything either”.

The result of the first workshop with 6.X.

Based on what we observed and how the students interacted with the materials online, we saw that the interaction was more chaotic and challenging than we imagined. We had the expectation that the students would have to be met by simple tasks, and that they were able to share their input in a socialized and controlled manner. Instead, we saw that the students were not interested in solving problems for us and that they were not really aligned with the visions of the project for creating a give box station.

We also saw students had trouble handling and navigating the challenges of working in groups. Either they did not want to, did not care, or were not interested in the assignments. Most of the groups returned without any work to present and we ended the day with a feeling that the students had learned nothing. We can in part say that the facilitation did not succeed quite as we hoped it would. It still left many students unengaged and drooping behind the blacked-out camera and the muted microphone.

Before the workshop, we had a preconceived idea that students were open-minded and wanted to learn. We see that the students were not as easy to work with as we thought. Instead, it seems like they wanted to explore and have fun. They do not want to participate online, and given the opportunity, some will aim at disturbing the teaching and workshop for others. We see that we had misjudged how the students can act and that they are not as interested in cooperating as we thought. At least not in an online forum. The teacher also remarked that many students are tired and bored of the online lectures. Often students spend the whole day in bed, sitting on their computer and their phone. This also led us back to the issue mentioned in our empirical interviews, as teachers mentioned that the current form of online class was affecting the student's mental health.

For our project, and the concern of sustainability and the course of the give box station, this meant that the students were still in the problematization phase in regard to the four phases of translation. The students did not care to solve the problem of circularity, as it did not directly affect them in any negative or positive way.

Moving from an online to a physical workshop

After our initial online encounter with the class of young students, we had a meeting with UBO and the class teacher to discuss the possibilities moving forward. As the problems of the online workshop were not something we had anticipated to this degree, we consulted with their teacher Rikke on what we could do to mitigate the challenges. We arrived at the possibility of moving to a physical workshop. This was made possible by some Covid-19 restrictions being lifted from the schools as the country and working life was slowly allowed to reopen, meaning that schools were allowed to go back to physical class every other week. This idea was supported by both UBO and us, so we decided to move our workshops to a physical interaction.

Reorganizing the course - Planning a physical workshop

As we had already planned out the online elements with UBO and sought to make them explicit, we now faced the challenge of moving the course and workshops from an online to a physical environment with physical interaction. We chose to organize a small workshop with two teachers whom we got in touch with over Facebook. The purpose of this was to involve experts in the field, in order to learn more about teaching in praxis and how we could conduct the physical workshop with the students in the best possible way.

We organized a workshop with two teachers, Frederik and Marie, and invited them both to Mural to show them our collected interview quotes and to facilitate a conversation about different topics situated in the quotes. We also talked about the workshop and showed them elements of the course that we had performed. In this, we also discussed our findings and concerns. We constructed a design game where we could ask Frederik and Marie to rate and review selected quotes and challenges raised by other teachers.

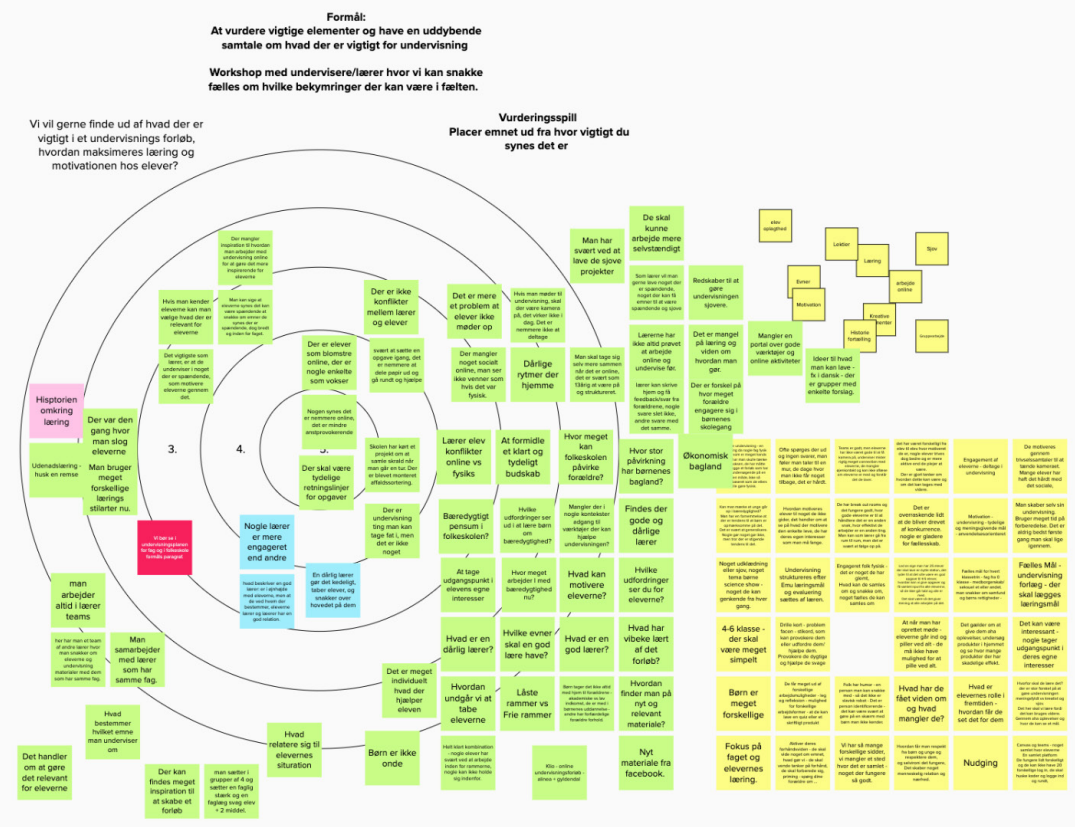


Figure 18: Our attempt of a design game for valuing quotes and subjects

During our workshop, we encountered problems with one of the participants' network connections. This made it hard to evaluate specific quotes and to place each quote on a rating. This resulted in the rest of the workshop developing into an interview where we ended up with even more quotes to add to our existing affinity diagram.

As a summary of our talk about teaching young students, we could conclude some important aspects to be aware of, in the course designed for the 6-grade class.

We should focus on making it:

- Simple and understandable
- Relevant for the students
- Motivational for the students
- Relatable for the students
- Young students have even less knowledge to base creative endeavors on, but they are great at looking out of the box
- Some students need more help than others

Before we ended the session we moved on to a different topic as we also were interested in the personality and motivational mindset of students. This led us to our initial descriptions of personas as Frederik and Marie assisted us in describing the types of students that they had encountered. In this, we worked from our observation and short understanding of students, as we began to structure different types of personas, based on comments made by Frederik and Marie. This led us to begin our initial personal work, separating descriptions of students encountered by Marie and Frederik see Figure 19.

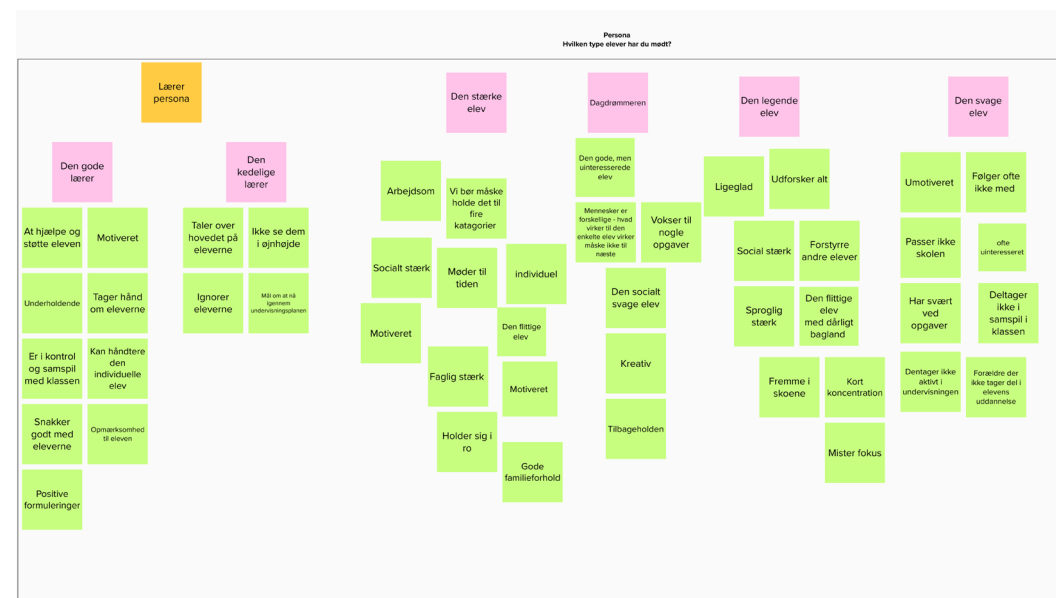


Figure 19: Initial work with personas

In this process we began to see a picture forming of four different personas, describing a different mindset observed by the teachers. This initial description of our persona work was saved for later, as we will bring it up to revision after collecting more empirical data from observations and workshops, this will lead to our later development of our four personas see page page 70.

Making physical boundary objects

Based on the findings from our first online chaotic workshop with the students, we needed to rethink the original plan of facilitating the workshop online. As the Covid-19 restrictions were slowly lifted, we started to develop our course plan into a physical workshop. A large part of the workshop could easily be translated from online to physical, but the challenge was still to make it work in the context.

In order to get the students engaged and to get them to talk about subjects, we devised printouts of the tasks and assignments. Allowing the students to work with the questions and materials in smaller groups. Here we divided the class into six groups, as this would help them work together and hopefully solve some of the tasks.

As we moved from online media to a physical one, we needed to make our online tasks into physical materialities. For this, we used printouts and low fidelity wood pieces as talking points and to help the students talk about ideas for the tasks. The idea was that these printouts, along with a plan and a guide for the day, would act as supportive elements for the students as they tried to talk about ideas in groups.

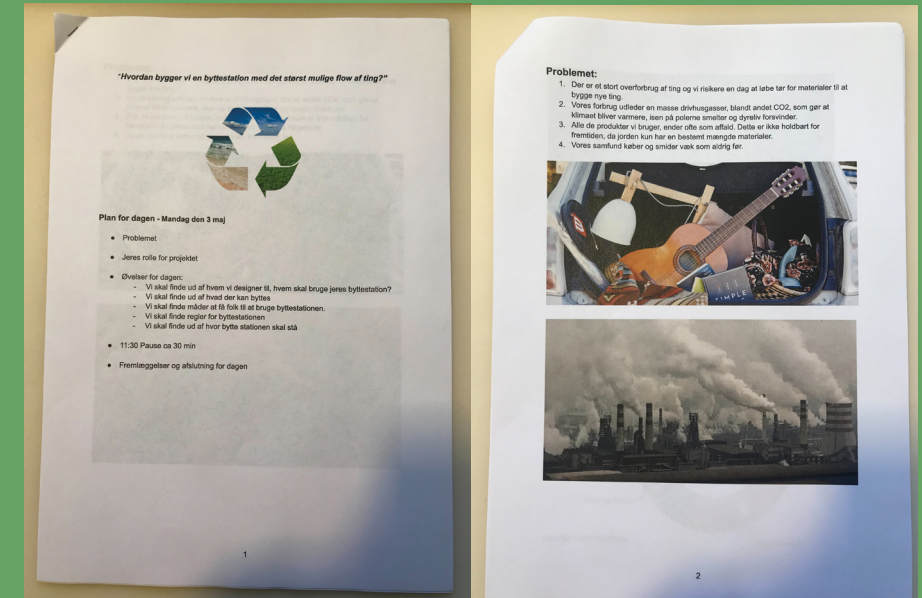


Figure 20: Intro and task document 6.X, for full size see appendix 04



Figure 21: Our intermediary objects

A physical workshop with students

The physical workshop with the students was conducted at Amager Nature School as UBO had permission to use the facilities. At 10 am the class met us there and were placed in six groups by their teacher Rikke. Mie and Aske from UBO started by presenting the place, as the students had never been there before. After the introduction, we began presenting the goals and the steps we had planned for the day.

Each group of students was given the materialities, print-outs, bricks, and post-its that we had prepared. This also showed the tasks for the day. We went through them together so that the students had an idea of what we were going to do in this session.



Figure 22: Class workshop, Peter facilitating the tasks for the day



Figure 23: Students working in groups

Observations and Results

During our workshop, we observed the students working in groups. We noted their work and how they behaved together and alone. Only a small portion of the class was verbally active in our questioning as we went through the work tasks we had prepared for the day. These diligent students were working on solving the questions and tasks and participated in the open debate after each question and took action during the small 10 min group working sessions. These good students had a lot of good ideas, and we could tell that they were trying to contribute and had their focus on us and Mie from UBO.

On the other end of the spectrum, other students seemed disengaged. They were sloping over the table, covering their face in their arms or hands. These students were not collaborating with their group or even engaging with the material. Other students were noisy and talked with

each other, even though we tried to facilitate the class. We needed to ask them directly if they had good ideas in order to get them to participate as they did not join in actively. In other aspects, we also observed that some students made fun games, used post-its to make planes, frogs, and figures. They made cool drawings on paper and wrote fun notes on the worksheets. Some built small cubes with the wooden blocks and did not create any real annoyance for the class.

During our presentation of the project and concepts of circularity in the beginning of the day, a lot of the students seemed to tilt their heads and look perplexed. When asked if anyone could explain what a give box station could do, there were no hands, even though they had talked about it in class and had just gotten another introduction. Here their teacher had to step in and guide the class as she became concerned with how well the students understood the different tasks and vocabulary we used in the explanation.

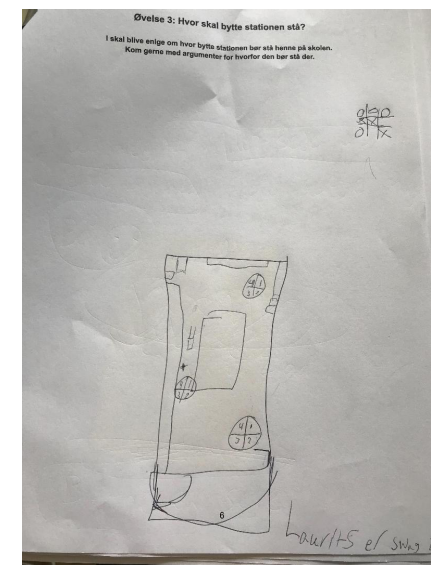
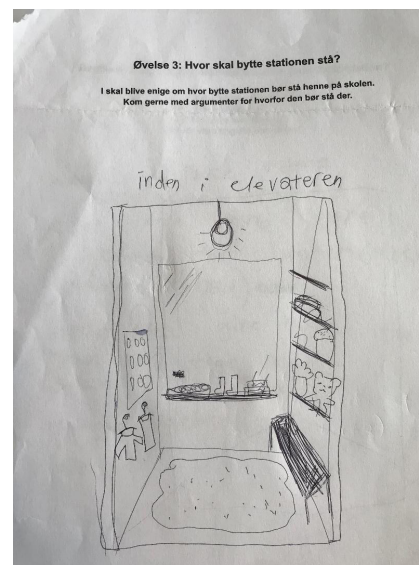
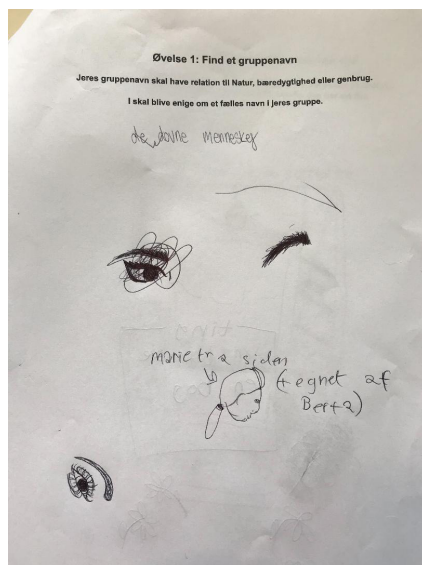


Figure 24: Drawings from the students in 6.X

The teacher worked to further the students' understanding and also went around to help and guide the students during the tasks. A common theme for the students, in our case, seemed to be that the problematization of sustainability is not entirely clear for them. They also like to work in their field of interest, as we see with the creative and strong students. On this notion, there is a need to make it more relevant and easier to understand for the students. The area and the motivation for why they should do it, is still lacking as the problematization from the student's point of view has not yet been formalized.

Field day - A visit to a recycling station

In order to bring their ideas to life and show the students what a give box station could be and do, the class took a field trip to the local recycling station (Møllegade) in Copenhagen. This particular recycling station was split into a give box station and a recycling station. After a short introduction to the recycling station, the material flow, and the waste hierarchy of the station, the students were tasked with finding and collecting materials in order to build their give box station. They were allowed to look for materials in the give box station and in the recycling station. The students found some interesting materials as well as some other items for decorating.

Accompanying the students was a carpenter provided by UBO in order to help the student build the give box station. The carpenter was attending the workshop to advise students in the collection of materials and to provide knowledge about the materials and its different advantages and disadvantages. This field trip also seemed to have the benefit of showing the students how a give box station can look and function in praxis.

Before this, they had only seen pictures and heard short explanations from their teacher and UBO. One finding was in how the surroundings and presentation of items in the give box station could make it more attractive for users, as it made the give box station look more inviting.

Even though the students had attempted to work with some design elements through the course, the carpenter tasked with building the give box station, already had an idea of how the give box station should look based on the materials available from the recycling station. As the carpenter already had a design plan, it gave the work performed by the student a form of redundancy as they did not influence the design after all.



Figure 25: Field Day at the recycling center and give box station

Analysis

Mapping our Actor-network

In order to identify and understand the actors and their relations to our case, we used ANT where we mapped the network around our case of education for sustainability and circular economy. By utilizing the ANT framework, we can map the relevant actors and their relations in the network. By understanding the actors and their relations in the network, we can begin to gain insight into why and how they are related to certain other actors and their matters of concern (Callon, 1986a). This also allows us to discuss the primary actors' relations and their matters of concern. In our efforts to draw out their matters of concern, first, we map the relevant actors, both human and non-human, which allows us to see and analyze their interests or conflicts of interests. (Latour, 1992). The different matters of concern provide us with the possibility to represent different actors in the design process, as to clarify the different opinions and standpoints in the network. As such, actors' matters of concern can act as intervention points to ground our later design process.

We have mapped the actors in the situated network that we are exploring. The illustration can be seen on Figure 26 on page 64 .

Actors and their relations in the network

At the top of our network, we find CC who are working towards implementing the national waste management of their Circular Copenhagen 2024 plan, in the efforts to meet national targets set by politics. This plan describes how they will meet both nationally and locally defined targets. The concern from CC is for the city to become a city where materials are not regarded as waste, but instead, materials

and products enter in a Circular Economy. They envision a future where resource consciousness is the norm and natural part of everyday life. As such, they aim at eventually eliminating the “take-make-waste” culture, implementing, and supporting a Circular Economy culture in its place (City of Copenhagen, 2019). Our collaboration partner UBO is related to the municipality and to the Technics and Environment Department (Miljø og Teknik forvaltningen) as they provide funding and project descriptions to UBO. Our network is situated around education in the elementary school, where students, teachers, and schools are our focus. Teachers, students, and schools are strongly related and have relations and ties to the educational agenda. This agenda is put in place by the Educational Plan and the school purpose paragraph. Thus, the Learning Goals are dictated by a top-down structure in the network. This structure continually formulates learning goals and aims at ensuring the newest standard and relevancy of learning and educational goals for schools and students. This relates both to other schools, and strongly to teachers as it attempts to regulate and steer the praxes and aims which are set for the student in the classroom. As the students in our project are still young, they are living in close connection with their parents which often establishes a relationship between the kids and family. Hence knowledge of practice might flow back and forth between the child and its parents during the educational journey. This relation might be stronger and weaker depending on the relationship with the parents.

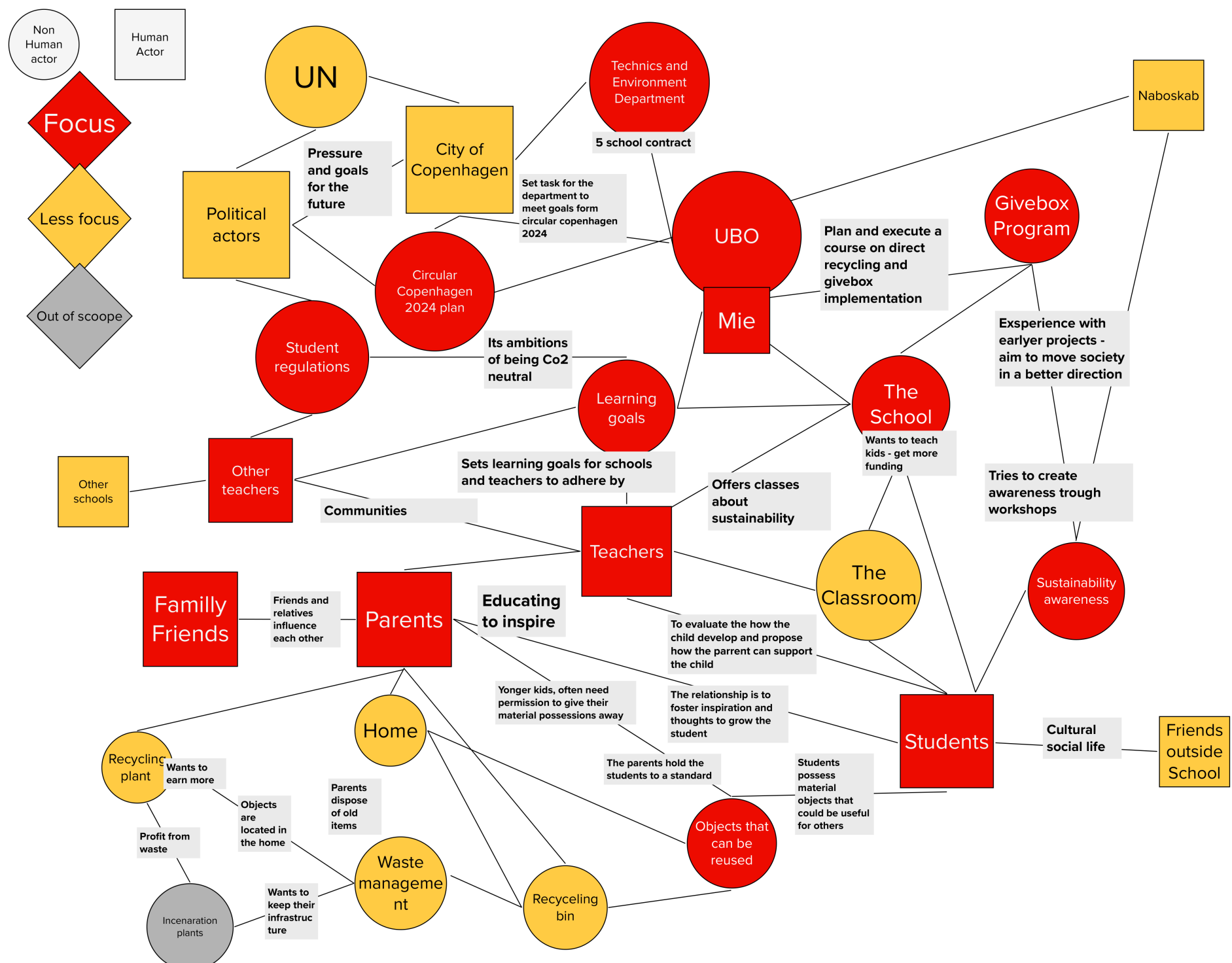


Figure 26: The relational Network of our project

Understanding the problematization

In order to understand the relations of our network, we can start by mapping and understanding Who's in? and Who's out? in regard to the goals set by our project. We look at defining who might benefit and prosper from the actions of the program that we are trying to push. Here, we can try to define actors' identities and their wants, as noted by (Callon, M. 1986a) in the process of describing the problematization phase relevant for our actor-network. As we map the top of the network, we note that in this case, a political aspect of education forms the top-down approach by establishing educational forms and goals of learning that then propagate down through the network, through the relations, eventually finding its way into the teachers, who in turn present and guide the students to its fruition. The political agenda is in place to secure returning votes, as it balances the good of the public and the expectations set by external political agreements. The promise of a better future in terms of reaching climate goals measured on the grand scale of the nation is setting the requirements for what must be done on a local basis. In our case, this is affecting what might be important steps to take in the education of young adults. For instance, CC aims at following and working towards these goal settings, by formulating the Circular Copenhagen waste strategy to be implemented through projects in the city. And we could argue that our project works to this end as well, creating action on a local level, working within the scope and aims of the strategy of CC and our collaboration partner UBO. As UBO is also constrained under the Environment and Technology department, as this department supplies the funding for the project, we see the top-down problematization and that the motivation for change is in one part being implied and imposed from a political perspective.

The Four Moments of Translation

As we analyze our actor-network, we also aim to understand where in the translation process the relevant actors are located, in relation to the course and the goals for CC and the future. As the 'four moments of translation' entails a translation process because of problematization, interessement, enrolment, and mobilization (Callon, 1986a). The four moments of translation formulates the stages actors should move through in order to make lasting changes in the network.

Looking from our perspective as sustainable designers, we aim to push for better education in sustainability as well as more circularity in our society. As we analyze the four moments of translation for our actors and the project, we can try to identify where we might face challenges. As noted in the ANT section regarding the top-down political aspect of CC and the Environment and Technology department, we see that the top-down approach entails political actors being aware of the problem to some extent. This pushes the agenda of sustainability for actors in the network.

In our work, we have zoomed in on the central actors of our network, as we are concerned with the implications of the implementation of these top-down goals. This leads us to view a constellation of actors working together, in which we see that relations go-between UBO to the teachers and from there to the students.

As we work to implement and push more sustainable education, we see the actors as having conflicting concerns. We see that UBO is working to fulfill the agenda goals of CC, and in doing so they have understood the problematization and are locked into their role in acting to solve the issues. The teachers we have engaged, have been problematized and are currently in the interessement phase where they try to lock into their own role in the supporting network. As the relations in the network are based around the teacher as a central element, we see that UBO and the teacher have a strong relation. In the same way, the students are strongly related to their teacher as they are familiarized through classes. We find that the relation between the students and UBO as a facilitator in the project are lacking.

Matters of Concern

Through our interviews, workshops, and observations we encountered a lot of statements about frustrations, and problematizations in regard to the project, but also about the everyday life of the school teachers. This continuous process allowed us to draw out matters of concern raised by the involved participants and allowed us to formulate their concerns into more concrete perspectives. As the students have not been a part of our interviews, we have relied on knowledge, perceptions, and extrapolation from teachers along with our own observations and interaction with the students during the workshops. Equipped with our gathered knowledge we sought to understand the subject of education and school from the students' and teachers' point of view, as we tried to formalize what concerns they might have.

UBO

We find that our collaboration partner UBO wishes to contribute to education in sustainability, but that they also want to fulfill the ambitions set by CC, regarding a more Circular Economy. At the same time, they also want to fulfill the aim of more give box stations in Copenhagen, a goal put forth by the Environment and Technical department. As UBO is also focusing on the educational aspects of sustainability, they aim at pushing better education in the subject. Because projects that aim to develop and establish better education are time demanding in preparation and execution for UBO, future programs were mentioned as a concern, as scaling to more and more schools would require more time. UBO does not have the budget or resources to deliver every project to the class teacher themselves. In this concern lies a wish for a more self-driven aspect.

Teachers

Teachers aim at fulfilling the learning requirements set by the Danish government which they must adhere to, by educating their students in the necessary material and tools in order for them to do well at the end of the school year. The teachers want to secure and foster a good learning environment, creating happy students whom they can prepare for later education and life. They want the social balance in the class to be good and to make the students' mental health a priority. But even so, the teachers find it challenging to engage every student and some will just not participate.

Students

In our observations, we found that there seem to be different types of students. We see that some students are working diligently on the tasks and participating. We also see that some students are disengaged and unmotivated within the class. There is a strong need for structure and clear work descriptions. Some struggle and need more support. Some students seek the collective social element as they socialize and want to have fun with each other.

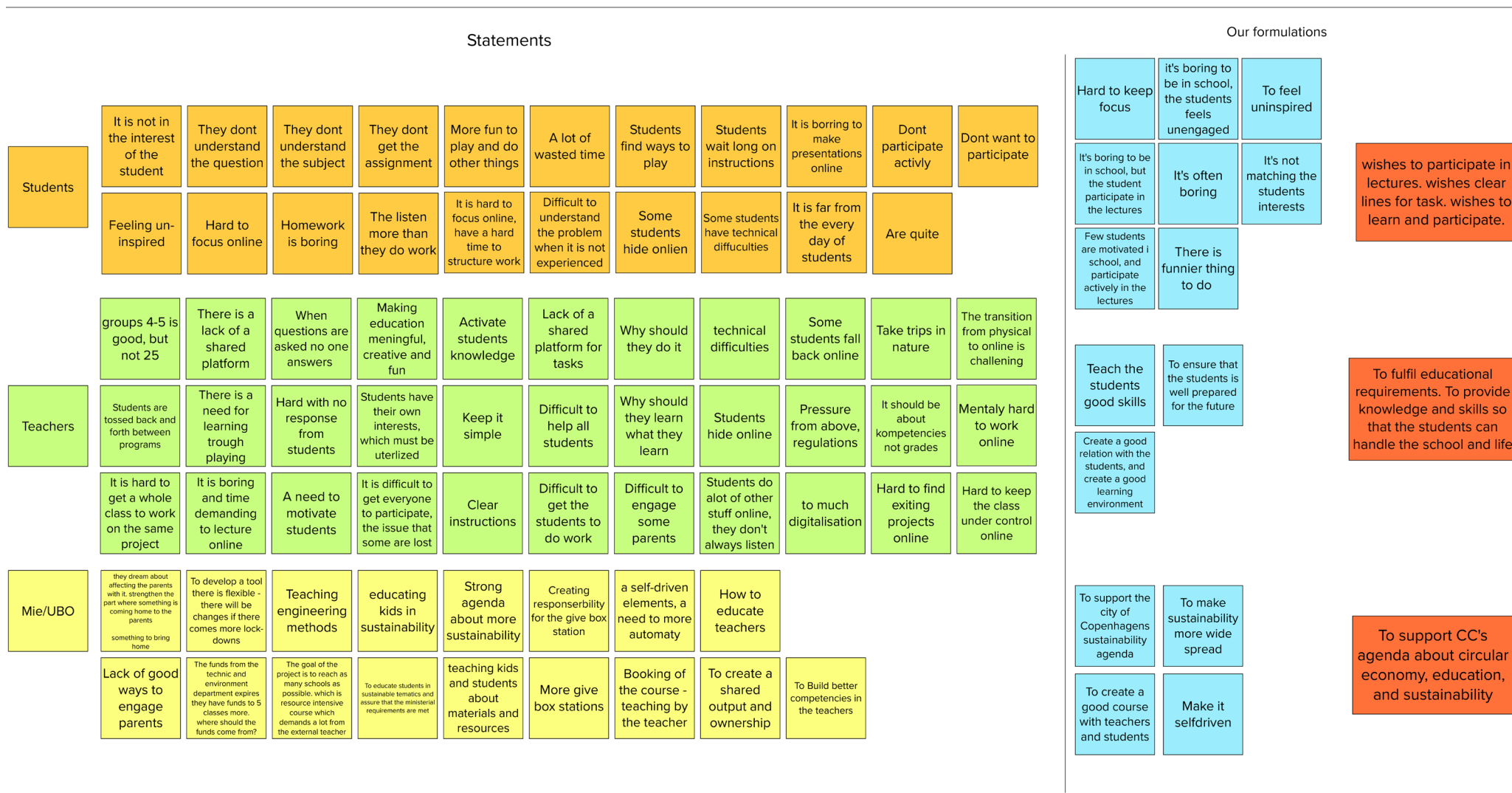


Figure 27: Mapping of Matters of Concern for relevant actors

Program and anti-program

To further investigate the dynamics and the different challenges in the class, we can also look at programs and anti-programs, since teachers and students seem to be conducting different programs which can result in conflict and missing of learning goals.

Teachers want to educate; they want to follow the school curriculum and foster the students' learning in alignment with the learning goals. They support the weak students and work to challenge the strong, all at the same time. They want to develop a healthy and secure learning environment that allows students to learn and develop. In opposition, some students, maybe unintentionally, make an anti-program that runs contrary to the class teacher. They want to have fun, be entertained, and make friends. They do not want to sit still, quietly and listen to the teacher talk about something they have no interest in. Hence, the school can feel like a chore, a place where they go because they are told, not because they want to.

As we have worked with the project of sustainability, it became clear that most of the students did not understand or care about the project and its concern for circularity. The students have thus not become aware of the problem and as to why they need to participate. They have not yet become problematized in the project.

Personas

In order to understand our actors in their matters of concern and to design with awareness of them, we have chosen the method of creating personas. By basing our personas on data of a cluster of people from similar social worlds, it allows for the construction of a fictitious person (Grudin & Pruitt, 2003). By identifying our actors and their concerns we will be able to design the project with the specific actor in mind, as this allows for a more fitting solution. This gives us an understanding of our effort needed in the enrolment of the relevant actors later on. Personas are frequently shaped around, personality, goals, challenges, interests, social ability. As the students in our project are all in the same demographic and age, we have also chosen to investigate the traits presented by the different students in the observed groups. This allows us to build on our initial persona layout from our workshop page Figure 19 on page 57.

The four personas

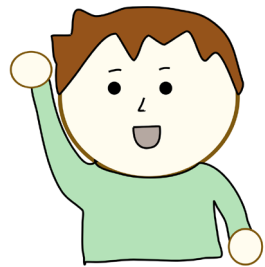
Through observations and statements from teachers, we have identified and formed four personas with different personalities corresponding to the different characters we have encountered. Based on their attitude, work ethic, motivational level, and behavior in class, we have collected their traits into a description of four personas, as formulated below.

Personas												
Susan - The Strong			Carl - the creative			Frank - Funny One				Ulrik - Unmotivated		
Quotes:	Can we start now?		I have an idea			Is this something we have to do?				None		
Work ethic	High	Ready on time	Works within interests	Middle		Works within interests	Middle			Rarely engaged in class work	Low	
Attentive	High	Attentative and engaged	Somewhat		Creates disturbance	Somewhat	Loses focus			Rarely	Does not care	Short attention
Motivation	Motivated		Middle	Can be high - it depends		Middle	Can be high - it depends				Does not follow	
Participation	Highly		Sometimes			Sometimes dominating in groups				Finds assignments difficult or boring	Low participation	
Collaboration	Can work with others	High	Quiet	Middle		Socially strong	High				Low	
Independence	Can work alone	High	Individual	High		Bored by individual work	Low				Low	
Needing guidance	Rarely		Grows to the assignment	yes		Yes					Yes	
Seeking help	Yes		Sometimes			Yes					No	
Special trait	Smart	To easy	Strong in niches	Creative	Likes to explore	High energy	Openminded	Talkative	Finds fun things to do		Wants to do other things	Easily distracted
MOC	Sustainability is often far from students everyday		Sustainability is often far from students everyday			Sustainability is often far from students everyday		Hard to understand the problem when its not visible			Not interested in the topics	Un-inspired
											Some students does not participate in class	Does not understand why

Figure 28: Persona work, see appendix 05 for larger model

Stuart - The Strong Student

“I sometimes wait a long time for the others in class.”

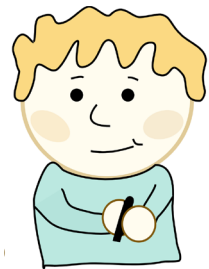


Motivation	●●●●●●●●
Collaborative	●●●●●●●●
Problematization of sustainability	●○○○○○

The strong student is a flexible, independent, and motivated student. Always ready on time and enjoys the challenges of the assignments in class. Wanting to participate in the task, either collaborative or alone, this student always tries the best, and if stuck, calls the teacher for help. The concern for this student is that the classes go slowly, a lot of time is wasted, and the waiting often becomes boring.

Carl - The Creative

“I like to play and be creative, sometimes I get bored.”

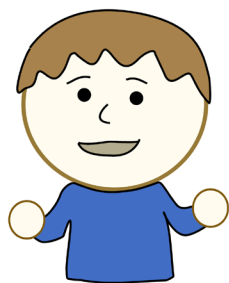


Motivation	●●●○○○
Collaborative	●●○○○○
Problematization of sustainability	●○○○○○

Being somewhat attentive, this persona is creative, individual, and likes to work within specific interests. Motivation for class assignments is varying as this student likes to explore and try things out. Collaborative work is not the easiest as the student likes to work alone, doing drawings, making small fun games on paper. The concern of the creative student is that classes are boring as this student likes to do stuff and is not entertained by long talks or discussions. The student will then fade into his own little world.

Frank - The Funny One

"I want to have fun and play with the others in class."

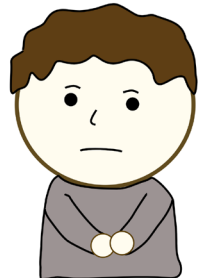


Motivation	● ● ● ○ ○ ○
Collaborative	● ● ● ● ● ●
Problematization of sustainability	● ○ ○ ○ ○ ○

Thriving in the center of attention, this student likes to talk and entertain. The slow-moving pace of teaching often becomes boring and attention begins to slide, resulting in disturbing behavior for other kids and for the class. The student is socially strong and likes to work in groups as the social aspects excites the student. The concern of the funny student is related to a problem with keeping focus. They will often find other funnier things to do in class.

Ulrik - The Unmotivated

"I don't understand why we should do this."



Motivation	● ○ ○ ○ ○ ○
Collaborative	● ○ ○ ○ ○ ○
Problematization of sustainability	● ○ ○ ○ ○ ○

Holding back, staying quiet, and reserved, this student holds potential but does not partake in class. Often sitting quietly by the group or alone, this student does not interact with others or take part in challenges or assignments unless the teacher is there to guide and motivate. Wanting to do other things the student waits patiently for the break or the end

of the school day. The concern of the unmotivated student is that school is not fun, topics do not seem to spark interest and hence there is no motivation to participate in class.

These personas lead us to an understanding of the different types of students present in our case. We will use this knowledge in our efforts to find a solution that might solve the problem of the slow pace of lectures, as well as creating more motivation for the students. We have our doubts as to whether it is possible to engage and motivate the persona Ulrik The Unmotivated, as we found it very challenging throughout our workshops and in discussions to get them to participate.

Addressing concerns

From our workshops with UBO, teachers, and students, we now had a lot of material we needed to analyze and interpret in order to narrow in on what is important for this project. As our empirical fieldwork had provided us with a lot of comments, quotes, concerns, and observations that formed our perspective, we tried to structure our understanding of the field through the affinity diagram method. This allowed us to summarize our findings, narrowing in on similarities and gaining an overview of the amount of empirical data. This process resulted in another affinity diagram, this time constructed by important factors for the project which we now could begin to address. This is illustrated below and in appendix 03.

There are of course, many elements which we could address, but as time constraints and our focus to work with the most pressing, we have eliminated some of these as these are

not the essence of our concern. We have therefore chosen to exclude two major topics; The integration of STEM, and the notion to include parents, even though they are a large part of the educational agenda. This is something we would work to address if the project were to continue further than our time boundary for this project.

The initial course structure followed a design strategy, where each phase, consisting of the steps of problematization, ideation, prototyping, and delivering, as these would move the process forward and result in a finished give box station. Through the process and collaboration with UBO, the focus has been on the output, e.g., to create a give box station with the highest amount of flow of items, but in focusing on this goal, we found that we may have missed out on creating and supporting a stronger involvement from the students, as they had not yet entered the stage of identifying the problematization for themselves. Hence, we knew we had to begin there.



Figure 29: Affinity Diagram of Concerns, see in large in appendix 03

OPP

In order to illustrate the problematization of the actors in our network, we can look at the Obligatory Passage Points as these are essential steps in the translation process concerning the problematization phase. In this, we can see how the actors are facing the Obstacle Problem and what we can then propose as a passage point.

By seeking to address the actor's goals we expect actors to be more willing to participate and complete the four moments of translation and begin to take part in the agenda for a sustainable future. In order to reframe the course to focus on the problematization, we can try and restructure the course to solve the identified actor concerns for the project.

As we summarized our collect concerns important for our scope, we found that:

- There is a lack of motivation and engagement of the students
- There is a need to make sustainability for the topic at hand understandable
- The assignments need to follow the students' level of understanding
- To support creativity and to fulfill course goals.

Through observations and the affinity diagram of concerns, it became clear that there is a lack of problematization for the students as some are unmotivated in the course.

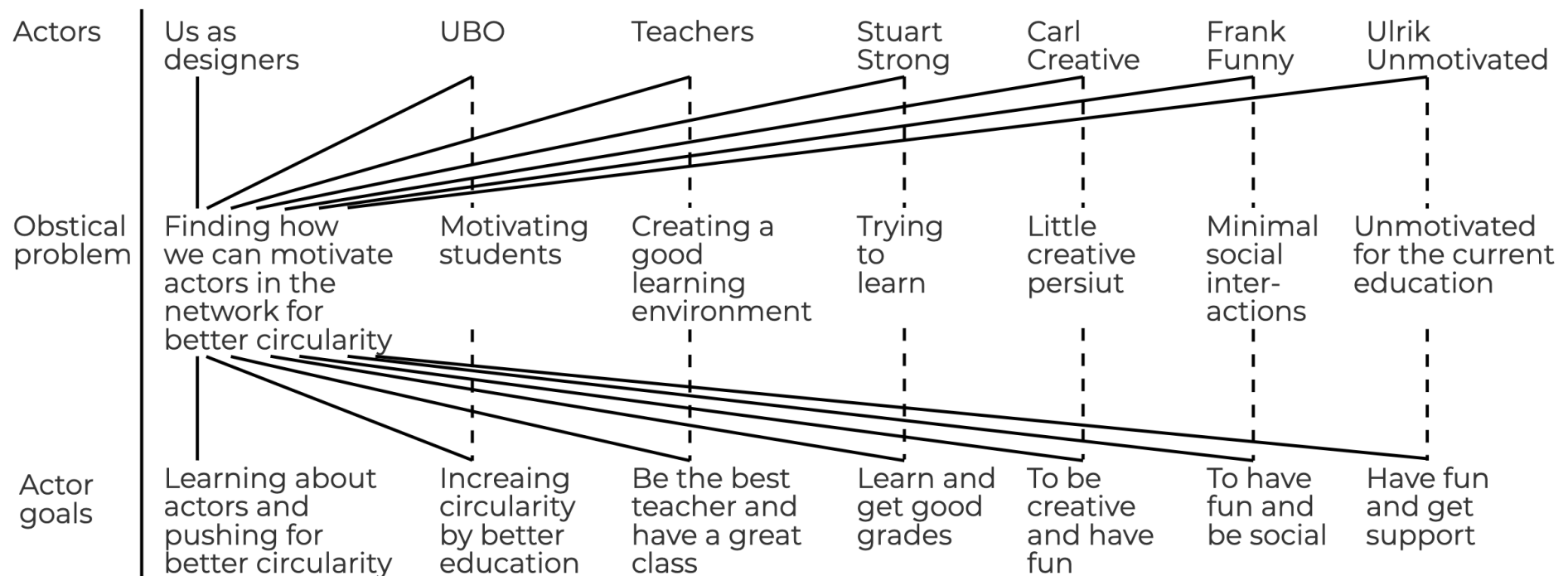


Figure 30: Obligatory Passage Point (inspired by Callon, 1986)

We see there are creative types who lack opportunity for more creative hands-on work, and we see students participating and trying, but becoming bored when they are not challenged. In our workshops, we also observed that the teacher and students had a strong relationship with each other, as the teacher knows the students and knows when and how to guide, reprimand, or encourage them. The students have little to no relation with UBO or other outside teachers, and the students are introduced to the course and UBO in the same setting. Initially, this resulted in missing progress, as we entered the first workshop with little to no idea about which level the students are at or how they like to work. In the workshop, we saw that their teacher had to step in and guide some of the teachings because she became concerned with how well the students understood the different tasks and vocabulary used in the explanation. This insight leads us to focus more on the collaborative process in regard to building the relations and utilizing the actors' strengths in the project. We concluded that the teacher was an untapped source of potential for better educational guidance, and as such could be a way to solve the problem of lacking motivation, addressing simplicity, and building on existing knowledge in the students.

As the layout and the design of the course did not achieve the intended results in terms of creating awareness on the problematization, creating ownership, or utilizing the creative abilities of the students, we will aim at designing a better and more suitable course in collaboration with the class teacher, as he/she has the greatest affiliation with the students, and is able to better plan and guide tasks to fit the students' specific needs.

The original core aim of the give box station course:

"How can we build a give box station with the largest amount of flow?"

But we now needed to take a step back and look at the foundation of the course, the problematization, and the why of the course, as this knowledge and reasoning needed to be established in order to build a solution with the students. We could now reframe the course with the identified concerns as we moved forward to the following design space.

Encouraging motivation among students

Knowing “why” can lead to motivation or lack thereof and is what moves people to act. Motivation is when there is a drive for action. Interests, values, and goals can be seen as essential components of motivation as they influence, in this case, a student’s behavior.

Learning in the school classrooms is often not done in isolation, but more within the context of relationships with other students and teachers. The motivation of an individual can in part be located in a combination of our Intrinsic and extrinsic values (Wigfield, Eccles, & Rodriguez, 1998). Our motivation could thus come from within, but also be external to us, i.e., in relation to our context. There is of course a lot more to the aspect of motivation and we will only just scratch the surface of what constitutes an individual’s motivation towards taking action.

Intrinsic values for motivation

Intrinsic motivation consists of the individual’s interests, values, and the goals they want to achieve. As such this relates to the enjoyment one gets from performing an activity. A task can have positive value as it facilitates the fulfillment of an internal important goal.

Extrinsic values for motivation

Extrinsic motivation comes from an individual’s external rewards achieved by engaging in activities that produce a reward. This could be rewards such as good grades, social status, or future job opportunities.

When students have aligned internal values for learning they often engage in learning tasks and activities even if it is not of interest to them. Students are more likely to be engaged when they have internalized the value of learning, adding to the notion that this might be an issue for our persona type Ulrik the Unmotivated.

The learning environment

Noted by Wigfield et al (1998) students progressing through school reported experiencing changes in authority and relationships with teachers. Often noted as less favorable interpersonal relations between students and teachers. They point to some teachers as less friendly, less supportive, and less caring as the students progress and grow. This is problematic because research shows that positive and emotionally warm relations with teachers do relate to students’ motivation (Wigfield, Eccles, & Rodriguez, 1998). Hence focusing on creating a positive learning environment and strengthening relations might prove valuable in strengthening motivation for students. This could be simple efforts such as giving recognition of students’ efforts and not just their ability in performing a task. By giving students a chance to achieve recognition for effort could foster more motivation.

Making sustainability understandable

The definition of sustainability can be traced back to the Brundtland definition as: “Development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (World Commission On Environment and Development, 1987) This definition can be interpreted and related to almost everything, ingraining sustainability in everything we do, making it a complex issue as the complexity of the problems we face with climate change presents no finite or most favorable solutions, without resulting in repercussions in certain areas.

The concept of sustainability has three dimensions: Planet, People, and Profit, where strong sustainability is constituted by the support and fulfillment of all three aspects. Sustainability having three dimensions stems from the Triple Bottom Line concept, coined by Elkington (Elkington, 1994). In developing a course in sustainability designed to teach middle school students, we would argue that the focus should be Planet/Environment as the Social and Economic aspects reside within. The concepts relevant for the course could be narrowed down to 3 elements: Understanding Sustainability, Circular Economy, and our Waste Hierarchy.

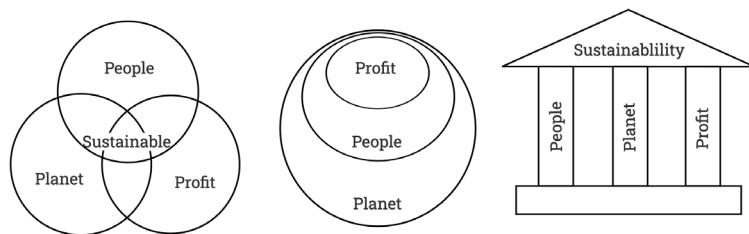


Figure 31: The triple bottom line; Planet, People, Profit. - Representation of sustainability as three intersecting circles, pillars, and concentric circles (United Nations, 1992) (Purvis, Mao, & Robinson, 2018)

Assignments that follow the student's level of understanding

Wanting to include these five elements proved to be no easy task to fulfill. We reached multiple dead ends in developing morphology charts, developing ideas on how to solve smaller parts of the issue, but often ended up with only partial solutions that did not manage to address the complicated issues of the praxis in the classroom. As the complicated nature of a lecture and a classroom requires for us to have a deeper understanding of the students, we needed to involve the teacher in the process of designing a solution that would have the best odds of succeeding in praxis.

Learning levels - Learning as much as possible

We are interested in supporting the learning possibilities presented to the students in the project. This leads us to the topic of understanding how students learn best. One challenge that we also observed in our workshops was that students are different and need help and Assignments that follow the student's level of understanding.

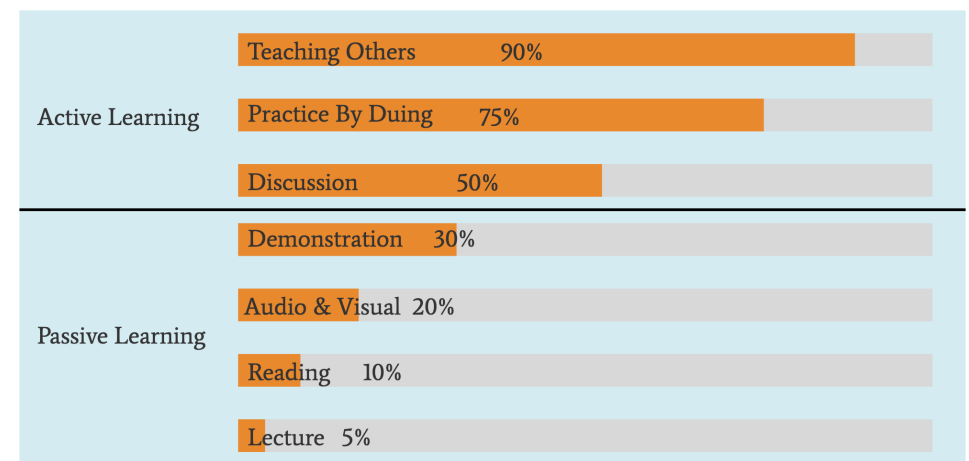


Figure 32: The learning pyramid - Adapted from Kare, 2012

The Learning Pyramid was developed and used by NTL Institute at our Bethel, Maine campus in the early 1960s. (Kare, 2012) In this, they formulated groups of learners' abilities to retain knowledge depending on the learning praxis encountered by the student. We see that the lowest and most disengaging form of learning is a lecture, listening passively results in a knowledge retention of 5%. Similarly on the low end, reading scores 10%, and a combination of auditory and visual learning scores 20% for retention rates. The lower stage can be regarded as a passive receiving stage. Moving up, we enter the participation stage where demonstration and group discussion constitute 30% and 50% respectively. At the top, we find Learning by doing, an active stage where students work actively with the knowledge, here 75% are retained by practicing what they learned. Lastly at the active top, we see approximately 90% retention of learning as a result of teaching or sharing knowledge with others. Being able to work and formulate thoughts requires the student to learn and recall, resulting in higher knowledge retention.

The exact percentage is debatable as this model has received some critique because the methods for obtaining those numbers are questionable (Kare, 2012). But for our purpose, the model illustrates the different learning methods and the gradual ability for learners to remember the knowledge for later use. From this, we hope to include a more method-oriented course design.

Conceptualizing - A design platform

The concept focuses on developing a stronger problematization for the students. In order to reach this goal, we need to focus on making the teaching element of the course optimal for the class. The issue of explaining and formulating tasks that the students are able to and want to work on, should be a task developed with the most qualified actors, making us able to incorporate their combined knowledge in the course. For instance, we want to benefit from the class teacher's knowledge about the students, as he/she knows them, their level, and the ways in which to engage them. But the teacher might lack knowledge in the area of sustainability. To supply her/him with that knowledge, we want to draw on the expertise and theoretical knowledge of UBO, as they are familiar with the theory and concepts supporting sustainability. Thus, our concept becomes the development of a platform which can facilitate collaboration and most successfully address the concerns of the different actors involved.

Our concept is a combination of the following parts:

- Stronger problematization for the students
- Delivering a finished give box station to the class/school
- Allowing for customization and details of the give box station

In the following we will elaborate on the 3 parts.

1. Stronger problematization for the students

As we have found, the students have not yet entered the problematization phase. We find that there is a need for the creation of more understanding and awareness. Currently, students are left with a vague idea of what sustainability is and why it is important. This could be aided through bettering of the educational elements in the course. By establishing a collaborative design tool for UBO and the respective teacher, they can collectively design the elements needed to spark the most motivation and engagement from the students. As the assignments also need to follow the students' level of understanding, the inclusion of the teacher in the planning and development of the course could help to better frame the elements and tasks needed, to fit the students' knowledge and skill set.

2. Delivering a finished give box station for the class

The initial course plan focused on allowing the students to ideate on the give box elements and the functionality of the design aspects of the give box station. But, because the students were tasked with the ideation and solving of a problem, which they did not care about or had identified with, resistance arose. So, instead of leading the students through a design process that they do not understand, we recommend building and designing the give box station as a Plug and Play solution. The give box station is going to be built and designed by the carpenter, as noted on page 61. By providing a finished give box station, we can focus on establishing the foundation for the student's ability to take ownership, through the understanding and identification with the issue in part one: sustainability. This will provide the school and the students with a finished give box station that they can utilize for additional ownership in the part 3.

3. Allowing for customization and details

This element aims at building creativity among the students in the aims of fulfilling course goals in Craftsmanship and Design in which students should develop competencies for designing, manufacturing, and evaluating the functional and esthetical values through practical work, as noted on page 16. By allowing for customization of the give box station, the students can understand materials and their use in the process of creating stronger ownership over the give box station. Our goal is then to provide a design game, which aims to support the UBO and the class teacher in their supervision of this project.

As the whole course aims to provide a foundational understanding of sustainability, more specifically an understanding of material culture, resources, environment, and material use, our concept as a design game aims to strengthen the problematization and to provide hands-on and creative elements for the give box course. Elements which hopefully also strengthen the students' understanding of sustainability and can motivate them to take action. The basic aim of our design game is to make the planning process more specific and targeted towards the students. To accomplish this, we seek to establish a design game that allows the teacher and UBO to choose different techniques/tasks to meet goals for all actors involved. This could be a more foundational step on the road towards establishing a give box station as a long-term functional element at the school. More importantly, it could be a way to develop a better understanding of the problem of sustainability among students, as it could activate their curiosity and concern for the solution.

The design game - A Collaborative planning space

We aim at staging a negotiation space, in which teachers and the UBO can generate ideas for methods that take the concerns into account. Here UBO and the teacher are invited to frame ideas and further requirements. The design game is meant to be a tool for collaboration and planning, making it easier to explore and detail elements in the course. With this game, we aim to assist UBO and the teacher in the planning process of a course in order to make it suitable for the students. The course should support the students in learning about sustainability and enlighten them about what action they can take towards it. The collaborative planning space will allow UBO and the teacher to customize the elements to the level of the students. In the game, we incorporate the personas as they can act as a conversational focus and as a reminder of which concerns should be addressed in regard to the different types of personas, i.e. students.

We have used Mural to build the game, as it offers a platform that can easily be customized, shared, and explored together. In this way, multiple actors can engage in the productive effort of formalizing and planning, as new elements can be added, changed, and altered by all. We have chosen to prepare an online version of the game because online collaboration can be more time-efficient.

Step 1. Addressing the problematization for the students

In this step, we wish to make sustainability more understandable for the students. To accomplish this, we need to look into which elements should be part of the learning in class. We have divided the course into four topics, which UBO and the teacher should aim to make as approachable for the students as possible.

What is Sustainability?

What is the Waste Hierarchy?

What is Circular Economy

What is a give box station?

We imagine that the alignment of ambitions and goals between UBO and the teacher is important. The design game consists of four subjects, which creates the stage for the planning and detailing. In order to create an overview of this, we have made space under each subject such that these goals can be discussed and summarized.

To the right, we have separated the seven sections from the learning pyramid see page on page 76.

This is done, in order to establish the best method of teaching the students about the different topics outlined above. We need the teacher's input as we need to formalize and discuss which methods of teaching. This will work like a morphology chart with a brainstorming exercise for each section. The goal is to build on learning methods to provide the best overall learning based on the levels of the learning pyramid.

How can we educate the students to develop concern for sustainability?

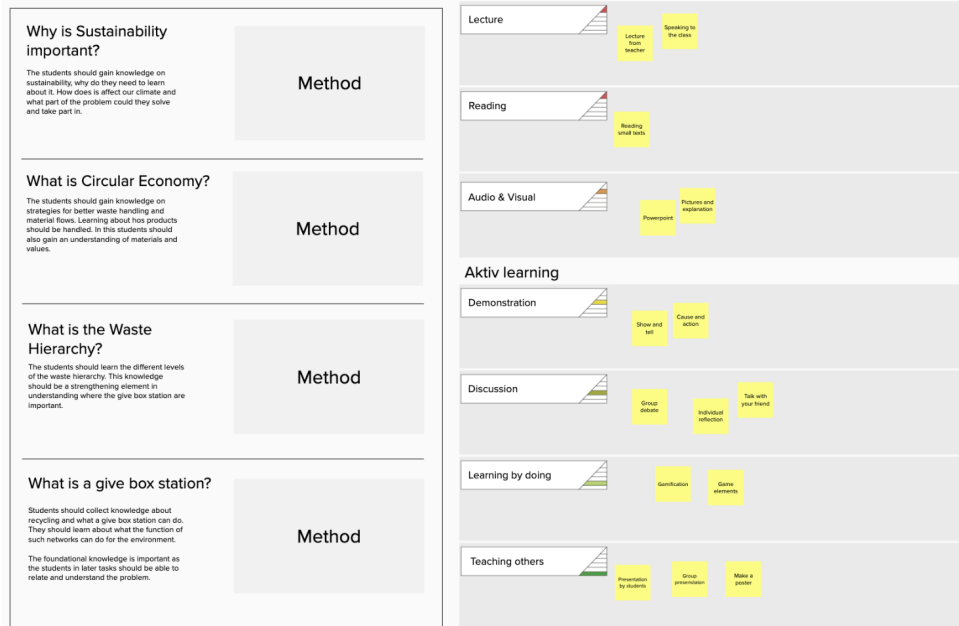


Figure 33: *Prototype of our collaborative design game section 1*

Lecture: PowerPoint, class teaching, speaking to students, telling stories

Reading: Homework, reading in class

Audio & visual: Movie, illustrations explained, figures, maps, illustrations which support the subject, creating visual representations and explaining, Figures in 2D or 3D,

Demonstration: Learning cause and effect. Relations and functional understanding. Seeing a course of action.

Learning by doing: In trying the task for themselves, the student are forced to think and develop an understanding of the matter, so the praxis and the result is correct. It is about practicing a task and perfecting the craft in the process. Discussions and small written texts.

Teaching others: Having understood the concept, the knowledge, the students are now capable of explaining and teaching the subject to another person.

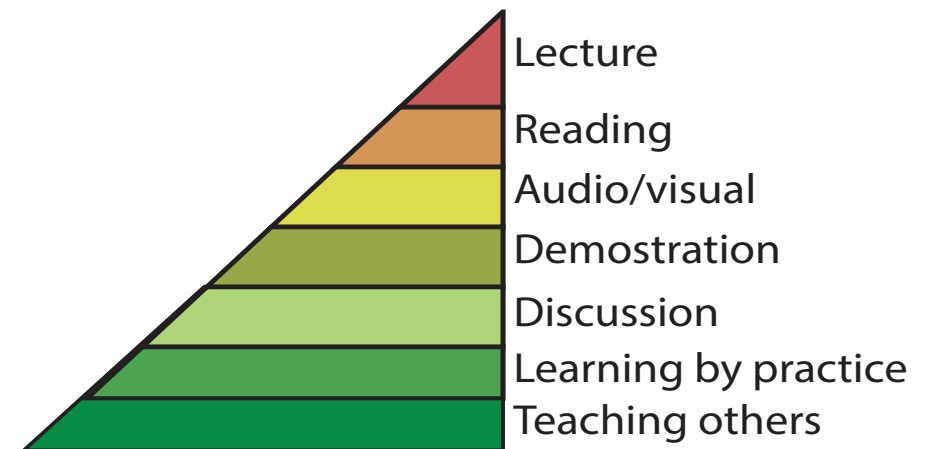


Figure 34: *Learning pyramid (inspired by Kare, 2012)*

In section 2, illustrated below, we can unfold the selected methods as in this example. We look at the learning method of “Gamification” which can take many different forms. In our illustration, we provide a space for elaborating on elements in each method, as we seek to specify what is important. To accompany this, we also make use of our four personas, to create awareness of their different strengths and concerns in education. Here we hope that the teacher and UBO can collectively attempt to address some of the persona concerns, in the effort towards motivating a greater part of the class. As UBO and the teacher are presented with the elements of the personas, we hope it will allow the opportunity to address each type of student better.

Step 2. Delivering a finished give box station to the school

As the finished give box station is delivered to the school, the students and teacher still need to discuss the matter of where the station should be located and how they handle the items that are not taken. As this is some of the tasks that UBO has already formalized, they might be able to utilize their measures in the process.

Step 3. Allowing for customization and details

The students are tasked with customizing the give box station. In this endeavor, they need to be creative and bring items, objects, and materials in order to customize the give box station. There is still the question of how this should work in praxis. Here we can again initiate a planning with the UBO and the teacher. We imagine that field trips to recycling stations or other recycling shops could be a way to collect items for customization.

Testing with UBO and teachers

As we need to test and specify our concept, we need to stage the negotiation space in order to understand the feasibility of our concept and its flaws and benefits for the actors. With the initial design game laid out, we need to test and make iterations on the elements in order to assure that the functionality and outcome works as intended for the involved actors. To do this we plan to first present our findings and our solution to UBO as they need to be enrolled in the act of making the students more motivated to participate and working on the students' understanding of sustainability and why that matters. As UBO will unquestionably have some darlings that might be hard to let go or alter, we also need to accommodate the elements that they think are a must to incorporate. This is a challenge faced with, when working with actors within a top-down politically influenced field.

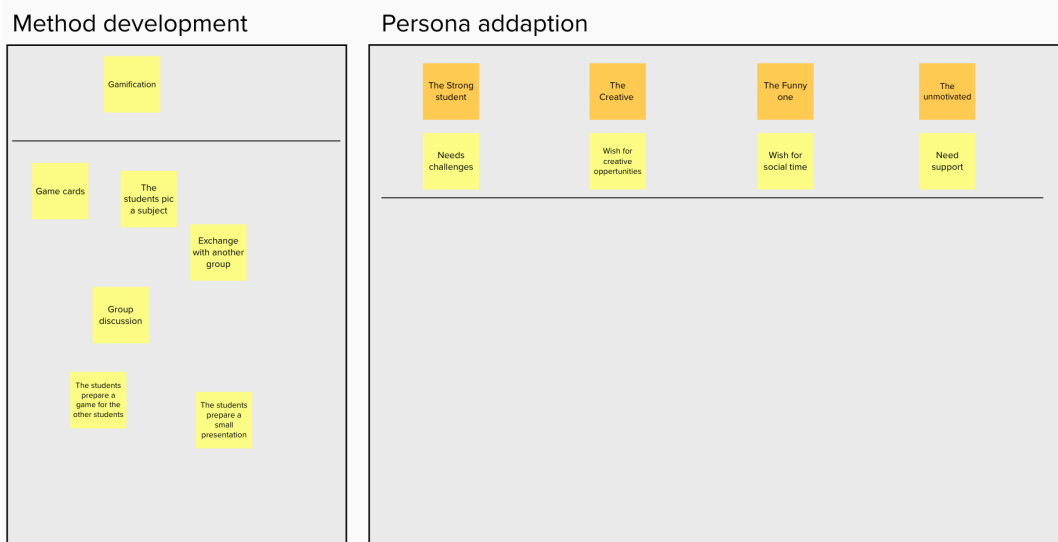


Figure 35: *Prototype of our collaborative design game section 2*

Sub-Conclusion

Our concept seeks to create a better collaborative process for our actors, aiming at developing a better course design by involving the teacher in the process of selecting methods and tasks which fit the students' needs. In this process, we also try to foster a greater understanding of and empathy towards the personas and the sustainability agenda, and its possible solutions might need a differentiated approach. We hope that this process of collaboration can foster a development of better methods to engage and motivate students. This can hopefully act as better intermediary objects as they travel through iterations and become more specified in their form and function, allowing actors to use and navigate with them.

There are still a lot of unknown factors and concerns which we have not managed to incorporate in this new concept. The element of self-sustaining the course, freeing time from UBO, and letting teachers drive the course on their own are still tasks which require that the basic elements be solidified before a finished solution can be distributed to teachers around the schools of Copenhagen.

Discussion

In this section, we will discuss our findings as we try to put our work into the context of education and the sustainability agenda for Copenhagen and our collective future.

On one level, the goal of education is to help students gain skills to live, learn, and work successfully within society. Today that means becoming information seekers and evaluators as well as problem-solvers and decision-makers (Black, 2010). In order to support this notion, we have worked within the field of education on sustainability as we seek to educate the next generation in their role for the future. To gain an understanding of what this entailed, our literature research focused on the importance of climate change education and sought to address the educational strategy for developing better climate change education. We found that this can be done by developing skills and knowledge, critical thinking, problem-solving, collaboration, knowledge on climate change, and sustainable consumption as these abilities focus on fostering the ability to adapt and adjust to the challenges of their current life as well as the future (Anderson, 2012). Creating the foundation for the students to be able to develop these abilities was initially our aim and hope for the project, as we wanted to incorporate tools and techniques in the course in order to make the young students better prepared for later life. We worked within a small niche of education, looking only at a 6-grade class in Copenhagen. In collaboration with UBO, we structured workshops that could support the agenda of the course and project. Through our work with UBO and our interview workshops with various actors, we gained an understanding of the importance of fitting the course to the class level.

The original course plan for the give box station development and implementation did not go as we had hoped and aspired for, and we realized that the students in our age group had a lot of other issues and challenges that they were struggling with. Keeping some of them from engaging in the project. Because of this, we had to take a large step back and restructure our approach. The give box course is based on the foundation of the students as a collaborator and a stakeholder in the project, involving and delegating responsibility to the students, which would, in turn, assure ownership over and a sense of care for the give box station. We found, however, that this aim did not work in praxis as we had hoped. This finding supported our development of a new concept to strengthen the foundational aspect of the program and ambitions for CC and UBO to create more circularity and more climate-conscious citizens. We sought to engage the students better and raise the participation level of unmotivated students, as their unrealized potential is suffering from the lack of engagement and motivational aspiration.

From our field data, we found recommendations for working with students' interest, which was mentioned by several teachers in our interview phase. We would argue that this is not always possible. Instead of building from preconceived values and interests, there could be ways to explore values for motivation. We hope that developing students' understanding and knowledge in the field of sustainability might unlock and inspire the formation of both intrinsic and extrinsic values which can support and motivate for action for change.

We found the class teacher to be the key to the students, as the teacher is the most competent to navigate the complex personalities and work levels in the class. The teacher and student have built relations with each other which allows the teacher to judge how the class can handle different concepts, challenges, and activities. For this reason, we have found it critical to create a tool that allows for the course to be easily adjustable to the students, in order to get the best possible outcome. Literature also points to the significant importance of the teacher and their praxis in teaching and relational work with the students, as the quality of the student-teacher relationship can be strongly linked to the level of the students' motivation. A supportive teacher offers students positive experiences which likely foster motivation, school engagement, and positive academic attitudes (Eisenberg, Duckworth, Spinrad, & Valiente, 2012). This is something we have sought to address in this project.

Why implement a give box station in schools and not on the streets of Copenhagen?

As kids grow fast compared to adults, we expect them to change clothes and interests much faster than adults. Kids grow out of clothes and stop playing with items, leading to the need for new items. We hope that some of the used items that are no longer used by one student, would find its way to the give box station and on to another person who can make new use of the item. Through the action of giving, one can lower the need of buying a brand-new item.

As the give box stations provided by NABOSKAB in 2016, developed a lot of interest in the local communities, they made a good case for establishing more circularity options in local areas around Copenhagen. Working to spark the engagement of the future citizens of Copenhagen, we

have followed the idea of implementing a give box station in a school setting, as more and better involvement of the younger generation i.e. the students at the school, is thought to foster better concern for sustainability in the future. In doing so, the give box station can be one step in the problematization phase, and the interessement through learning and development courses could follow. We hope that through continual work and in allowing actors to move into the interessement phase and take part in solving the issue, it will lead to the enrolment and then mobilization of the students as they grow and take their place as an adult and sustainable responsible citizens of Copenhagen.

One of many solutions

As we were initially met with a finished plan for the course and the concept of developing a give box station with the class through the program, we have not investigated other possibilities for solutions that might be able to interest actors or solve the problem of circularity for CC in a better way. We are aware that this give box course is one solution out of many which all seek to support the development of a more sustainable way of life - both now and in the future. What all programs have in common, is that they need action in order to create change. This is what we have been focusing on creating a foundation for, through the motivation and involvement of young students.

The feasibility of the concept

As we are in the midst of a global pandemic, with uncertain times, we might face new lock-downs and stay-at-home orders, meaning that the physical aspect of education could be limited again. For this reason, we have devised an online solution as the collaborative platform and process can be facilitated online to better avoid physical interaction. This

online process will lead to the formation of objects and tasks, these can either be made online or physical. As we have seen in our fieldwork, online classes at this age level are a massive challenge for the teacher and leave many students disturbingly unengaged. Nevertheless, the collaborative approach that we suggest, might stand a better chance against the lack of motivation embodied by the students for this course and the give box station.

We recognize that there is a large unknown factor in regard to what a better understanding of a problem plays in the aspect of motivation for taking action within the problem area. We imagine that the first step in the process is to become more aware of the sustainability issues we face as a society. This way students might be able to identify some of their own underlying and unknown concerns and values which might begin to motivate their actions for the program and for the future.

Methodological and Theoretical implications

In this part, we wish to discuss the theoretical lenses we have used to analyze our field. To this end, we will go through our use of the ANT framework for our project.

ANT

In our thesis, we have used the ANT framework (Callon, 1986) as our theoretical lenses in order to view and analyze our empirical knowledge. It has given us the ability to view the related nature of our network and understand the concerns of our relevant actors. We have looked at the four phases of translation as a means to understand how far the actors are in the process of translation as well as the OPPs for the network.

As we saw the students had still not entered the problematization phase. We expect our contribution of developing a means for better problematization and framing of concern will be able to start the translation phase for the students. The teacher has been problematized and interested and is now in the enrolment phase, as UBO aims to mobilize the network. In the end, we need to withdraw from the network, as our role as facilitators should be to facilitate the process for actors to enter the problematization, interessement, enrolment, and mobilization phase, so the actors are able to contribute in the stabilization of the network on their own. We experienced conflicting interest from actors, in the form of agreement or disagreement with the project, we have sought to address these through our concept, which now need to stand the trial of testing and if successful implementation in praxis.

Through the moments of translation, the ANT foundation allowed us to discuss potential conflicting matters of concern, which we found important for the negotiation processes between actors. We aimed to understand what might move them through the four moments of translation in our work to address their concerns and as such, the framework has provided us with lenses to analyze and formalize a solution that seeks to address the concerns for the involved actors.

Participatory Design (PD)

Through our project, we have chosen to work with PD because it builds on the premise that people who are going to use a product or solution, are involved in designing it. One challenge, which we also worked with, is the incremental nature of ideas and solutions as opposed to radical change; actors often work with what they know. This also posed a challenge in our project.

PD is highly reliant on participants' involvement. Co-design and user involvement is needed in the process of designing, by utilizing skills of the participants, but we were challenged by the students' lack of participation and the teachers' limited time and lack of prioritization of the collaboration. For instance, the students did not or could not participate as we had imagined, which was one of our biggest challenges. This challenge could be a factor that can compromise the final design. We wanted to involve the students more in our workshops and in discovering their concerns, but this was a challenge, since we had to consult with the teacher first, and she chose to prioritize other actions. As such, we never got a reply to our questionnaire or our invitation for a workshop with the students. Instead, we went through the project and course development with UBO and the course arrangement with the teacher and class. Ideally, we would have liked to work more with students in designing and addressing concerns from their perspective, as this could have made the process more transparent for the actors, as well as creating more involvement in the process.

In our final stage of the project, we aim at staging a negotiation space, as a testing and specification phase, in which teachers and the UBO can address ideas for the solution and the concerns that it addresses. This negotiation space is to be represented as a space in which UBO and the teacher are invited to frame ideas and further requirements and provide us with their valuable reflections on the concept, for further evaluation. As designers, we have the role as facilitators and will have to stage and navigate the collaborative design process for the participants. In our concept, we have tried to represent the Matter of Concerns of the actors by a materiality that represents concerns, as well as the overall project concern.

The sustainable aspect of this project

As the premise of the give box station is to slow down consumption and limit the need for buying new items, as illustrated on page 33, it will have consequences for other areas in the world. Depending on the scale and the efficiency, the give box station can slow the production of products by limiting the need to buy new. In the small scale of this project, these implications are almost non-existing as the items that will be given away are in such small amounts, due to the lack of interest - for now. If, on the other hand, the project is successful in translating the students and enrolling them in the final stages of mobilization, we can imagine that the scale of items given and circulated would begin to increase. If this concept could be scaled to the whole city of Copenhagen this could begin to have some significant effect on other parts of the network, for instance for retail, and develop more than just a local benefit.

Environmental sustainability

By introducing the give box station in a community, we aim at slowing the loop and directly reusing materials, thus extending the life of the product and limiting the production of new products. The potential to lower the production of new similar products, can reduce the amount of raw material, energy, and pollution used in production, packaging, and transportation of new goods. Thus, helping lower the CO² footprint and material footprint of the citizens of Copenhagen.

Social sustainability

The social aspect of a give box station could entail a stronger community in local areas of Copenhagen. By giving items of use to people who might not have the economic capability to otherwise attain such items. In the extreme case, limiting the buying force of new products, this would affect production and sellers in other countries. Depending on the circumstances and scale, this could put workers out of jobs leading to a deterioration of the social sustainability in poor regions where goods are produced.

Economic sustainability

In the same vein of thought, some citizens of Copenhagen might save money as the items in the give box station replaces the need to buy new. Some may take advantage of the free items and collect more than they need in the effort to resell items. And as in the scenario for poor regions of production, a decline in demand would entail less pay for workers as harder economic times would follow, until initiatives were taken to adapt their work-life to the new situation.

Barriers for the project

There can be no question about the massive challenge facing teachers and educators in our educational programs. To provide knowledge, foster critical thinking, and lead students towards a better future is, by their own accord, a massive challenge even in a one-on-one situation. Imagine 25 students not willing to follow or try the tasks proposed, leaving each school day almost as uninspired as when they arrived. Some fortunate rise to the occasion and even more do so over time, as they grow older and their conscientiousness develops, which is one of the five big

traits in an individual's personality (Soto, John, Gosling, & Potter, 2011). Conscientiousness is defined as the tendency to be organized, responsible, hardworking, and is positively related to academic performance (Eisenberg, Duckworth, Spinrad, & Valiente, 2012).

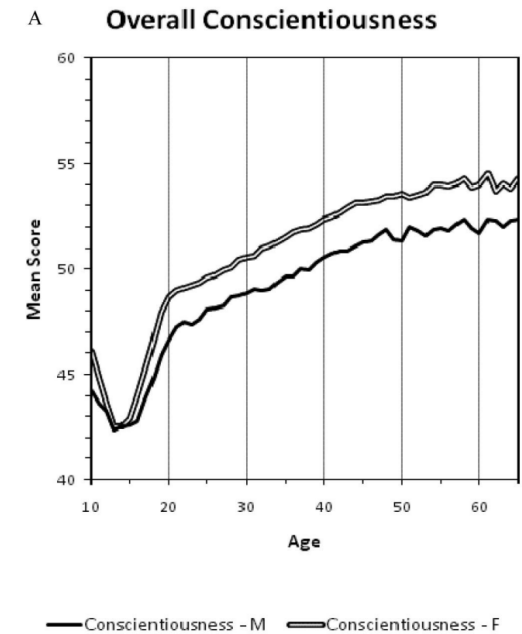


Figure 36: (Eisenberg, Duckworth, Spinrad, & Valiente, 2012)

One paper reports finding a trend for a lack of conscientiousness for the age between 12-16 (Soto, John, Gosling, & Potter, 2011), which is consistent with the lack of work ethic and motivation we observed in our workshop. This could imply that moving the course to a later age and higher-class levels could provide an increase in success and provide a slightly more collaborative class. On the other hand, we could also argue that education about sustainability should be in focus from a young age and throughout the school levels and fitment could instead be achieved by varying the complexity through class levels.

As we saw in the report by NABOSKAB (2016), they identified user groups as being primarily female users, showing a significant lack of interest among young men aged 20-30. As the report does not mention young kids or school students, it could seem that this user group is either not aware of the benefits or might not have ownership over their own items at home. We would imagine that some parents control what is bought and discarded with the approval of their kids. It is unclear which items kids would want to give away on their own as most of them mentioned during our workshop that they liked all their belongings and could not specify items that they did not use, see page page 54. Despite this, we believe that the preemptive action of problematization and development of knowledge on the topic of sustainability might lead to a change of views, beliefs, and values of some students. This could in turn lead to the increased awareness and partaking in the community formed around a give box station later in their lives. Supporting this notion, we found that the topic of climate change often resonates with held values, often supporting, or conflicting with the identity and way of life. As a recommendation, they suggest that designing and implementing programs about climate change would require increasing knowledge of climate change as well as acknowledging the cultural ideology that plays a role in perception and learning (Monroe, Plate, Oxarart, Bowers, & Chaves, 2017). This cultural ideological element is something we have not discussed or studied for this project, but it is something that could be relevant in our further work.

Our hopes concerning education for sustainability in the future

When designing for sustainability, we are relying on our ambitions and aims for a better future. Since sustainability is about working to make the present and the future better, we think it is important to discuss what future we can imagine. In our dream scenario, we are neglecting the resisting nature of actors, culture, organizational lock-ins, and the path to make this change.

When we look at the school system for the middle class, it seems to be built upon centuries of cultural norms, with lectures often consisting of one teacher being knowledgeable in the topic at hand, trying to lecture a room full of young minds, all vastly different, but still being presented with mostly the same teaching style, disregarding their personal ambitions as well as their working and learning styles. Every child is expected to learn from the teacher, who is often teaching from a script, with the risk of speaking over students' heads and alienating some students in the process. The educational system is training students to work in a manner that produces an output that can be measured on a test. As mentioned by literature in the beginning, we also see students being left ill-prepared for the future, as they conduct themselves in a disinterested manner through the every day of their school program. The traditional school system has for a long time consisted of a teacher supervising a group of students, often lecturing on the subject, and expecting students to memorize and learn in the process. There seems to be a lack of answering the “why”, and a lack of ambition and goal setting from the student side. Instead of pushing for learning about a certain topic, students should be given tools to explore and navigate topics and their possibilities for the future.

Undoubtedly, every student has different interests, and their “why” will be different. One thought could be to restructure the school system, with the creation of a new educational space where communities offer more hands-on practical learning through project-based or inquiry action-oriented learning. We imagine a future where students are being taught and trained in the tools which can help them in their future. In this imagined scenario of educational praxis, the students should be taught more freely and be allowed and encouraged to explore. Hence, elementary school should be a place where students could find and explore their passions, develop their individual skills and dive into their own topics of interest. This, of course, opens a whole new box of unresolved issues and poses the challenge of preparing students for later education, as regular skills and discipline would have to be handled in a new way. This could be in the form of more internship workshops, where students work in groups learning subjects by observing, trying, and working with the knowledge they are offered. Allowing free choice of interests could be one path towards creating better engagement and motivation, with the goal of moving students to the higher levels of the learning pyramid. Students need to leave their seats and explore the world and the issues at hand, through the process of testing and experimenting for themselves.

Conclusion

Our project is situated in a twofold contribution to the sustainability agenda of Copenhagen, in which the main aims are to increase circularity, thereby lowering material consumption, and carbon emissions. For these aims to be met, there is a need for the development of environmental consciousness and a need for action among the citizens of Copenhagen. In our venture to contribute to this development through this project, we have collaborated with UBO, an organization who aims at developing better educational courses on sustainability for teachers and students in the middle school. This course aimed at educating and influencing the students actions to meet the agenda of UBO.

In this project, we have therefore sought to understand, map, and navigate the actors' matters of concern, which arose as they worked with the course program. Here we identified one major obstacle that created resistance in the students, as they seemed to lack the motivation to participate and engage in the course and its tasks. As we conducted our workshops this challenge of creating motivation for change was not easily handled, as we encountered the anti-programs constructed by the students. As we sought to find a solution to this to better work with students, we looked at our process for developing a course and found that the elements were based on political agendas and aims of actors outside the classroom. To reach and problematize the students better, we needed to reevaluate our course design and involve the teacher in the process. In this process we aimed at meeting the concerns of actors in the classroom whilst still meeting the political concerns.

Throughout our projects, we learned that the political ambitions and the visionary documents created to solve the challenges, can sometimes be a long way from the reality faced in middle school - at least in our case. The students are not part of the same program and do not always share the same concerns. Furthermore they possess their own anti-program and concerns, making the role of teachers even more impressive and important for our future. We developed the initial concept to facilitate a more collaborative process between actors, and as we seek to develop a better course for the students, we now face the challenge of testing, iterating, and adapting to feedback and creating improvements. This testing will be done after this project has been delivered and is thus part of our further work for this project. We hope that the collaborative tools we suggest and aim to develop, can facilitate a better course and support a shared determination towards finding out how students can be better educated on sustainability, and by so, develop concerns which may inspire action in the future. We hope that education on sustainability and the creation of conscientiousness in the future citizens can develop minds that seek to tackle and solve the challenges of the future, in the spirit of mitigation and even adaptation for our future.

Further work

As mentioned, we plan on conducting a meeting with UBO where we want to discuss and evaluate our findings and suggested solutions for the project and the collaboration. Furthermore, we plan to conduct a workshop with UBO and a teacher where we test and evaluate the process of collaborative course design. We want to develop and deliver a tool which can support the ambitions and projects conducted by UBO, now and in the future.

Boundaries of the project

Contacting participants has proved challenging at the time of this study. Due to the pandemic, actors have worked hard to manage the ever-changing challenges, which has led to a few rejections and unanswered emails in the process of reaching out to the network and the relevant actors. We believe that this is in small part due to the pressure of the pandemic, but mostly it is just a reality of a collaboration process.

Our observations have also been severely limited as no physical meetings were possible at the beginning of our project, making some preliminary research and ethnography left to be desired. Likewise, online workshops and meetings have been a challenge as they are limited in conveying the same level of information as spoken words in a physical forum, because we lack tone of voice, and due to grainy video leaving a vast amount of body language and relations to be unexplored or missing.

Physical materiality has also been limited due to the limitations in online meetings, moving most of our collaborations and workshops to an online interactive whiteboard. This has meant that some of our online workshops did not work as intended and thus had to be restructured to a physical workshop, in order to get a better result.

Reflections

In this project, we have learned about the learning environment in a middle school class in Copenhagen. Here we have encountered the many different actors and personas as described in this thesis. We have learned about the challenge of working with actors who oppose the case and program of our design project. In this, we have, similarly to Callon and the Scallop and fishermen case (Callon 1986a), experienced the ways in which we have to address concerns and work with bringing the actors through the Obligatory Passage Point, in order to bring the network to an alignment and a create a mobilization of the actors. We look at a still network case and seek to bring the actors through the four phases of translation and we try to strengthen the relations between actors and help UBO to position themselves better for future cases and projects.

If we were to do the project over again, we would like to create a stronger relation and connection to the educators and teachers, as we lack relation to and information from the students. This is problematic because we would regard them as the most essential actors in the network and our field. We have worked with knowledge from teachers but were quite limited in observations and fieldwork early on. Because of this, we should ideally have explored many more relations and praxes in classrooms to better understand the younger students and their struggles, instead of relying on observations and interview data to form our understanding of them.

A challenge is that the students in younger classes are hard to reach, as access is often granted by a teacher. For future projects we would aim to seek beyond the collaboration with UBO and their connections in the fields, as we then could have made more observations and interactions. Our focus also shifted during this project, as the lockdown restrictions were lifted and students went from the online to the physical classroom. Initially, we aimed to work with problems in the online educational world, looking into online tools and methods for working and running courses online. We realized that as we attempted to structure and improve the course UBO would facilitate, we sometimes took on the role of teacher and planner.

We found ourselves working in the network as a related actor, whilst we provided materials for UBO. We realized that this role does not work for us as Sustainable Designers, as we need to leave the network and the praxis at some point. We need to be “the hole in the donut”, where we can leave the actors and the network in a new and improved configuration. We would recommend that other students remember that they are only a temporary part of their network, and thus must not make the network reliant upon their presence.

This project is a demonstration of the navigation through the world and network of actors who share the ambitions of bettering education on sustainability. When entering this world, we dive into the existing praxes in our process of mapping concerns. With our work and presence, we aim at supporting the actors in the network as they each work towards their own goals. Our work in this project and process has been to further the ambition for more Circular Economy and the fostering of more conscious citizens and consumers in the future, through improved education on sustainability. As this project is very case specific, we would imagine that some classes have a better dynamic and hence engage better in the work in classrooms. We also know that demographic plays a large part in the culture and values for the students. In our case, we found that there is still a long way to go before education on sustainability can find a way to allow young students to understand it properly, and hence be motivated to take part in the work and progress towards creating a more sustainable future.

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