HUG+, Development of modern school furniture for group work

Process report // MSc4 ID3 // May 2014 // Collaboration with Højer Møbler A/S

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HUG+

Process report

TITLE SHEET

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Synopsis

Dette master speciale præsenterer HUG+ - et møbel til gangarealerne i folkeskolen. Det er udviklet i samarbejde med Højer Møbler A/S, som er dansk producent af skolemøbler. Projektet omhandler udviklingen af en møbel-løsning til gruppearbejde i folkeskolen. Grundlaget for dette er fundet gennem kombinering af observeringer i folkeskolen og research om moderne undervisningsformer for mere effektiv læring.

HUG+ passer til den omdannelse der sker i folkeskolen lige nu, hvor en ny skolereform presser folkeskolerne til at tænke nyt. Med HUG+ kan skolerne få bedre udnyttelse af gangarealerne og samtidig få et møbel som indbyder til læring gennem gruppearbejde.

HUG+ favner eleverne og lader dem tilpasse løsningen til den åbenhed eller lukkethed de efterspørger i den specifikke situation. Dette giver eleverne følelsen af tryghed og mulighed for fordybelse, hvilket kan føre til bedre og mere effektiv læring.

Christine Fanny Olsen

The main part of my studies in the field of industrial design has been absolved at the University of Southern Denmark and Aalborg University. Apart from that I have gathered inspiration and knowledge from other European countries. I'm a dreamer and like to observe my surroundings, which help me to come up with the design ideas I like to work with.

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Kristina Ekkelund Jensen

I am born and raised in the Aarhus area. I graduated as Bachelor of engineering in Integrated Design at University of Southern Denmark in Odense. All my studies have been focused on the development of industrial design products. I value solutions which fit into the socio-cultural context and give value to someone.

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Rikke Møller

I graduated as bachelor in Industrial Design from Aalborg University in 2012. Until 5th semester I worked on projects within architecture, urban environment and industrial design. All future projects is only about Industrial Design. I am a very open and social person who uses my surroundings as inspiration to create exciting, different and quirky ideas and concepts. I appreciate user-oriented solutions that don't compromise on the function, aesthetics or quality.

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READING GUIDE

This report consists of a process report - describes the process behind the developed product - and a product report – presenting the developed solution. The product report should be read first followed by the process report to get a better understanding of the final product. Appendix is placed on additional CD. Appendix index are on p.80.

Through the perusal of the reports specific words related to the project and schools environment will be mentioned. The words are explained here for a better understanding.

List of words

Elementary school – The traditional Danish school for pupils from pre-school to tenth grade – Danish: Folkeskolen

Vocational facilities – The rooms at elementary schools for lessons like chemistry. Danish: Faglokaler

Safety feeling – Refers to the Danish word “tryghed”. It is about feeling safe in the given environment, so you can be relaxed and focus on the important things around you.

Cosy cave feeling – Refers to the Danish word “hyggelig hule fornemmelse”. The cosy cave provides the good feeling about an environment and situation.

Thanks to...

Højer Møbler A/S
for collaboration through the project

All visited schools:
Nordstjerneskolen
Bangbostrand skole
GL. Lindholm skole
Svenstrup skole
Skipper Clemens skole
Sulsted skole
Vestre skole
for provided the opportunity of observing the school environment.

All contacted **teachers and student teachers**
for informing about the teaching in the elementary schools.

TABLE OF CONTENTS

INTRODUCTION

The project

The project origins in a meeting with Højer Møbler A/S (Højer), Danish provider of school furniture, in January 2014, where the group is presented to Højer's new product a transportable work surface called the board solution targeted for the elementary school. Together it is decided to try developing a feature or product to the board solution to make it suitable for group work.

The project meets some difficulties according to the board solution making it necessary to change direction, but still with focus on furniture for group work.

The focus leads to the problem statement: "How to do group work equally when using technology". The problem statement is specified during the process.

In the following is the process of the board-solution-project roughly described afterwards going into detailed description of the process of the group work focus.

The collaboration

Højer was selected as collaboration partner because of having an innovative approach to school furniture. They are placed in Northern Jutland making a closer collaboration possible. The development of innovative and functional furniture is also an interest of the group members. The main contact to Højer has been to Heidi Jensen, product manager.

The school

Working with products for schools are interesting according to the rapid development happening now in Denmark because of the School Reform being realised this year 2014. It is setting new demands to the Danish school to increase the learning. Being able to develop furniture for better learning is interesting and meaningful.

PROCESS MAPPING

The process - first part

The development process is divided in two parts. The project started with the focus on the task given by Højer. The development process was characterised by research about the elementary school environment/tendencies and the research and work done by Højer for the board solution. The development process started broad and were narrowed down through the gathered research and information. The research made consisted of both field research and theoretical research.

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7
Week tasks	Meeting with Højer- introduction to the company *Problem introduction* Supervisor meeting *Project explanation* Collaboration agreement Contact Schools Design Brief No. 1 Research: Højers main Competitors	Report/project overview Received information about the board development *Get the understanding of the board solution* Preparation of school visit Visit at Nordstjerne and Bangbostrand school Processing data from school visit and theory Research: School reform Architecture Good teaching Design Brief No. 1 continued	Supervisor meeting, Heidi from Højer was pressent *Try to explain the board correct - The board solution is not clear* Finishing the program More in depth explanation of the board solution Research: Technology in schools teaching methods	Editing the program and do illustrations Deliver program	Ideation *Several rounds with different goals through the week* Categorizing the ideas Evaluate the ideas Supervisor meeting *Feedback on the program - Need to find the need in the school. Observe the board in use. Be critical about Højers information* Be more critical, visual and concrete: Competitors and company profile Design Brief No. 2	Confusion about the project process *Process structure* Suppervisor meeting about the process Visit at Skipper Clemens international school Focus only on classroom and Cooperative Learning (CL) Ideation wich CL in focus Contact Schools which are using CL Research: Group work Classroom and CL	Ideation using mock ups of the board and on categories Preparation for Status Status and feedback *"I don't see the potential!"* *The board solution is not understandble* Main focus of project- which way to go? *Discussion of different options to become more critical and visionary according to the project and personal interests* Design Brief No. 3
Week conclusions	*Better arguments for the board solution is necessary*	*Understanding of the school situation today*	*Description of the board solution*	*Program send to supervisor and Højer*	*Be critical about the board, Højer and the information from Højer*	*Choose the traditional development process for the project. Focus on field research*	*Preparation of going in a new direction with the project*
	Start of project			Hand-in program			Status

The process - second part

The second part started as a new development process, guided by iterations processing research followed by statements, ideations, developments and evaluations. Through the whole process the conclusions from the evaluations were shaping the next steps in the process. Because of that the steps in the development process were close related.
The iterations rounds made started broad and were narrowed down after every new evaluated statement, which benefited the best processed solution.

	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13
Week tasks	Supervisor meeting *Choose the direction: Group work - realisable concept* Arrange visits to schools *Svenstrup skole Sulsted Skole Gl. Lindholm skole* Visit Vestre skole with Højer *Observations at a school using modern teaching and Højers modern furiture*	Visit Schools *Svenstrup Skole Sulsted Skole Gl. Lindholmskole* Mapping the research material *Categoricse the information* Evaluate the potential problem statement *Combining the categories and weigh the potentials aganst practical and theoretical background knowledge Turn them into possible problemstatements* Supervisor meeting *Create limitations for the project to get focused* Creating limitations *Focus on the hallway solution and a group size of 4 pupils.*	Choosing a problem *Through a selection scheme - one category was found* Describe the requirements of the solution *MoSCoW Solution for 2014 and 2020* Prepare plan for the Ideation and the evaluation of the ideas Ideation *Follow the intended plan which consist of different methods* Idea categories *Categorise the ideas*	Ideation *Ideation related to the categories* Selection scheme *Through a selection scheme 2 main concepts were chosen - 2014 and 2020* Ideation *Further ideation on the 2 main concept* Development of the 2 concepts Documentation of the process mapping	Preparation for Status Supervisor meeting *Positive response on the concepts* Status and feedback *Usefull arguments for both concepts which helps during the selection* Selection of main concept *Through arguments the 2014 concept was chosen*	A Moodboard on work spaces *Understand and get inspiration on work spaces* Research on projectors Dimensions test *Understand the minimum sizes for the concep - hight 190cm, coverarm 70cm wide, Coverarm roof needs cover the pupils* Ideation structure made
Week conclusions	*Main focus - finding the need in at schools*	*Main focus - finding the need specify the focus*	*Chosen problem: Group work and the use of technology. Ideate plenty ideas*	*Two concepts chosen. Development started.*	*The 2014 concept - best arguments according to schools and Højer*	*Got an understanding of the further devlopment*

Status

The process is approached as a stage gate model, where each iteration leeds to new problems to solve or considerations to add untill an optimal solution is developed. The detailed process is described in app. The log.

Week 13

Ideation- 1
Inspiration from moodboard

Supervisor meeting
Focus on 3 positions the furniture offeres and the experience of using the furniture

Update of the MoSCoW and problemstatment
Narrow down the concept theme

Ideation- 2
Categorise and discarding ideas not fitting the musts.

Ideation-3
Ideate on the chosen categories

Perception of room
When is the room perception achieved

Choose concepts based on MUST's
2 concepts on the main idea (cover arms) and 3 ideas on the benches

Prepare the presentation for Højer

Højer meeting
Comments on the concepts and what is possible to produce etc.

Good feedback from Højer on the 2 concepts and how to continue. Got some material samples and new inspiration.

Week 14

Evaluation on the two concepts
Pointing out the values

Evaluate and choose a concept
The HUG is chosen upon the values

Supervisor meeting
Inspiration for the concept ideation and product development

Report structure and writing

3D modeling to define the main form
Get the main understanding

Research on materials and parts for construction
Components quotation and material samples collected

Construction of frame
Poul from the workshop confirms the validity of the framework

HUG concept is selected. Main form and types of materials is decided.

Week 15

Supervisor meeting
Confirm framework, discussing the added value - maybe increase the modularity

Construction considerations
Use of standard components

Trip to Silvan
Inspiration on standard components

Report writing and 3D modelling
Static calculations on 3D model
Review on report draft

Main construction in development

Week 16 and 17

Construction development

Report writing and handing in

Main construction in development

Hand-in project

THE SHIFT

Originally the problem statement was set in collaboration with Højer A/S. Højer wished to get a solution developed for their new invention: A board solution. The task was to bring the board solution from being an individual tool to a group tool. App. The program - including the pre-phase of the project - handed in the 28th of Feb. 2014.
The process is described in the process mapping p.7-9. The development ran over a period of 7 weeks (03-02-14 - 24-03-14). The shift is not radical, which means all ready done research is useable in the following project.
In the following the first project will be introduced and the problems discussed to get insight in the process.

Højer's approach to the modern school

Højer is developing furniture for a more active school day where the pupils are moving around during the day for a more active day including differentiated learning. Højer calls this "quick change of scene". To explain this evolution in schools according to architecture and interior, Højer has developed the model "Four levels of freedom" which is explained later on page 20.

The Board Solution Development

Højer's solution is a board supporting the active learning by setting the teaching free or in other words makes it possible to bring your work surface around for work in different places and in different positions. The board is developed by Højer in collaboration with 3Part. Højer has introduced the early edition at Vestre skole, which found the board solution useful for reaching the last levels in four levels of freedom. The core aspect is: To provide a work surface for effective change of scenes.

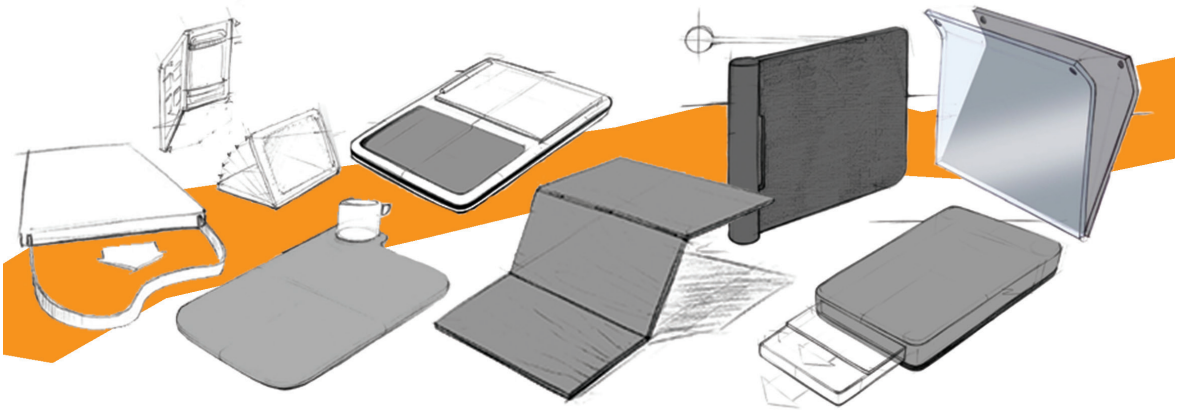
ill. 10a Højer's the board solution

The Board Solution

- Portable work surface
- A fold, which makes it easy to hold the board, gives an edge which helps you to carry stuff around and makes it able to place it slanting for a better writing position.
- Elastic bands, which can hold personal items, books, paper etc. for easier carrying things around.
- Material: Pagholz, an impregnated beechwood veneer.
- Size: 56 x 40 cm
- Individual tool

The task

The task set by Højer: To develop a solution for group work, where the board solution is included. The purpose is to make the board solution useable in more situations and make it more suitable for pupils interacting together. The final product should be a part of a product line with furniture supporting the new type of school with a free classroom for a more active day.



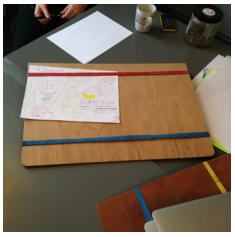
ill.10b Højer's development process of the board solution

Approach to the project

The main approach is described below. Further description of the ideation process is shown in appendix, Board solution Ideation.

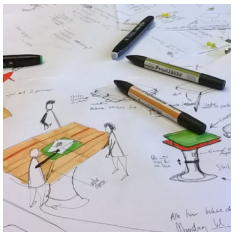
ill. 11a Project approach

Understanding the school today - visits, theory, articles



Understanding the board solution

Understanding of the way Højer is working and the market of school furniture



Extensive Ideation - leading to many questions according to focus and how to select

?

Status 1
Need of better focus
The board solution is not well-argued

The shift of problem statement

The research made upon the modern school, App. The program, p.13, shows that the school is developing as Højer is predicting meaning that the focus of flexible learning environments is relevant for the schools. What is also discovered is that the use of media and technology is increasing and following the tendencies on the market. It is needed to question if the board solution is still relevant during a school day where everyone is using tablets. The way to explore this issue is testing of the board solution in the environment, which Højer hasn´t done in full scale yet.

The turning point was the first status evaluation (presentation of project for peers and co-supervisors) where the audience did not support the presented evidence. The critical point is the lack of evidence of whether the board solution is fulfilling the intended purpose as Højer sees it. Since no testing yet is done according to the board solution in use it is after this evaluation decided to change direction. The option on ways to go in this project is listed and evaluated.

The options:
All in on the board solution - The project would turn into an analysis project about the board and how well it fits the future school environment.
Group work focus- the solution for a free classroom in the future – an eye-opener project for Højer and the schools.
Group work focus – think out of the box, but make the solution realistic, that Højer can add to product assortment.
Choose new subject in the school sector. Ex: better social competencies, technology focus.
Cooperative learning- Develop furniture/tool/solution fitting to the learning methods: Cooperative Learning.

The chosen direction is to discard the board solution and keep focus on group work and use the knowledge acquired about this subject and the school and learning in general. The main argumentation for discarding the board solution is the question of newness and added value, which is not defendable without the extensive testing. Group work focus is chosen since this seems natural according to gathered knowledge. Further steps will focus on finding a valid problem statement focusing on a specific problem according to group work.

The approach in first part of the project has been to look at the project as a consultancy job set by Højer and executed by our team. This approach gave a professional and realistic task, but it conflicted with the roach of a master thesis project, where a more critical and analytical approach is needed. The shift must include a more challenging approach to Højers way of thinking of themselves as a furniture company.

THE KNOWLEDGE BROUGHT

The following pages are showing the knowledge brougth from the first project period.

The subjects include:

- Højer - company profile
- Buying school furniture
- Competitors analysis
- Modern school
- School visits

ABOUT HØJER MØBLER

The information about Højer Møbler A/S is gathered on their webpage (www.hojermobler.dk), from observations and meetings with Heidi Nørgaard Jensen, Product manager at Højer, and from a visit to Højers customer Vestre Skole, in Silkeborg.

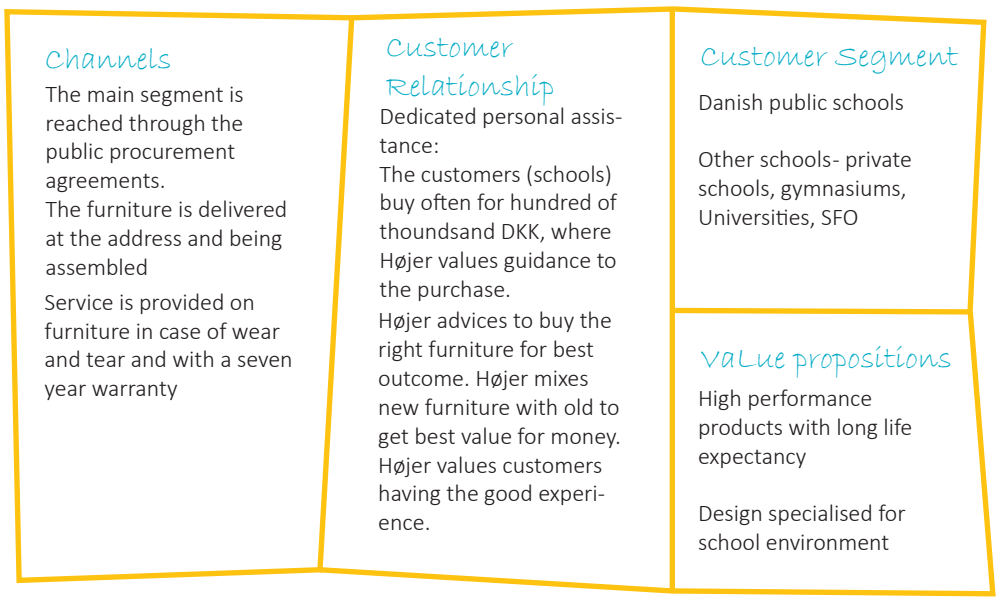
Højer Møbler A/S has more than 20 years of experience in development, production and delivering learning furniture for educational use. Højer describes themselves as providers of functional, inspiring and innovative solutions that support different kinds of learning methods. They describe their customer contact as a careful and thoughtful arrangement of solutions supporting the pedagogical goal and promote welfare and learning within the people who use them.

> *"When a school wants new furniture, it is important to us to guide the schools to good solutions, that they will value for a long time – We do not sell furniture we create learning environments customized for each school", Heidi Jensen, Højer.*

This statement is from the visit to Vestre School, Silkeborg, during a meeting with school manager and Højer. The focus was the use of the rooms along with how it is possible to use some of the old furniture for being able to update more classrooms at the same time.

Højer is branding themselves as a school furniture company that makes innovative furniture, but also as an interior design company with focus on the holistic solution. One of Højers sales and business employees is a part of starting up a new post graduate course along with University College Nordjylland for teachers about interior understanding according to education.

Højer Møbler, FurnX and OJ Skolemøbler are all related companies in the same concern. OJ Skolemøbler is the traditional brand, but now Højer is the brand on the Danish market, and FurnX is the brand known outside Denmark. The development of a new product solution is designed by Højer and FurnX, as they have the same employees. Højer do not manufacture product parts, but order from close outside manufacturers. Højer assembly the product, pack, send and mount it for the customer.



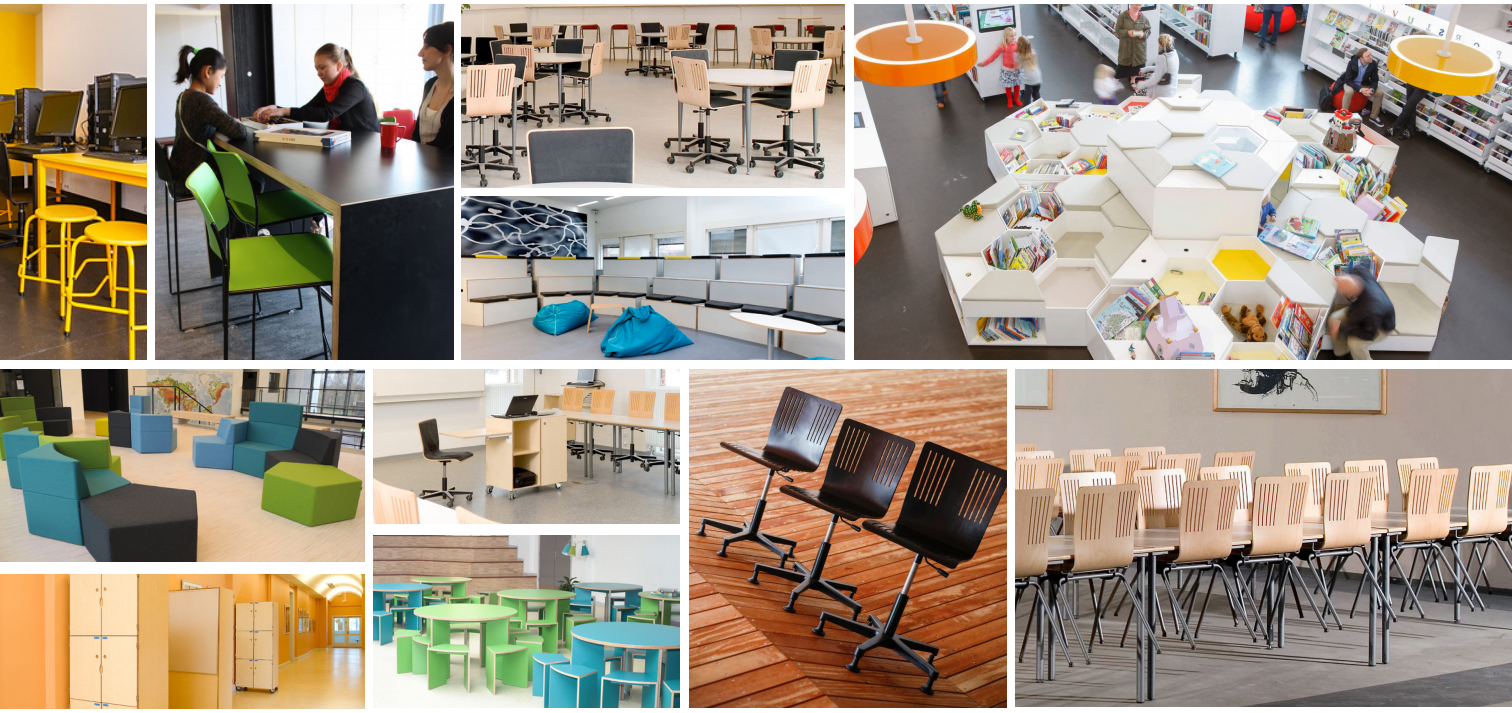
ill.13a Part of Højers business strategy. App. Business canvas of Højer. The canvas is developed on basis of the knowledge aquired during the project.

Højer aims for a seven week delivery time. The delivery time is an important part of the agreements with the schools. The fast delivery is possible since the furniture parts are produced in Denmark and northern Europe. Højer's life expectancy on their furniture is twenty years and they have a warranty of seven years, which demands a high quality as the demands for furniture in Danish schools are higher than the European demands, which Højer Møbler fulfills. All Højer's own furniture is labelled with the Danish indoor climate label, which means increased demands according to degasification of chemicals in products. Højer only uses sustainable wood in own furniture. A few products in theirs assortment are bought from other companies to have a wider range of products.

Højer has a broad range of furniture for schools. Looking at their product portfolio gives a view of a both standard traditional assortment and innovative and creative furniture. An example of Højer's innovative design is the new table, named Mute, which table surface absorbs noise and in this way gives a better indoor environment. An overview of Højer Møbler can be seen in the illustration below.

Højer's core value

- *Innovative within learning solutions – Follow the development of teaching and well-being*
- *Need and user oriented – Include the users in the development process*
- *Create practical and system based solutions*
- *Scalable solutions – Ad on to the existing furniture solutions*
- *20 years life expectancy*
- *Fulfill Danish standards within environmental demands, the Danish label for indoor climate and only use of sustainable wood – within own production partners*



ill. 14a Extract of Højers furniture portfolio.

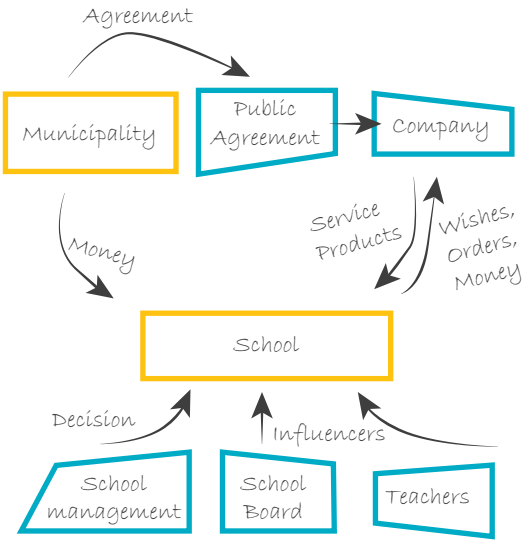
BUYING SCHOOL FURNITURE

Actors map

The actors map shows the process and who is involved when the school buys new furniture. The understanding gives an idea of the complexity of the arrangements and which parameters that influence the decision.

When the public schools buy furniture in Denmark they are limited by the public agreements made by the municipality, which limits the school to buy furniture from one main supplier. Having this type of agreement is essential to a company like Højer, since this is the main way to sell school furniture in Denmark (Konkurrence og forbrugerstyrelsen, Københavns Kommune).

The schools economy is limited by the municipality, but the final decision maker, of which furniture to buy, is the management of each school. The decision is influenced by the school board and the teachers (School visit and information from Højer). A simple description of how the actors influence each other is seen on the illustration below. Different types of agreement and further description of the process is described in app. Actors Map.



ill. 15a Actors map

School Economy

The schools budgets are tight and the furniture are expensive when meeting the demands in a school. Looking into school budgets shows that the schools priorities differently, but many schools try to manage to buy new furniture for one classroom for each year. It also show a tendency of the schools having budgets to prioritise one bigger investment each year which for example can be: smart boards for all classrooms, tablets for everyone, modernisation of buildings, interior or outdoor areas. The investment is dependent on the school size. (Esbjerg municipality and Malling School)

As an example is here Malling School according to vice-leader: Per Bisgaard Pedersen, 600 pupils:
100.000DKK each year for furniture for 1 classroom and 25.000 for the common areas if not investing in this as the big investment.
One big investment:
Just invested 700.000DKK on the preschool (indskoling) facilities.
Next project is 800.000DKK on teacher work spaces according to the new reform.
Last year was 500.000DKK on smart boards.

Sum up

The actors map and school economy gives an insight in the process when buying furniture for schools. Every school has a limited budget where they need to prioritises money according to the need each school have. Both the budget and priorities vary each year.

THE COMPETITORS ON THE MARKET

The aim is to understand the market for school furniture and to see how Højer differentiates. A diagram mapping of the focus points of companies has been made see ill.17a.

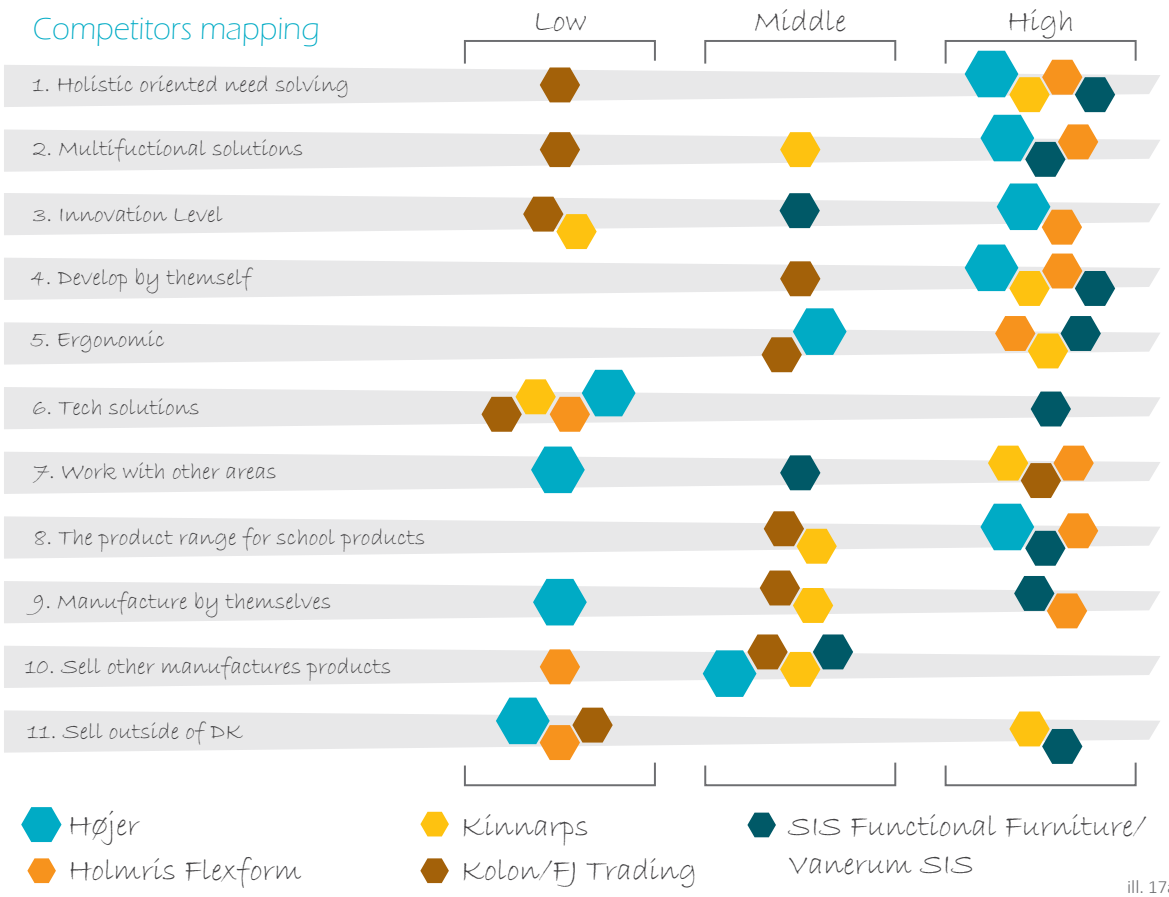
The companies are found through research on which companies that the Danish schools has agreements with to provide school furniture and Højers biggest competitors named by Heidi Jensen. The estimations are done on basis of the companies' web-pages and product range. The companies are all designers of school furniture. Consultancies are selling furniture solutions for schools, which are not developed or produced by themselves, but by other brands. The consultancies are not specialised in school interior, but more office interior in general. These are not seen as direct competitors and are therefore left out of this analysis.

Looking at Holmris Flexform and Kinnarps, which Højer has named as their biggest competitors, it shows very similar portfolios for the traditional school furniture. see ill. 16a. Højer differs in a more variated assortment for alternative furniture such as the mute table, the big library and the lounge elements - all module based furniture, see ill. 14a. Holmeris Flexform is developing the traditional table and chair concept with new angles and surfaces, when Kinnarps is a big provider of office furniture, but does not fucus directly on the school environment.

Explanation of the competitors mapping

1) Holistic oriented need solving – Do the company help to understand the need and provide a holistic solution for the elementary school when buying new furniture?
2) Multifunctional solutions – Do the companies develop multifunctional products, which can be used for different purposes and products that are module based, so additions are possible.
3) Innovation level – How innovative are the companies approach and solutions for the modern school thinking according to teaching?
4) Developed by them self – Is it the company who is developing the furniture solutions by them self?
5) Ergonomics – How focused on ergonomics is the company when providing both total solutions and single products. Meaning helping the user to be placed in correct positions.
6) Tech solutions – Are the company making furniture suitable for technologies available in the danish school?
7) Work with other areas – Do the company create solutions for other areas or businesses than the elementary school. A high position = work with many different areas.
8) The product range of school products – How large are the companies' range of furniture for the school not including the vocational facilities.
9) Manufacture by themselves – Do the company manufactures the products by themselves?
10) Sell other manufactures products – Do the company sell external products in their total solutions?
11) Sell outside Denmark – How big is their market outside Denmark?

Ill. 16a Stool from Holmris Flexform, stool from Højer, chair from Højer, chai from Holmris flexform, chair from Kinnarps



ill. 17a

The most of the companies have high focus on the best holistic solutions for the needs of the elementary school versus those who sell specific orders without guidance to the school. When the company don't have specific furniture designed by them self, they use external furniture designs for a larger port folio.

The big companies Kinnarps, Holmris Flexform and SIS Functional Furniture have a bigger work area, where other environments than education are in focus as well. This can influence their specific knowledge in the elementary school environment compared to the companies, which core competence is solutions for the elementary school.
All the companies have their own ways of reaching and covering the needs from the elementary schools, but in total they are similar in their way of providing the tradional furniture - the functionality and wear resistance are essential for them all.
SIS functional stand out according to tech solutions, where they both sell furniture and tech products.

Højer and Holmris Flexform are standing out in the innovative category. They have focus on the future upcoming tendencies for the schools and develop their products in that direction.

Højer's strategy is to keep on designing innovative furniture of high quality to stand out, and to follow the development of the elementary schools.

THE MODERN SCHOOL

The Danish schools are slowly developing from the traditional settings to a more modern way of teaching. The aim is to create the best suitable school environment for all pupils. To get an understanding of the upcoming tendencies, a study has been made of the new school reform, new teaching methods and how the technology is influencing the teaching in schools.

Government

School Reform 2014

- Longer and varying school day
- Up to 9 hours longer weeks for the youngest pupils
- More movement – 45 min daily
- Varying, different and practical teaching methods
- Challenge both strong and weak pupils – offer homework assistance and immersion
- Ground value of the school design is to foster solidarity between the pupils
- Focus on the well-being, calmness, order and educational environment with follow up using questionnaires

ill. 18a School reform

The school reform

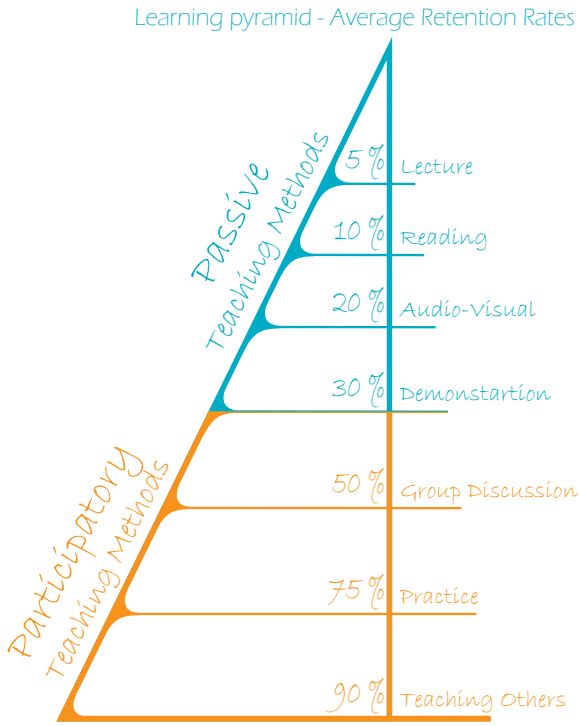
In Denmark there is a continuously focus on the development of the school sector and how the system needs to be to create the best environment for good learning. The new upcoming school reform, which is to be implemented in august 2014, is an indication of that the educational environment is changing and forced to be run in a more optimal way.

The new school reform has focus on flexible learning environments and varied teaching. The reform is built upon scientific knowledge (School reform, 2014). The school reforms significant increase of hours; focus on teaching methods and well-being sets the higher demands for school environment and furniture. Highlights from the school reform are showed in the illustration 18a.

Theory

The learning Pyramid

The Learning pyramid illustrates the retention of the taught information through different learning styles (The Learning Pyramid – from the National Trainung Laboratories. Bethel, Maine). The most rewarding teaching methods are through the Participatory Teaching Methods where the pupils are actively participating in the teaching. While passive teaching have little impact. The four levels of freedom p.20 builds on the learning pyramid.



ill. 18b Learning pyramid

Theory

Teaching methods

Flipped-classroom uses technology to replace the frontal teaching which helps to use the teachers time more effectively. The homework is focused on video recorded lectures, which the pupils have access to from home. Then the pupils will go to class already having an idea of the subject and while solving the related task for the subject the teacher is working as a tutor/supervisor. In this way it's easier to reach all the different pupils and provide the right help. (http://www.laeringsteknologi.dk/?p=333)

Learning Styles is based on a theory from the 1970's many different but still close related theories are developed. This one is based on Dunn and Rundle, used by Aarhus Kommune as information for all their schools. The theory builds on the fact that everyone is learning differently and if the teaching is capacious of all the different styles, a more effective learning is reached. In general it builds on the main elements of difference in sensory perception: Some learn best by audio, visual, tactile/kinetic or in combinations. Also other factors influence.

Cooperative Learning is structured group work where "the pupils work together in heterogeneous teams, which consists of different levels of academic knowledge to achieve synergy in the work." (http://www.emu.dk/modul/cooperative-learning,). The teacher is having a role as a facilitator of the work, which is scheduled. Structure is a large part of the method. It makes it possible to activate the pupils, at the same time and reach a clear process of learning: discussions, analysis, problem solving, communication etc. (Cooperative Learning – Undervisning med samarbejdsstrukturer by Spencer Kagan and Jette Stenlev, 2009)

These teaching methods shows a development of the school. Through talks to teachers and student teachers it is discovered that teaching methods are something that they use according to the situation and that it is always an evaluation of each class. The methods are helping the teachers away from the passive frontal teaching, where some pupils often are losing focus and becoming inactive when not raising their hands and participating in class discussions.
See app. Interview with teachers and student teachers.

Tools

Technology in school

Technology is being integrated and increased continuously in the Danish elementary school. The digital government administration (digitaliseringsstyrelsen) is funding digitalisation in the public schools to support the increase of use.

Educational material is also developing into the digital world to provide more flexible teaching. As an example Systime (publisher) and Dansklærerforeningen are running a project to make digital school books. (Politikken, PA-tillæg, "Den moderne folkeskole, 2.marts 2013")

Technology is used in group work, where the pupils use technology to educate and help each other during the task. Such a project is running at Hillerød Vest Skole, where the pupils make animations and posters which have resulted in more active pupils. The teachers see the technology as a useful tool in this process to reach all pupils and create the active learning. (Politikken, PA-tillæg, "En folkeskole I tridt med tiden", "Digitalt liv I dansk undervisning" and "Elever skal undervise hinanden" 2.marts 2013) App. Technology.

ill. 19a- Pupils using tablets as a part of a participatory teaching, Vestre Skole, Silkeborg

Højer

Højer has done research projects to get insight into the school today and which new type of furniture is needed (Heidi Jensen, Højer). Højer´s observations show a need for a school environment which both facilitate different work constellations simultaneously and a quick change of scene.

> *"Over time we have understood, that it is necessary to activate the pupils when learning, otherwise the learning is not effective enough" Headmaster, Vestre skole, Højer's observation*

The school is limited by its walls and space is often an issue, which forces the teacher to think alternatively to fulfill these demands to different teaching styles. With a change of scene, the teachers often uses time on moving the furniture around to the specific learning style. This slow change of scene causes a static classroom.

Højer has developed "the four levels of freedom- the interior design of learning environments" which is a model, describing how the interior is placed in different learning environments. This model derives from the theory of the learning pyramid, explained on page 18. The model is divided into four steps going from the traditional frontal interior to the free interior. Højer has developed the model to illustrate how the interior can be designed to support a more active learning where scene changes are quick and suitable for a differentiated teaching (Heidi Jensen, Højer)

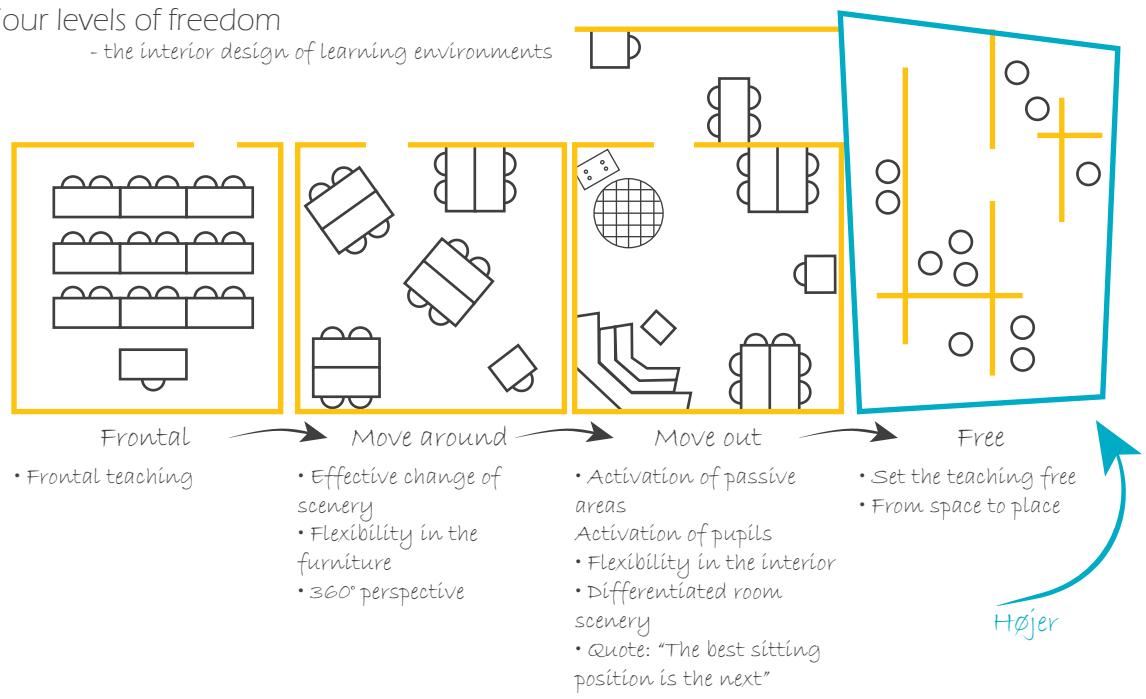
The characteristic for each step is showed in the figure below, which is identical to the one developed by Højer. The yellow lines indicate the rooms in each of the four levels. The blue box is indicating the aim of Højers innovative furniture.

Sum up

The model "Four levels of freedom" describes through architecture and interior how the school can be supported to more active learning. The model will be used continuously during the project.

Four levels of freedom

- the interior design of learning environments



ill. 20a Each step forward increases the quick change of scene

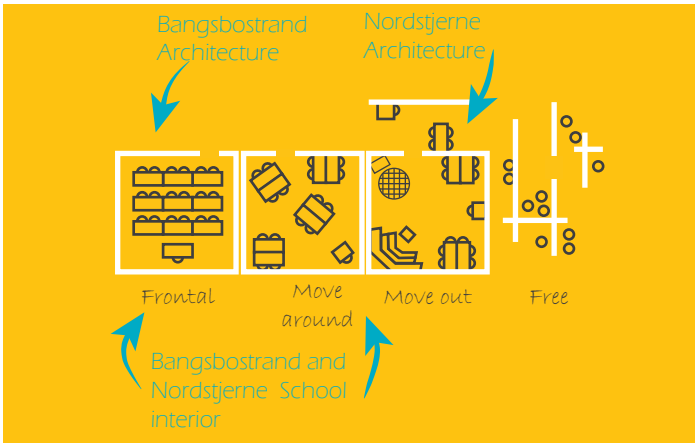
SCHOOL VISIT

By visiting two different types of elementary schools in Frederikshavn, a common understanding of which kind of teaching methods and tools is used during the schooling and how the interior design in their learning environments are set. The two types of schools are built with different architecture, Bangsbostrand School; a traditional school from 1902 – with several renovations through the years, and Nordstjerne School; a new school from 2013, which is built after the 2020 environmentally requirement for buildings. During the school visit the environment will be observed and then compared with Højers model, the four levels of freedom, page 18. The observations are showed in ill. 21a. and the comparison is showed in ill. 21b.

At Nordstjerne School, the architecture encourages to ***move around***, ***move out*** or having a ***free*** interior design to provide an effective learning environment; but the teachers keep teaching the same way as they always have done – the frontal teaching. They don't utilise the opportunity that the architecture attribute to. The choice of interior design confirms the traditional teaching, which has been decided randomly by the school leader, see app. School leader interview, Nordstjerneskolen

At Bangsbostrand School, the architecture urge to a frontal interior design, but the teachers both use a ***frontal*** and a ***move around*** interior design in their teaching. The changes to fulfill the new school reform is a challenge to Bangsbostrand School because of a limiting architecture, though they see possibilities in interior design to reach the goals.

The observations at schools showed that the architecture is moving fast forward with a focus on the modern tendencies of teaching, but having a modern school architecture does not mean the teachers have developed the teaching. Another challenge is to prepare traditional schools to the school reform. What must be taken into consideration is how to get the traditional teachers to teach actively in a more convenient way.



ill. 21b Compare schools with four levels of freedom

Bangbostrand School

Nordstjerne School

ill. 21a Observation pictures from school visit

SCHOOL VISIT 2

Visit at Skipper Clemens School

The aim with this visit was to look further at how group work is conducted. The visit goes to the 10th grade department at the private school Skipper Clemens School in Aalborg. The facilities are small and only consist of a narrow hallway and a long classroom for each class, see ill 22a.

The visit shows a school interior for frontal teaching, but where they are trying to do group work by turning around. See the pictures below.

The school uses technology in all classes. The pupils bring their own computers or ipads. The pupils use the smartboard actively. When they are doing group work of four pupils around a laptop it is not suitable for everyone to see and participate, while sitting in a row by a long table. See the pictures below all showing group work at Skipper Clemens School.

The visit is an eye opener according to having equal access to materials (laptop, etc.), while working in groups and equal participation in discussions.

ill. 22a Observation pictures from school visit, all pupils using technology when working.

FINDING THE PROBLEM

The new project direction begins the 24th of March 2014 with the focus of using the gathered knowledge. The plan is to focus on group work in the elementary school, where it is observed (especially during visit to Skipper Clemens School) that group work is ineffective and not well facilitated. To find a clear problem the plan is to visit schools and observe group work. This will be compared to theory and articles to find a general problem.

The visited schools:

- Vestre School, Silkeborg
- Svendstrup School
- Sulsted School
- Gl. Lindholm School

Procedure

Observations

Interior design: How is the interior? Is it being used as intended? What is working, what is not?
The pupils: How are pupils behaving and interacting during the lessons? How are they using the facilities?
Teacher: How are they running a lesson? Are they using any teaching methods? How are they using the facilities?

Mapping

The observations from all school visits are mapped along with the information found during the theory and article study of the modern school. This also includes the teachers and student teachers' statements and already visted schools.

GROUP WORK OBSERVATIONS

Vestre School, Silkeborg

This visit is along with Højer, where they are observing the 8th grades for whom they have designed the classrooms in the style of the modern school. This is estimated to be the third level- move out- in the Four Levels of Freedom model by Højer. This consists of a furniture for sitting in levels, some normal and high tables and some cosy furniture. The rooms has been in use for app. 2 months.

The observations give good impression in how a modern school day can be. See ill 24a. A general observation is that the pupils feel comfortable in the room. They move around as they like (also during instructions from the teachers) and use the room according to the lessons. They don't have a certain seat belonging to each pupil. The pupils are happy and everyone is getting along – includes the relation between the two classes too. Benny, teacher: " It was difficult in the beginning, but now I am really happy about the changes of the room. We (teachers) had to get used to that some noise is okay and that it is okay to move around in the room and sit in different ways- it is actually giving the good humming kind of noise, rather than the bad disturbing kind"

Few pupils seems to be having a harder time managing the free environment, but the teachers are trying out things for helping these by giving them a specific seat in the class along the wall. Benny, teacher, states that this behavior also was present before, but now it isn´t so disturbing for the whole class."
App. School Visits Summaries for more detailed description of the observations.

Specific observations

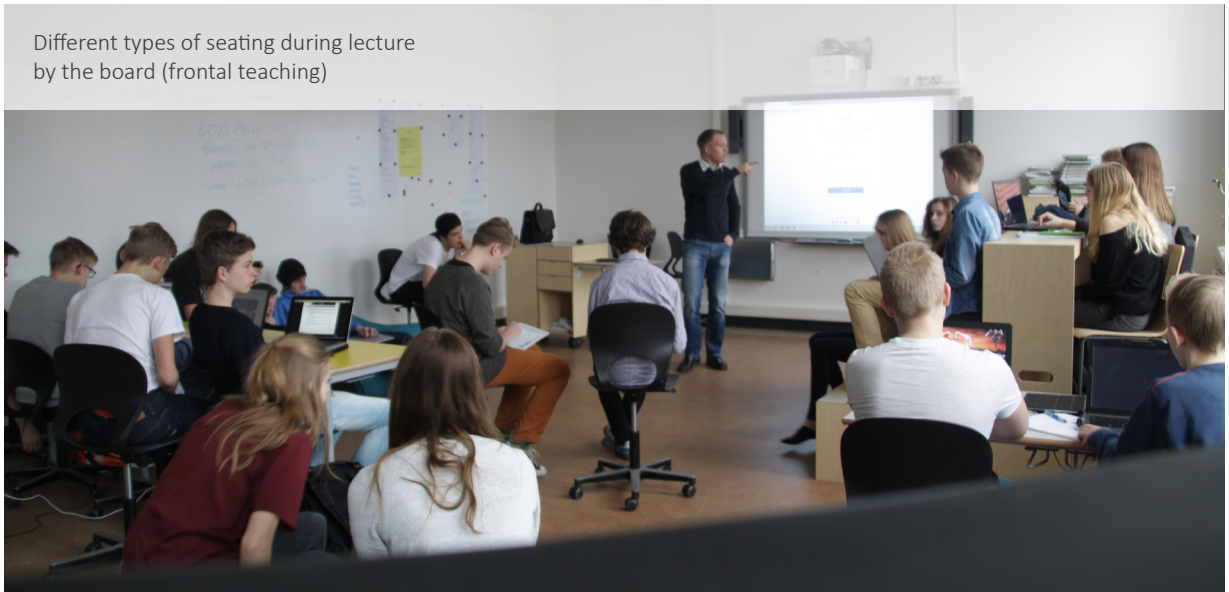
- *Sitting in different positions and letting the pupils move around gives another kind of quietude and brings activity into the school day.*
- *Pupils sharing seats seems to be improving social relations.*
- *Closed environments are giving feelings of comfort and safety, which some pupils prefer when working alone or in groups.*
- *Using technology, such as tablets and laptops are increasing and seems irreplaceable to the pupils. They share screens and sit close so everyone can participate, but it gets difficult in groups of 3, 4 or more pupils.*
- *Working in groups are a daily activity. The pupils move around in the classroom and hallway to work.*

After the observations a meeting with Højer and Kristian Toft, School leader and Ole Krogh Mortensen, vice-leader takes place. They are both happy and proud about the new classrooms and are already considering expanding the idea to other classrooms.

Ole Krogh Mortensen, Vice-leader: "Some of the teacher are a bit worried about all this moving around with furniture and climbing on them?" Heidi Jensen from Højer answers: "But don't worry the furniture are made for this." Referred to this conversation it shows that the whole aspect of a more active day in general conflicts with the traditional principles of the teachers, which is a habit to break.

ill. 24a Observation pictures from school visit.

Different types of seating during lecture by the board (frontal teaching)



Pupils sitting in levels

Presenting on a big whiteboard screen using a tablet for notes

Different types of seating in the classroom

Sharing seats and sitting close is normal during lessons

Different types of seating- some likes to sit behind the stairs

Sitting by a high table gives teachers good accessibility

Pupils like to sit close and sit behind a cover to increase privacy and concentration

Svenstrup School

The preschool (0.klasse), first grade and fifth grade are observed. The teaching is very different between the classes. The young grades are working in groups and are active through creative tasks in shorter periods of time, mostly in groups of two pupils. The fifth grade is working with longer session of frontal teaching, where the pupils take turns to get up to the smart board to show tasks. This type of teaching is very active for half the class, while the rest are passive. The whole class is provided with laptops from the school, which they use actively. They start group work half way through where they are making paper posters.

Sulsted School

The sixth grade is observed. They are discussing group division and the question of when the pupils are dividing groups by themselves- it gives social conflicts in the class. They use the classroom and hallway for group work - the pupils prefer the hallway. The pupils uses tablets and books in the lesson. The general way of class interior at the school is frontal teaching.

Gl. Lindholm School

The seventh grade having German is visited. They are divided in groups with both genders in each group. They divide themselves in the hallway and common areas but one group stays in the classroom. They sit in general around a squared table with four pupils in a group. They write on paper and do research on tablets and smartphones. It is noticed that the strong pupil in each group is leading; which is interpreted as not being equal work. In the hallway there seems to be more things disturbing the concentration of the group, e.g. when other pupils are walking by or in and out from rooms.

Sum up

The four schools are all using group work during lessons. Vestre School is more visionary in the way of teaching compared to the other schools. They activate and motivate all pupils in different ways. The group work at the three other schools seems in some episodes to be unstructured and seems less dynamic according to handling noise and being inclusive than the classes observed at Vestre School. In general the pupils like to get out of the classroom when possible. The hallways are being used in all schools for group work. All schools are using technologies: the teacher by the smart board and the pupils with notebooks, tablets or smartphones when working in groups or individual. See the summaries of the school visits app. School Visits Summaries

ill. 26a Svenstrup School

ill. 26b GL Lindholm School

ill. 26c GL Lindholm School

ill. 26d Sulsted school

MAPPING

Finding the potential problem for the project begins with a mapping of the problems recognised in the schools during the school visits. See ill 27a showing all the problems each represented in a picture with a text describing the problem, see app.Problem map out, for a closer look. The problems recognised from the research of theories, articles and through teacher interviews are mapped at the paper, see ill.27b.

The problems are grouped and combined into potential categories, ending with main categories all related to group work: See potential categories.

Discarding of categories

Each category is evaluate according to whether an observed (practical) problem and theoretical problem is present. Those not having both are discarded, leaving five categories left (orange). Each of these five categories are described clearly according to the knowledge gathered. Each of these descriptions can be found in app. Category description.

Selection of one category

The selection is based equally on five parameters:

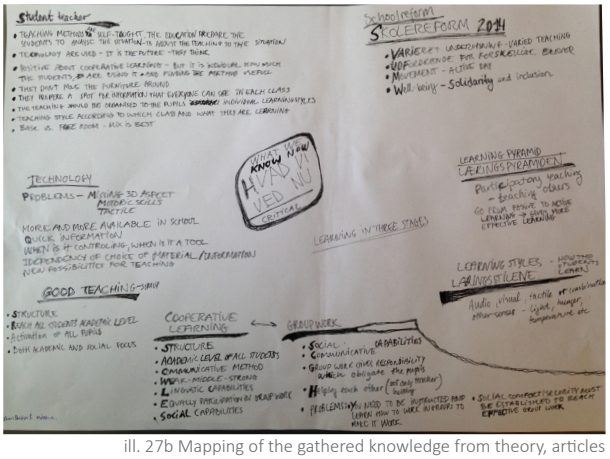
- User testing option - Some of the categories might need long period of time for testing rather than others
- Future perspective - Is this a long lasting problem?
- Personal interest - Is the subject of our interest and giving the learning opportunities wanted?
- Højer - Does the category and a potential furniture fit into the thoughts of Højer?
- Background - How much background information is gathered about the category?

Each category is phrased into a problem. Selection scheme is to be found in app. Category description.
The selection resulted in choosing the problem:

> "How to do group work equally when using technology?"

This category scored high in all parameters.

ill. 27a Mapping of the observations



ill. 27b Mapping of the gathered knowledge from theory, articles and teacher students

Potential categories

- *Group furniture supporting differentiated teaching and learning methods*
- *Generate structure in group work*
- *Contact between pupils when using technology*
- *Cooperative learning meets technology*
- *Support pupils movement in classroom*
- *Cooperative Learning meets different learning styles model*
- *Furniture supporting different sitting position*
- *Support inclusion through furniture*
- *Making the use of technology tactile*
- *Create the pupils "own space" in a free class room*

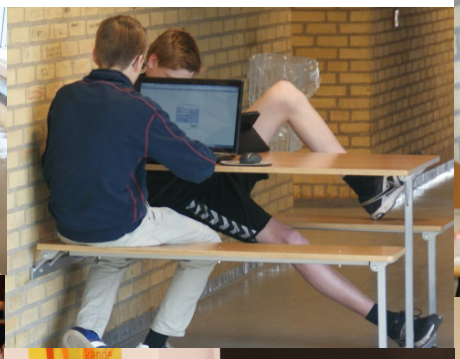
THE PROBLEM

Problem statement

> "How to do group work equally when using technology"

When visiting schools it is clear that they use technology for research, presentation and solving tasks. Group work is happening every day, but in classrooms designed for frontal teaching, which results in group work where the pupils are not participating equally – by no equal possibility of seeing and touching the common screen.

The research shows that when equality is increased the possibility of more active pupils are present which leads to more effective learning, according to the learning pyramid, meaning better academic competences. When pupils are participating actively in group work the cooperative learning theory states that better communication skills and social competencies are increased as well. In schools are an increased focus on the use of technology and teaching materials are being digitalized. The school reform starting august 2014 also supports a more active school day along with the increase of social relations.



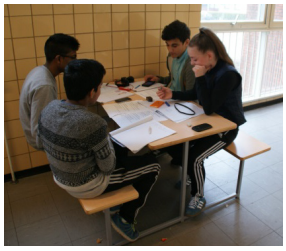
ill. 28a Pictures from observations, that decribes the problem statement.

MoSCoW

The MoSCoW model is used for specifying the demands of the problem statement. It will be used for ideation and selection of ideas. The model will be updated during the project- http://businessanalystlearnings.com/ba-techniques/2013/3/5/moscow-technique-requirements-prioritization

MUST

Group work (of 4 pupils)



It is noticed by observations that the teachers normally gather four pupils in the group divisions.

Use of technology

Through observations the pupils increased use of technology devices during the lessons is noticed.

Equal participation
Shared work surface

It is noticed that a common surface where everyone can participate, makes the group work equal.

Hallway solution

Every school has hallways with lots of unused space. It is observed that pupils like to get out of the classroom to work. There are many restrictions on the furniture in hallways.

Possibility of sitting down

It´s observed that pupils wants to sit down

Work surface for both technology and books/papers

It is observed that fifth grade and up are working in group of four and using technology during most tasks

Suitable for 5thgrade and up

It´s observed that the pupils need room for both technology and books/papers

SHOULD

- **Classroom Solution**
- **Sit good with possibility of shifting positions**

COULD

- **Eye contact between pupils**
- **Work acces from several angles**
- **Improve social relationship between pupils**
- **Support small groups/buddies**
- **Support individual work**
- **Create a closed environment for concentration**

WONT

- **Not for vocational facilities**
- **Not for frontal teaching**
- **Not for fourth grade and down**

ill. 29a

IDEA IDEATION

The idea ideation is describing the development from the first ideas to the idea concept. To guide the idea ideation an ideation- and selection plan is made. The aim for the idea ideation is to present one to two ideas at second status seminar, there after one idea will be selected to further development. All iterations will be described in relation to understand what the outcome is and what it will be used for in the further development. At the end of every iteration there will be a sum up of all ideation rounds.

What to do?

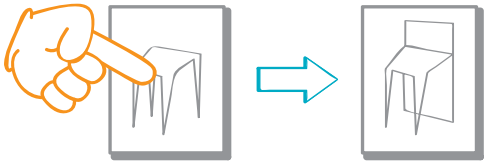
IDEATION AND SELECTION PLAN

Structure for all ideation techniques

- Ideation origins in the problem statement: "Doing group work equally when using technology"
- Document the process with pictures
- After the ideation do circle technique- draw on each other's drawings for adding
- Present ideas for each other
- Do selection according to selection plan

Selection plan

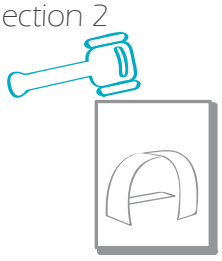
Selection 1



Point out good features in every idea, according to problem statement

Assemble all into a "good feature" drawing

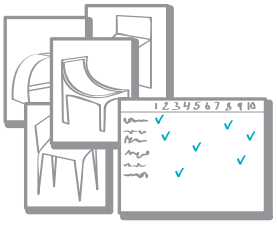
Selection 2



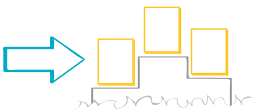
Judge all ideas according to MUST

Ideas that do not fulfil MUST, will be discarded

Selection 3



Set up voting form - using MoSCoW, gut feeling, and more parametres



The top 3 ideas, will be futher developed

ill. 30a Selection plan for idea ideation

Original Plan of Ideation rounds

1 Empty brain

- Empty the brain for ideas

Outcome: Ideas for inspiration

2 Focus words

- Make a list of focus words from MoSCoW
- Drag 2 focus words from the hat
- Combine the words into an idea
- Drag new words every 10 minutes

Outcome: Do selection 1

3 Future, year 3000

- Print pictures for future inspiration
- Drag 1 focus word, and use pictures as inspiration
- Draw on common paper
- Switch seat every 10 minutes

Outcome: Do selection 1

4 Problem statement

- Print inspiration pictures according to the problem statement
- Ideate and write numbers on the drawings, according to inspiration pictures

Outcome: Do selection 2

5 Abstract

- Draw 3 quick lines
- Pass on to the person next to you
- Draw 3 new lines and pass on, every 3 minutes
- Repeat 5 times, before presenting

Outcome: Do selection 2

6 Realistic ideation

- Gather ideas from Selection 1 and 2
- Use selected ideas as inspiration
- ! The ideation must be realistic- suitable for the problem statement and the MUSTs
- Draw in 1 hour

Outcome: Do selection 3

Iteration overview

Through the process the ideation rounds were made into iterations. During the ideation more rounds were added to push the creativity and create extreme ideas.

What went on?

Iteration 1	Iteration 2	Iteration 3	Iteration 4	Iteration 5
1. Empty brain 2. Focus words 3. Future, year 3000 4. Problem statement	5. Research on technology tendencies 6. 2014 (added) 7. 2020 (added) 8. Realistic ideation (refined round)	9. Ideation on categosies Hallway sizes Measure of pupils 10. Choosing ideas	11. Test of reach and workflow 12. Understanding of ideas	13. Detailing two ideas: 2020 and 2014 Choose one idea
Outcome	Outcome	Outcome	Outcome	Outcome
Many ideas for inspiration Foundation of categories	More specific ideas in two overall directions	Understanding of size on idea Three gathered ideas for 2020 and 2014	Common understanding of ideas	Idea to develop into a concept

ill. 31a iteration overview for idea ideation

ITERATION 1

1.Empty brain

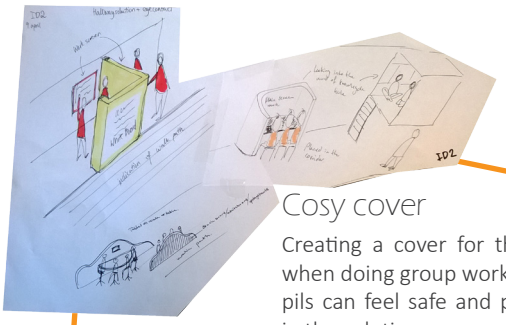
Open the ideation with a free round, where the only factor is to empty the brain for ideas. Any kind of idea is allowed.

Outcome is a lot of different ideas for inspiration for further ideation.

2.Focus words

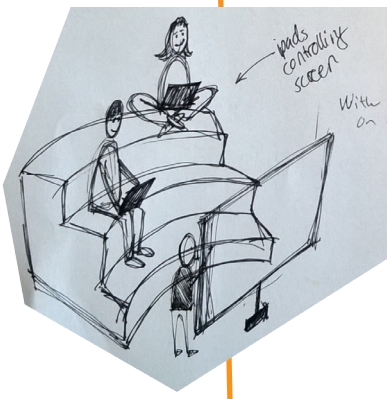
The focus words were made from the MoSCow and will be used to create a forced relation between the conditions that are set up. The focus words are sit down, stand up, hallway solution, classroom, equal participation, shared surface, work access from several angles, and work access from several levels. By combining two words, there will be a focus on how these two conditions can be solved.

Outcome: According to the plan, selection 1 should be used, but it is difficult to combine the various drawings without losing some of the features. Instead, 6 main ideas that describe the good features, within the idea, are made. Each idea is given a name, which describes the type of solution it refers to, see ill.32a.



Cosy cover

Creating a cover for the pupils when doing group work. The pupils can feel safe and protected in the solution.

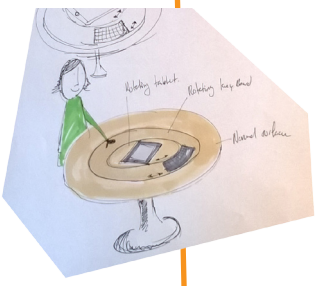


Control of big screen with each pupils tablet

With use of technology the pupils can control a larger screen together

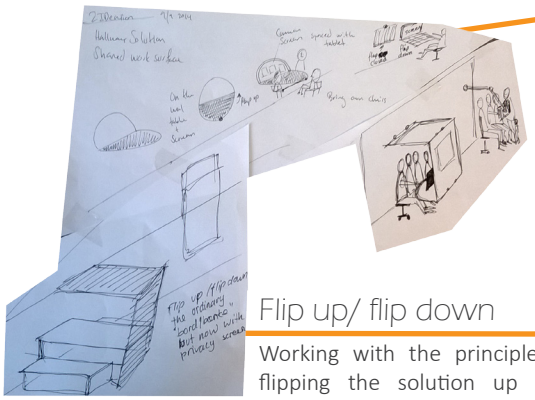
Whiteboard with tablet mount

A mounting solution for tablets. Mount on different surfaces, ex. whiteboard



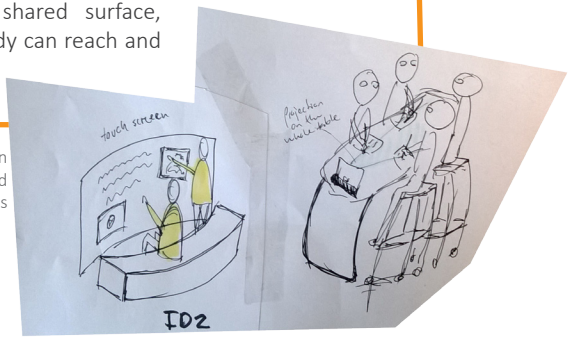
Rotation table

Table where elements can rotate as needed. Can create a workflow, due to the quick accessibility to the work surface and use of technologies.



Interactive screen/table

Create a big shared surface, where everybody can reach and see the work.



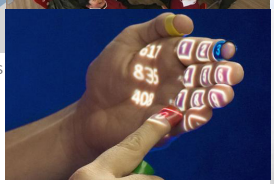
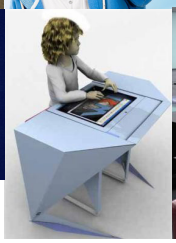
Flip up/ flip down

Working with the principle of flipping the solution up and down, to create more space in hallway, when not in use.

ill. 32a Description on developed categories





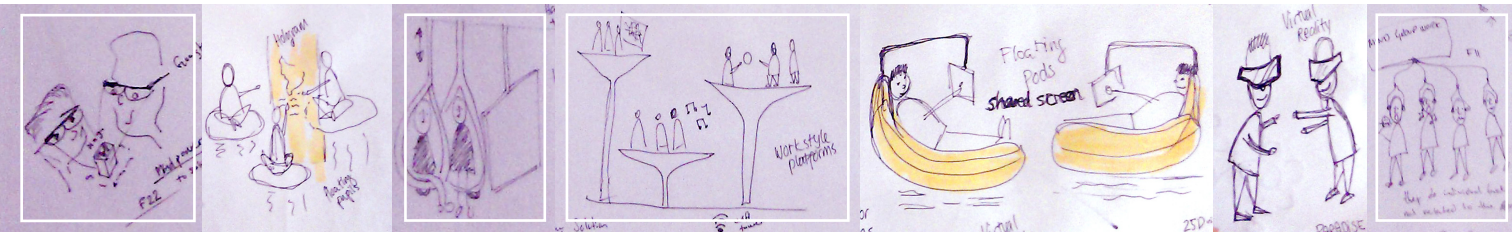




ill. 33a Extract from future inspiration pictures

3. Future, year 3000

With inspiration in futuristic pictures and the focus words, a future ideation for year 3000 is made. This is made to get all the wild and crazy ideas, about the future school, in play as inspiration for future realistic ideations. By switching seat every 10 minutes, the ideas on the paper will be as inspiration for new ones.

Outcome: A lot of varied ideas, with lot of potential in them. Combining all good ideas are hard, so a list of inspiration words of what the future can hold is made. The list contains: Hologram, Learning without talking, Learning without a screen, 25D video - where pupils will be a part of the video, Google glasses look-a-like and Brain scanner. While sketching ideas with inspiration in the pictures, a feeling of lack of information about different kinds of technologies occurres. A list of technology research is made: Speak based technology, Brain scan – learning styles/emotions register, Cloud service, 3D print, Quantified self, Eye tracking technology and multi touch screen.

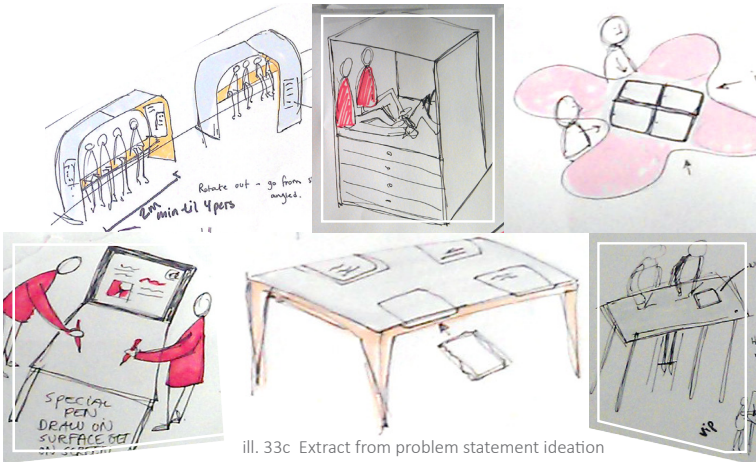


ill. 33b Extract from future ideation

4. Problem statement

This ideation will focus on how to solve the conditions that the problem statement sets. This ideation use inspiration pictures of solutions that includes group work and technology. The ideas are made with inspiration from one or several pictures.

Outcome: The ideas are not yet developed to do selection on 2, so selection 1 is made. Instead of making a good feature sketch - the ideas with potentials are added to the existing categories from round two.



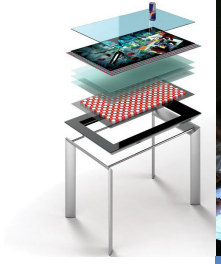
ill. 33c Extract from problem statement ideation




ill. 33d Extract from problem statement inspiration pictures

Sum up, Iteration 1

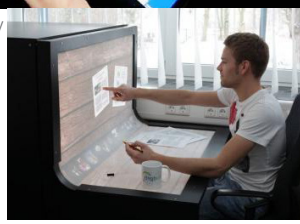
Iteration 1 is used to open up many various types of ideas which are moving in different directions. The outcome from the rounds is: different categories, abstract ideas that opened up the way of thinking and present and future ideas. The different categories created in round 2 and added ideas in round 4, are the foundation for the main categories used in the further ideation.



ITERATION 2

5. Research on technology tendencies

Since the problem statement deals with technology and the school visit observations shows that technology is upcoming in schools, a picture research on technology tendencies are made for inspiration. The research is focused on what is possible now and in the future within technology. The research is made with inspiration from the technology list from round 3. See pictures from research in ill. 35a.



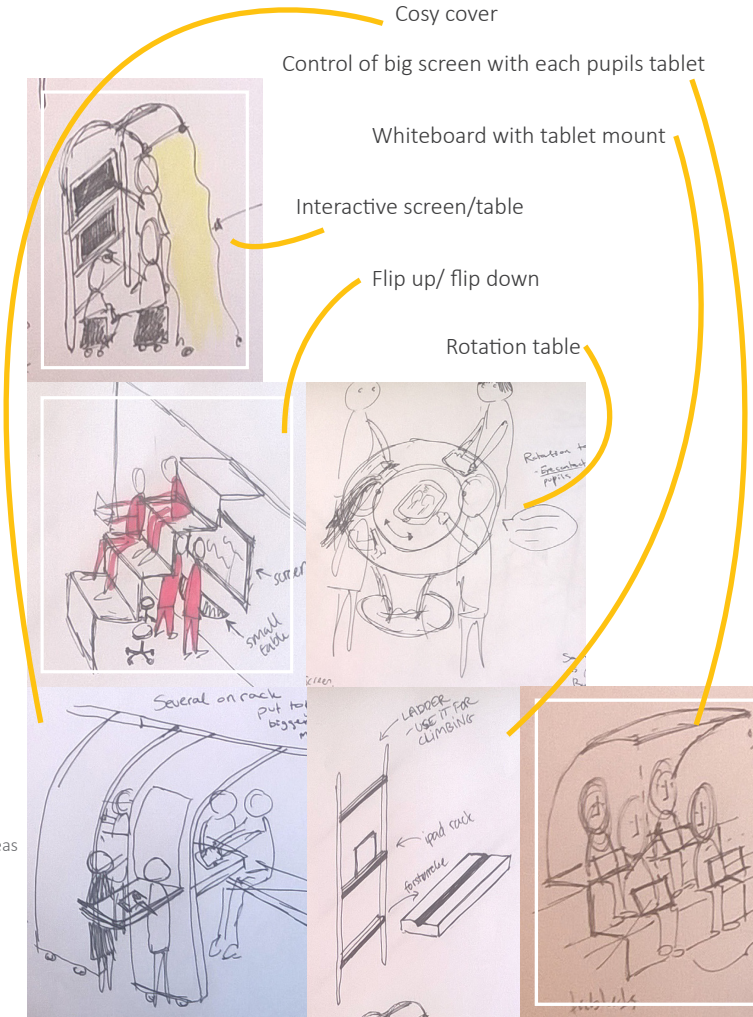
ill. 35a Extract from research on technology

Outcome: The research is starting the thoughts about going in two directions - develop ideas for the school of today and ideas for the school of the future. Both directions achieve to become more realistic and possible.
1: Due to the upcoming school reform and the expectation from Højer a solution for 2014 is chosen.
2: Based on the fast moving technology tendency and to push the expectation from Højer a future solution for 2020 is chosen. Todays upcomming technology tendencies are considered to be available in 2020.
Both directions must take inspiration in the developed categories, ideas and the technology research.

6. 2014 (added round)

This added ideation focus on ideas that fits the school of 2014. As technology has become a larger part of the schools, a mapping of existing technologies in schools is made, based on the observations: Tablets, laptops, smartboards, external screens, projectors, smartphones, stationary computers, overhead projectors, speakers and wifi. The ideation takes basis in the categories from iteration 1, the technologies from the mapping, and how to use them in various situations while doing group work.

Outcome: Developed and experimented with ideas on the basis of the categories. The Ideas with most potential in relation to the use of technology and the MUST is being added to the categories.

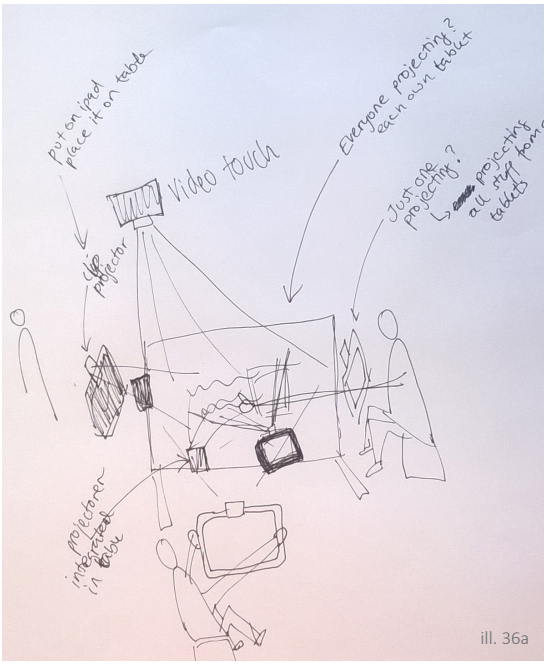


ill. 35b Mapping of categories in ideas

7. 2020 (added round)

With the same principle as the round 6, this added ideation is focusing on ideas that fit the school of 2020 and the inspiration in the research on technology. All ideas must include a kinds of technology and reflect on how to use it in various situations while doing group work.

Outcome: Several of the ideas have similarity, so selection 1 is made to sum up the good features which create a new category: Projection.



ill. 36a

Projection

Dealing with an equal shared and visible work surface. Projection can be from the ceiling, on the table or from the tablet.

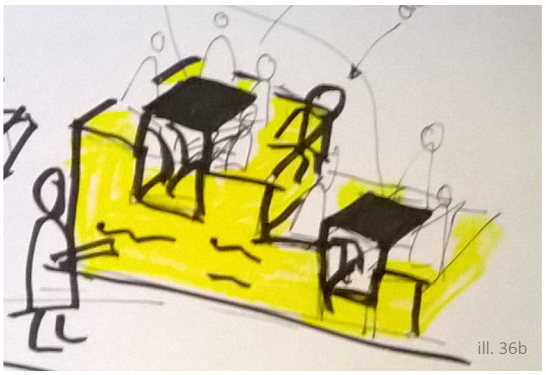
8. Realistic ideation (refined round)

This ideation focused on making the ideas in the categories realistic, as to the use of technology and overall construction. The realistic and unrealistic features of each category is pointed out, see app. Realistic features.

Outcome: A new category is created from the features from ideas that aren't showed in the other categories. This category is called: Levels. The categories with no substance within making them realistic are discarded. Due to the similarities "Interactive screen/table", "Control of big screen with each pupils tablet" and "projection" are combined into the category: Common Screen

The remaining categories are:

- Cosy cover
- Common Screen
- Levels
- Flip up / flip down


ill. 36b

Levels

Dealing with creating several areas in the hallway, where the pupils can use different positions while working.

Sum up, Iteration 2

The research on technology tendencies are leading into the two directions 2014 and 2020. All ideas from iteration 2 are evaluated according to problem statement and MUST. The 2014 and 2020 rounds each leads to a direction to follow in the further development, and two new categories are added- Projection and Levels.

ITERATION 3

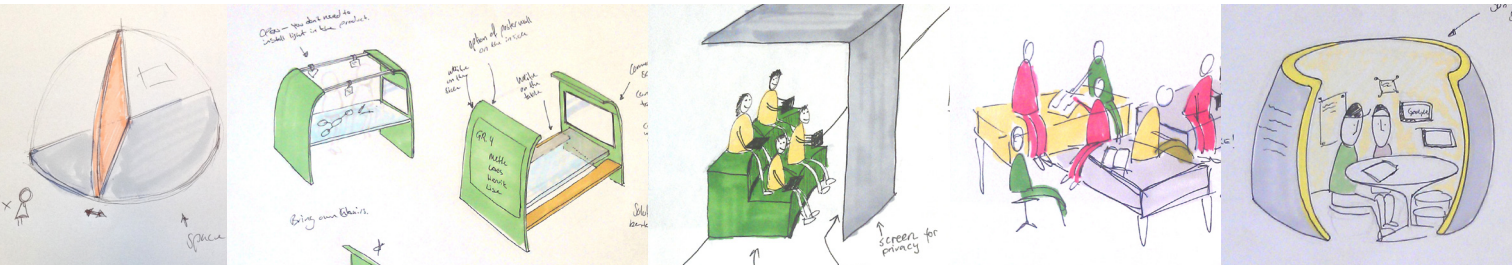
According to the ideation and selection plan, the idea ideation stops here. But the ideas at this stage are not yet developed enough to present at status. The ideas are still too undefined, and need more development, so more rounds are added. The further ideations are aimed for a 2014 and 2020 direction.

9. Ideation on categories

This ideation is made with inspiration in the created categories and directions of 2014 and 2020. This leads to intesting ideas see. ill37 a and ill.37b. But many ideas are hard to evaluated, beacuse of lack of knowledge about sizes and functions. This leads to physical tests of ideas, before the decision of discarding and choosing.

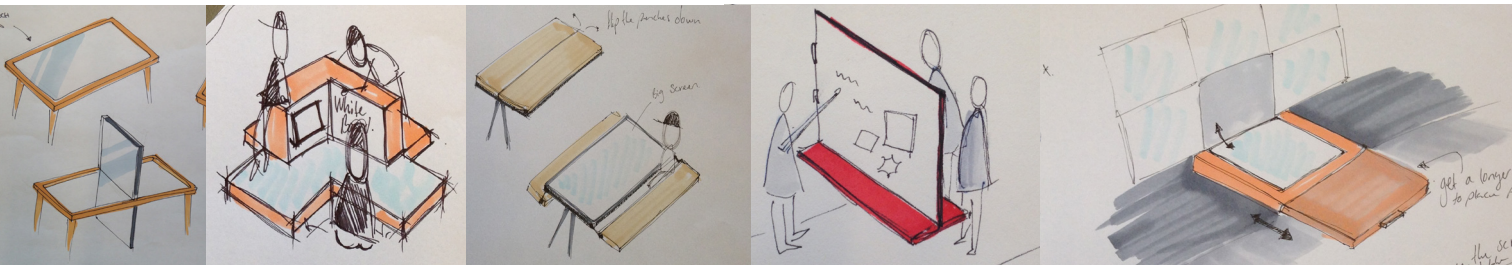
2014 Ideas

ill.37a Extract from ideation on 2014 combined with the categories



2020 Ideas

ill.37b Extract from ideation on 2020 combined with the categories



Hallway sizes

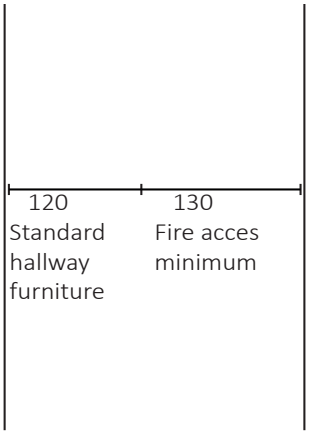
To find the right sizes for a hallway furniture the hallway is analysed according to maximum sizes. The critical size is the size outwards in the room.

Fire access demands require minimum 130cm free passage for fire exit hallways with maximum capacity of 130 puils (Danish building Regulation BR08)

Furniture already used in hallways now are observed to often be the flip table in ill.37c. The furniture were measured to be app.120cm out in the room. Højer's edition of the table is 134cm.

The information leads to a maximum size of the furniture of 120cm, to make it possible to fit as many hallways as possible.

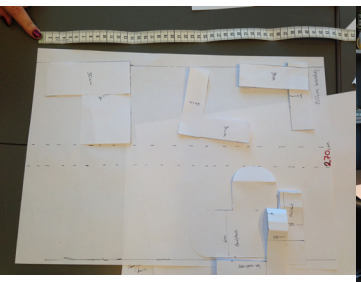
ill. 37c Existing flip down table



ill. 37d Measure on hallway

The ideas are body stormed and measured to see if they are possible to fit to the hallway demands. Also positions between the pupils and the access to a common work surface is considered. See ill. 28a.
Ill. 38a shows the minimum sizes found through the body storming. It is taken into consideration that pupils are smaller than the test persons, but the sizes are used as minimum sizes, so also bigger pupils fit the solution.

ill. 38a Testing measurements on ideas



Sizing the furniture seen from the top view, trying to fit into hallway size demands

Working in levels, when positioned around a worksurface like in the second idea in the 2020 ideas p.37.

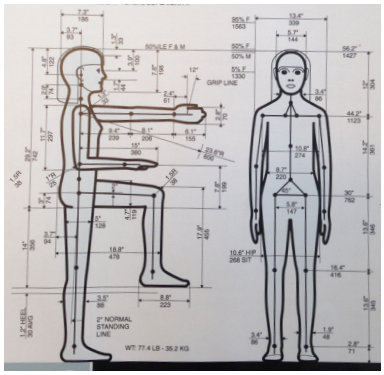
Sizes of round furniture including four pupils. Inner circle shows the aim of 120cm, which is too small for group work

Sitting four pupils in a corner- not enough space for everyone to participate

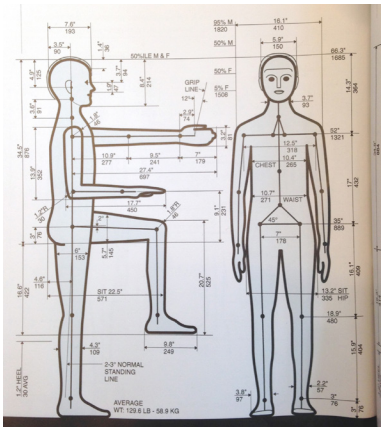
Sitting in levels with a screen in front

Measure of pupils

Measure of Man & Woman by Henry Dreyfuss Association is used for understanding the size of pupils. The size is showed in ill.38b and 38c.
An average sixteen year old is used as the maximum size and an eleven year old as minimum, relating to the fifth to ninth grade in school.
Min. reach distance: 60cm
Two sixteen year old sitting close together: 82cm



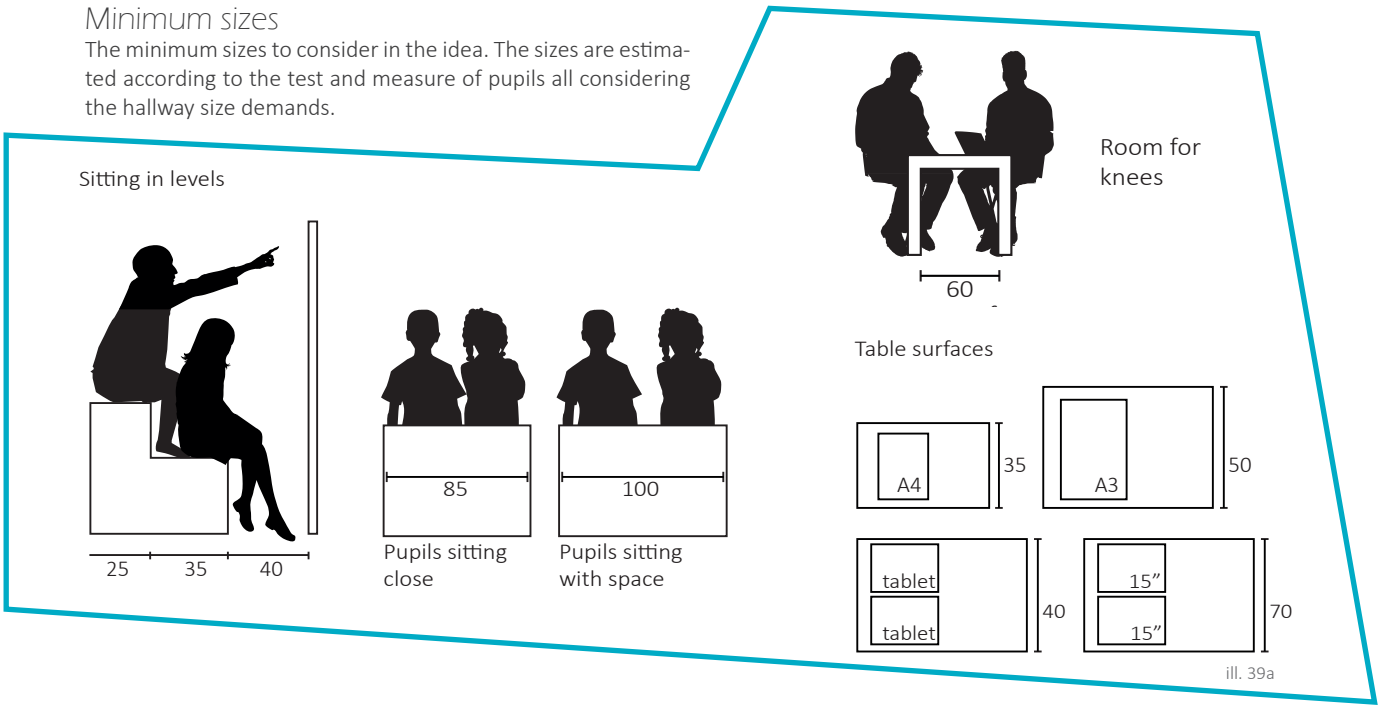
Ill 38b Measure of eleven year old.



Ill 38c Measure of sixteen year old.

Minimum sizes

The minimum sizes to consider in the idea. The sizes are estimated according to the test and measure of pupils all considering the hallway size demands.



ill. 39a

10. Choosing ideas

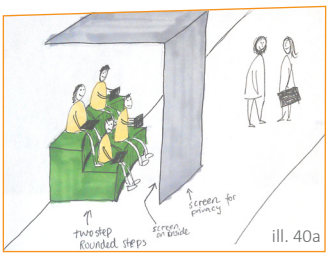
The ideas are evaluated according to test results, where some furniture are discarded according to size and lack of equal work surface.

All remaining ideas will go through selection 3, where parameters are used for choosing. The ideas are voted against these parameters: Newness 30% (is the solution seen before?), Recognisability 10% (is it recognisable as a work space?), Visibility 15% (is the work visible for every group member?), Multiple types of group work 15% (suitable for group work, individual work, several groups), Personal preference 30% (group members personal aspect on idea). The parameters are selected on the basis of creating an intuitive, modern and functional solution. As all the ideas could have been modified into a Højer product, this parameter was not selected for the voting. The percentage is set due to the weighting of the relevance. Every group member give points 1, 3 or 6 to each voting and on basis of a short discussion a point is agreed. The personal preference voting is an average of all 3 votes. See the App. Voting scheme.

Outcome: Top 3 of each direction is chosen for further development. The six ideas are on the same level and can all be modified to the better. The intention of using a form facilitate a good discussion of the parameters and the ideas, which leads to a progress in the process. The percentages are discussed afterwards and could have been left out, since they are hard to estimate, this will be considered for further selections.
The chosen top 3 ideas from each direction have much in common. The 2014 ideas deal with the cosy cover feeling, where the group can define their own space and work in a calm and safe environment without anyone is disturbing. The 2020 ideas deal with the use of technology in a different way that could increase the workflow, while the pupils are using the solution. The ideas are presented on the following page.

Top 3 of 2014

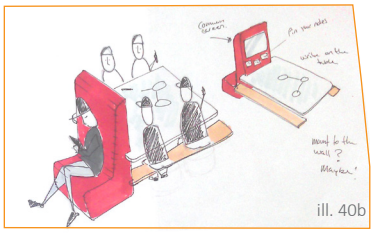
Cosy Cover
Levels
Common screen



ill. 40a

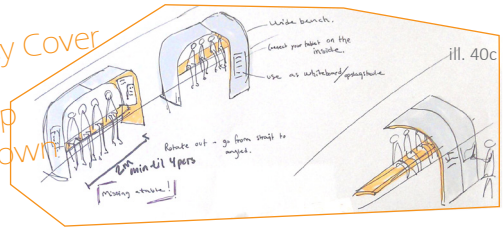
Pupils are sitting in levels in front of a big common screen. They control the screen with their tablets. The screen covers for the disturbance from other pupils in the hallway.

Cosy Cover
Common screen


ill. 40b

A combination between a work surface and a soft chair, used as a cover. The pupils can write on the table and use the screen in the chair for presentations. An individual pupil can use the chair while a group is working.

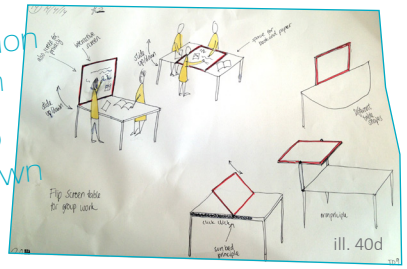
Cosy Cover
Flip up flip down


ill. 40c

Movable arm makes it possible for the pupils to define their own work space. The solution can be adjusted to the needs. Several groups can use it at once.

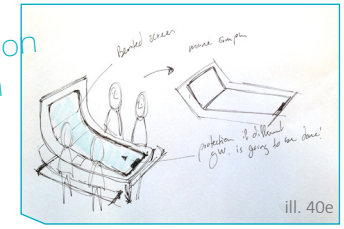
Top 3 of 2020

Common screen
Flip up flip down


ill. 40d

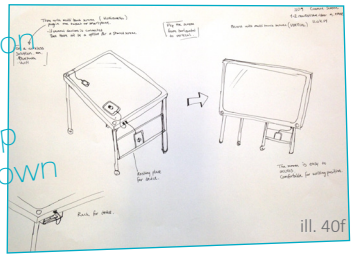
Interactive movable screen on top of a table. The screen can be used as a working surface and also a cover. The screen can be adjusted to the pupils needs.

Common screen


ill. 40e

Bendable interactive screen for increased workflow. Possible for swiping a task from horizontal to vertical position. Pupils can have several work tasks open at once, and still keep an overview.

Common screen
Flip up flip down


ill. 40f

Big common interactive screen. Possible to flip from horizontal to vertical position. Gives the pupils opportunity to work both standing and sitting.

Sum up, iteration 3

The 3 ideas from each direction have many similarities and will be combined into one idea per direction. The level of the detail in the ideas must be increased for presentation at status.

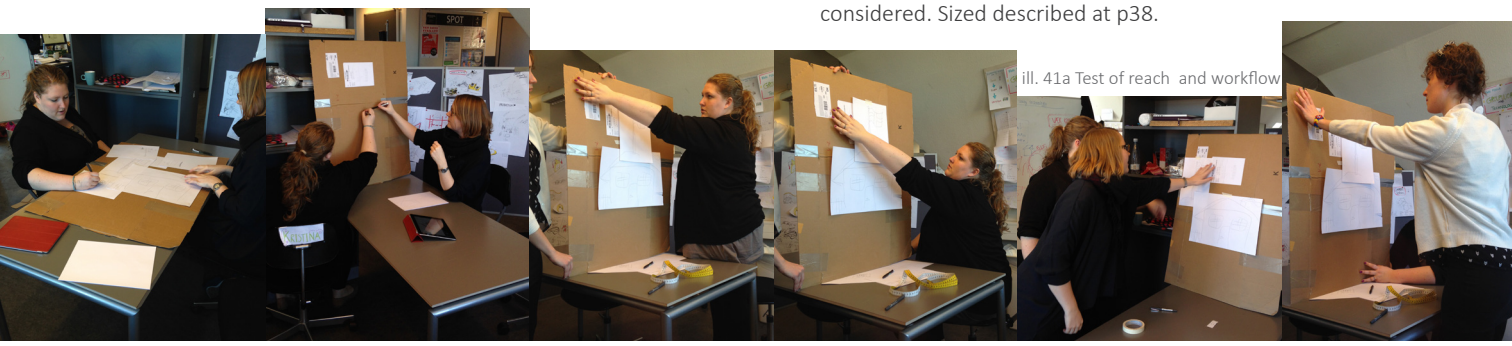
ITERATION 4

11. Test of reach and workflow

Working with directions where technology is a focus, gives the possibility to create a common visible surface where several tasks can be done. All ideas from the 2020 direction includes a larger interactive screen and 2014 ideas are including whiteboards and shared big screens. All ideas consider different placements of the shared work surface and deal with different work positions. A simple test with cardboard is set up, to study the workflow when the combination of two work surfaces (table surface, interactive screen, whiteboard etc.) are positioned in different angles and the reach when sitting and standing. See ill.41a.

Outcome: The test of the 2020 direction deals with larger interactive screens in different positions. (screens made of cardboard). The test showed considerations about the position and angle of the screen, the reach when a pupil is sitting/standing and the accessibility to the screen both in view and reach. When the work is positioned horizontal it creates a common work surface where everybody can reach and see.
When the screen is positioned vertical it creates a work surface for presentation, and stationary work due to that everybody cannot reach and pupils can block the view for other pupils in the group.
The test showed that the view angles are awkward, when sitting around a table placed in front of the screen - the person nearest a vertical surface have the best reach accessibility, but does not have the best view on the work.

The test is made with the members of the group, which fits the arm length of a sixteen year old: app. 70cm, which is the maximum. Also size of eleven years olds are considered. Sized described at p38.



ill. 41a Test of reach and workflow

Workflow on interactive screen when placed on table works well

Workflow on vertical big surface is awkward when having a table in front, but have good visibility

Reach distances when standing are good on bigger screens

Big screens are hard to reach on the top corner, when sitting

Two persons sitting beside each other. Awkward when the farthest away person reaching in

Good reach ablitity with small table in front when standing, but awkward for the one sitting on the side

12. Understanding of ideas

For better understanding the top 3 ideas from round 10, the values and challenges are described for each idea.
The full description is shown in app. Description of top 3 ideas.
The values gathered: Include both a horizontal and vertical work surface, common visible screen, type of technology/software and reach and workflow – both sitting and standing. The 2014 values are: Inclusion, usable for several groups at once, define own workspace and make a cosy cover.
The challenges gathered: The contact between the pupils when sitting in a row, consider where to place personal things, cosider what kind of software exists if groups working together on one screen, the value of a bended screen, flipping screens must be easy to do.

Sum up, iteration 4

The knowledge about reach and workflow give an understanding of the use and accessibility in the solutions. This knowledge will actively be used in further development.

The values and challenges is giving a common understanding of the ideas.
They will also be included in the further development of one idea concept for each direction as well as.

ill. 42a. Extract from mood board of 2020

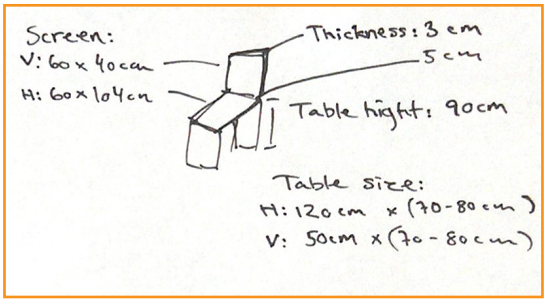
ITERATION 5

In this iteration the ideas will be developed into idea concepts, so they can be presented at status. The detailing needs to be increased to get a good feedback, so one direction can be selected for further development.

13. Detailing two ideas, 2014 and 2020

Both ideas works with the problem statement: to create a common visible shared work surface where pupils can participate equally when doing group work. Mood boards for both directions are made to get inspiration for styling and functions, see ill.42a. With inspiration from the mood board and the dimensions from previous tests p.38 and p.41, the ideas are developed.

During the development considerations were made about: Højer's aspect by including technology into a solution, pupils placement with/on the solution, the shape and size, how to use the technology – which technology/ software?, high or normal table solution – teacher aspect when supervising, question about newness – is it just a screen on a table/wall?, and where do the pupils place their personal things?

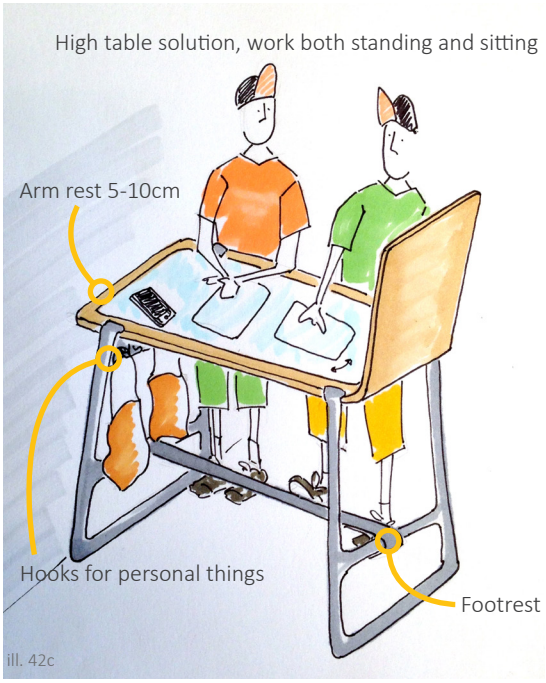


ill. 42b Measurement on 2020 concept idea

2020 Concept idea

The idea of 2020 is working with creating a workflow with use of technology. The combination of a horizontal and a vertical screen will make it possible to swipe the work back and forward and thereby create a fluent workflow. The screen is depending on a multi touch function, same principle as the Samsung SUR40 multi touch screen, due to the use of several pupils at once, see app. Samsung screen. The horizontal screen is used for the ongoing work in the group, while the vertical is for creating an overview, store work or present work for each other or the teacher.

Sketches of the concept

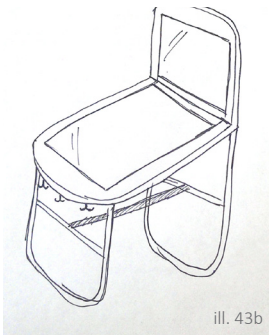


ill. 42c

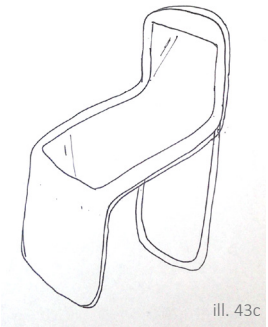
ill. 43a

Values

- *A fluent workflow*
- *Common and clearly visible work surface for everyone*
- *A horizontal and vertical screen*
- *Standing and sitting option*
- *Good view access for teacher when supervising*
- *Technology adapted to school furniture in a holistic solution*
- *Establishing collaboration when working digitally*
- *Challenging Højer into mixing furniture and technology*



ill. 43b



ill. 43c

Sketches during the development

ill. 43d

ill. 43e

Solution without pupils

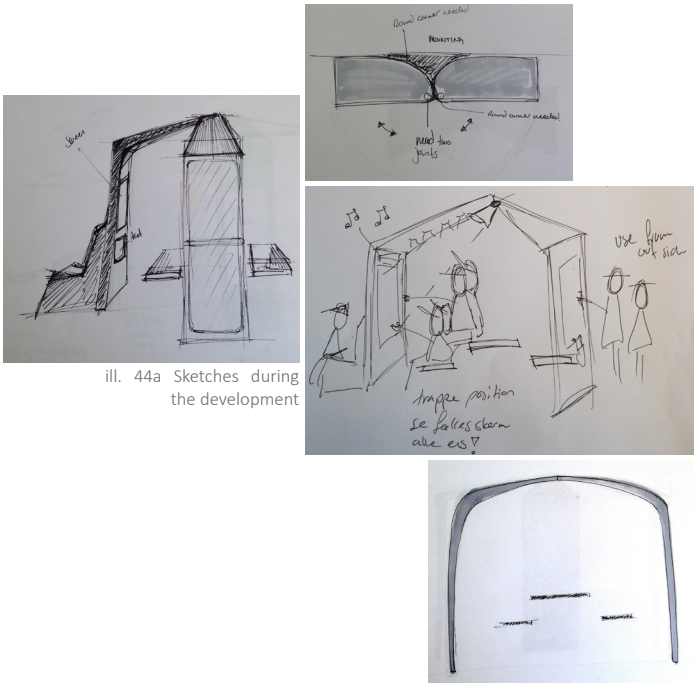
ill. 43f

2014 concept Idea

The idea of 2014 is working with creating a cosy cover, where the pupils can define and adjust their own work space. This solution will be based on working with the technologies that the school already have, such as: tablets, projectors and smart boards. The principle is to have a cover around the working table, so the pupils get the feeling of being in a cosy cave for better concentration and to feel safe and protected. The solution consists of several work surfaces, both horizontal and vertical. The work surfaces invites to different working positions such as in levels, across each other or standing.

During the development of the idea, the number of arms needed to create a room, the shape and styling of the arms and how the arms will move and be moved is explored. Considerations made about the size and volume on the hallway due to the use of the solution, the constructions and fire demands. See app. Development of 2014 idea concept

ill. 44b Extract from moodboard of the 2014 idea

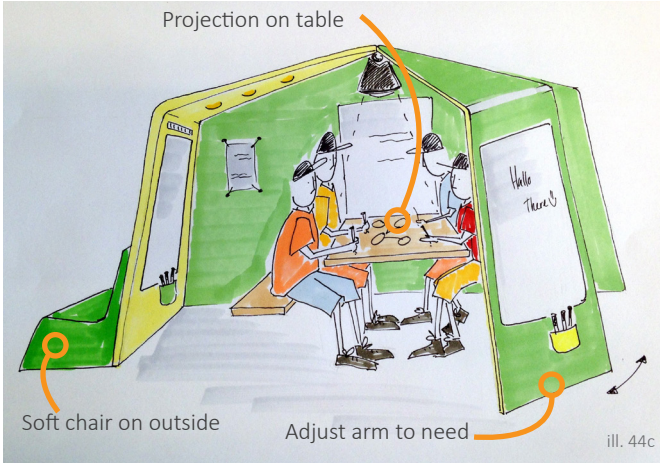


ill. 44a Sketches during the development

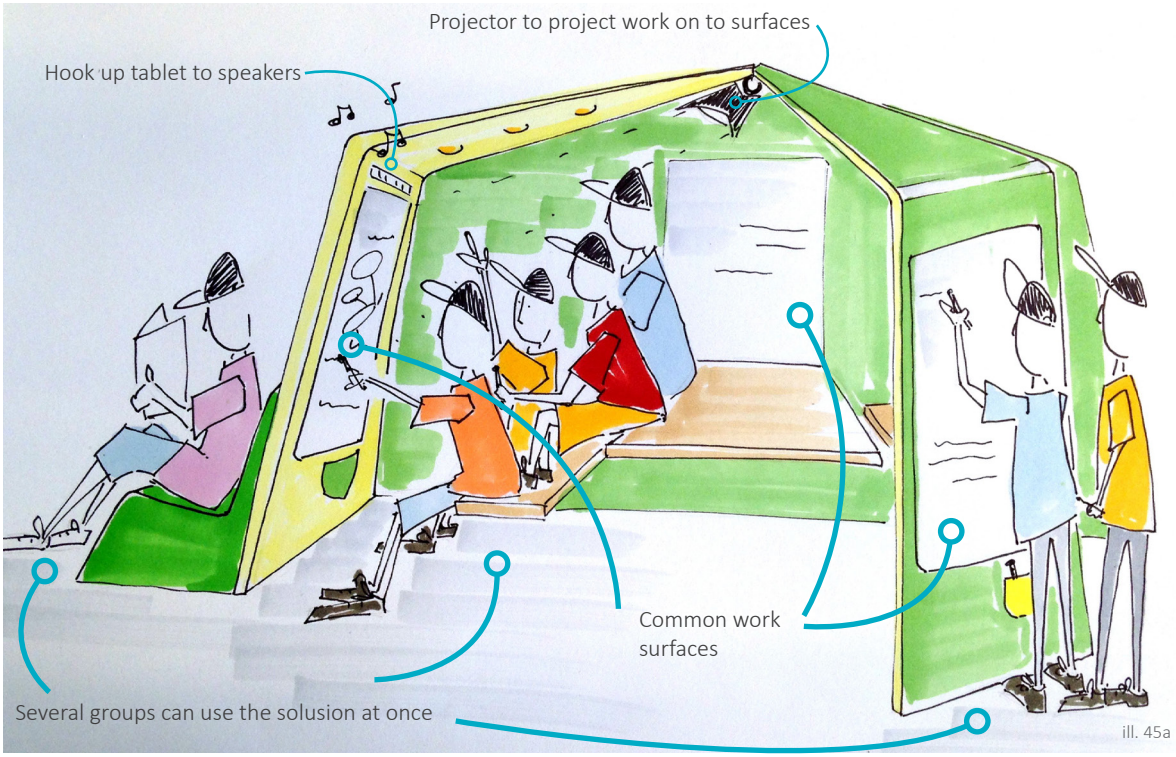
Values

Cosy cave - Create room in the room
A scalable solution – mix and match
Multiple shared and visible surfaces
Expandable according to future technology
Different learning styles
Make attention about the use of technology in different ways
Different work positions
Defining own work space

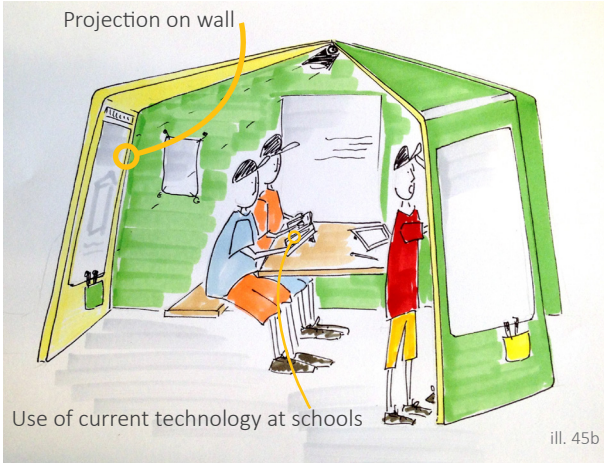
Sketches of the concept



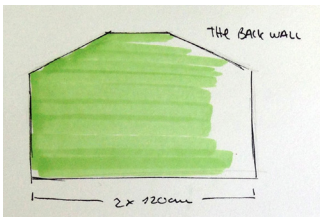
ill. 44c

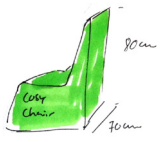


ill. 45a

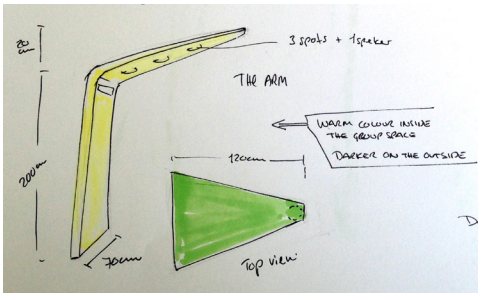


ill. 45b





Mix and match



ill. 45c

Modular system- adjustable to the schools need.

Choose one idea

The two ideas are presented at the status seminar, where feedback is given from peers and co-supervisors. The two idea concepts are afterwards evaluated on relevant categories that represent the problem statement, Højer and the benefits in the concepts.

The evaluation categories

- *Problem statement – how are the idea concepts dealing with the problem statement in terms of used technologies*
- *Højers existing furniture - does the idea concepts fit into the present product range of Højer*
- *Højer future furniture – will the idea concepts fit the upcoming furniture of Højer*
- *Life expectancy – The lifetime for the idea concept*
- *Business case - which business forces does the concept idea has?*
- *Values USP – Unique selling points*
- *Values ESP – Emotional selling points*
- *Considerations – Vital questions related to accomplish the idea concepts*
- *Problem – Problems related to the idea concepts*

Both idea concepts are representing good values and are solving the problem statement, which is the reason why the most influencing categories on the decision are the ones related to Højer, the life expectancy and the business strategy. Full selection in app Selection discussion.

The chosen idea concept is the 2014

The 2014 idea is well fitting the thoughts and product range of Højer at the current time and in the future.
Højer does not at the moment include technology such as interactive screens in products since this demands knowledge of technology, maintenance of technology and technology has low life time expectancy compared to school furniture.
Instead is a focuse on solutions which works well with the schools existing technologies. This is interesting for Højer to consider, since technology is increasing in schools, p.19.
The scalability in the 2014 idea makes it more available for the schools and extend the lifetime, since new available technologies and parts in the furniture such as interactive screens or furniture parts can be added or changed.

The main reason for not choosing the 2020 idea is the mismatch between Højer and the incorporation of complex custom-made technology.

Values of the 2014 idea

1. The idea "Creates a learning environment" on the hallway where the pupils can open up or close it according to the wanted privacy. This gives the possibility of enhanced quietude. Relates to observation in schools, where defined smaller environments gives the pupils comfort

2. It blocks the visual noice for better concentration and embraces the pupils, so they feel safe and protected relating to the observation of pupils at Vestre School.

3. Different sitting positions are possible so the pupils can move around in the furniture, both sitting across, sitting in levels and standing which gives a more active school day, relating to the School reform.

4. Shared bigger work surfaces are provided for better equal participation and vision to the group work giving the possibility for activation of all group members, leading to more effective learning, realated to the theory about the learning pyramid.

5. The solution gives the possiblity to shared seating and work surfaces, which is observed to have a possible effect on the social relation. Working together also have the possibility of enhancing the pupils social relation as well as communicative skills according to the cooperative learning method.

6. Using technology is a part of the solution, which makes it a contemporary solution as well as future-proof. Relating to the research on technologies in school.

Conclusion on the idea ideation

The idea ideation describes the development of the idea concept through five iterations, which is going to be developed further in the project. Through these iterations the categories found in idea ideation are developed and used as guidelines in the development of ideas and the two directions – the 2014 and 2020 idea concepts. Through feedback and evaluations on the two directions a selection scheme is used to question the two directions according to Højer, the schools and the values provided in the idea concepts. The chosen idea concept is the 2014 idea based on the good fit to Højer and their thoughts and the scalability option in the future to extend the life expiry.

The 2014 idea concept is a furniture solution that provides a comfortable space where a group of four can concentrate when doing group work. When using technology devices and the big shared work surfaces the pupils has the possibility of equal participation, while changing positions as the pupils prefer.

Reflection

The idea ideation is a two week process. It has been of focus to use the previous research, the problem statemen and the MoSCoW in the ideation process. When lack of knowledge has occured research and tests are made to make progress.

The hard parts in the ideation was the selection parts, it is estimated because of the low detaling of the ideas, which means that many ideas has the same developement potentials. It has been dealt with by always refering to parameters or to create new ones. All ideation has been made with a aim in the beginning, which in some cases has been to open up the creative process other times to narrow it down. When looking back it is estimated also to have been hard because of an open problem statement and MoSCoW, which could have been more specific. The specification could have been more focussed by a narrow desription of the statement done by asking: What can it do and what does that give? Example: ”Shared common work surfaces helps the pupils to equal participation so the possibility of more active pupils occurs, giving the pupils effective learning”

The plan made in the beginning was not followed completely, but adjusted during the process and new ideation rounds was added along with research and tests. This gave a dynamic process, but still a kick-off foundation to refere to, when the ideation was hard.

The ideation rounds are presented chronologically in the report, but categories are more mixed in the actual process, where all the ideation rounds where continued with a circle technique, so everyone in the group could add to all ideas. This gave a common ownership of the ideas.

CONCEPT IDEATION

After selecting the idea of 2014, the concept behind the idea needs to be developed further. This concept ideation is describing the development from the chosen idea concept to a detailed draft. The development runs through four iterations.

ITERATION 1

The first iteration on the 2014 concept consists of an understanding of existing covers and space dividers and suitable dimensions for cover arms, which guides the creative process.

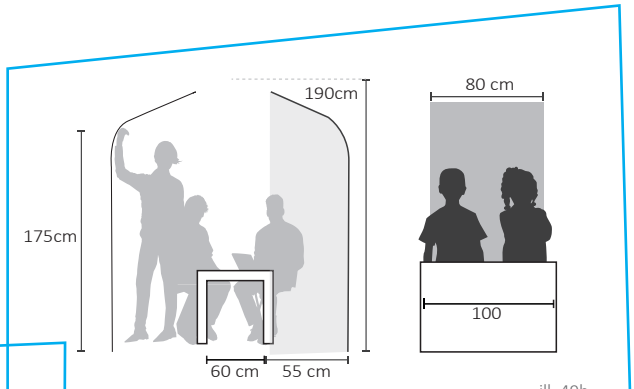
Inspiration

The moodboard consists of categories describing different coverings and their values in various work environments – both group work and individual work solutions are shown. See the App Inspiration moodboard.

ill.49a Extract from moodboard of covers and space dividing

Dimensions

The concept deals with creating a cosy group work environment. To understand how small or big dimensions of the concept needs to be, to fulfil the cosy feeling, a cardboard model is made. The models starting point is build upon the minimum sizes needed when sitting together, see App Minimum sizes. While adjusting the model the minimum dimensions, which still provides the cosy feeling are found.



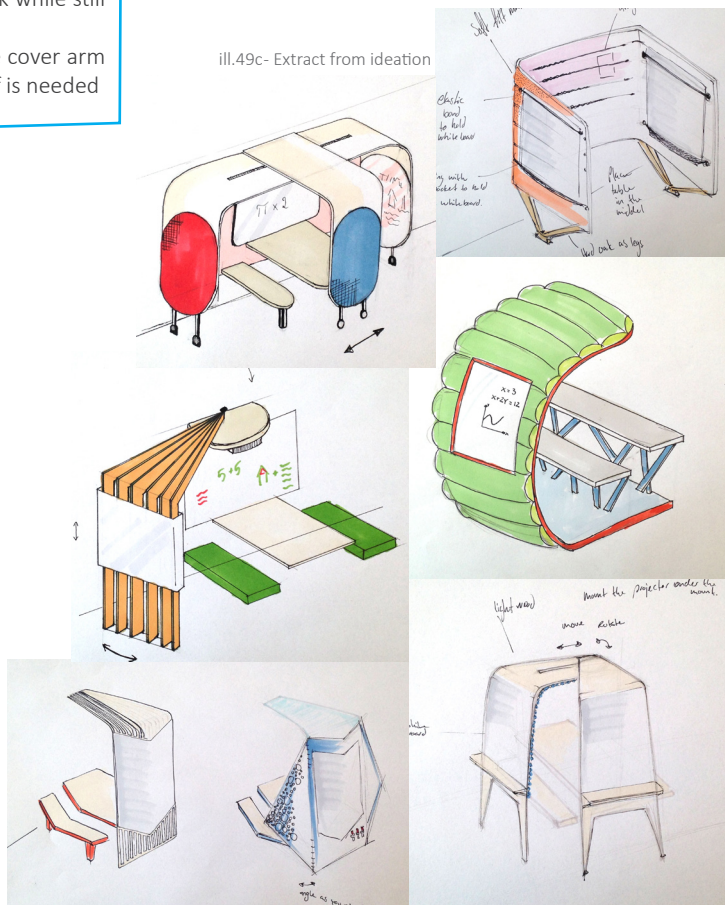
ill. 49b

Minimum height –175cm before a roof starts covering the pupils
Minimum height – 190cm in the middle of the furniture solution
Wide of the cover arm – needs to cover two pupils at the back while still keeping the cosy feeling – 80cm is decided, see p. 38
The cover arm – the cosy feeling by the roof is kept when the cover arm reach above the pupils, while sitting on the bench – 55cm roof is needed
See ill. 49b

Ideation

With the inspiration from the MUST´s p.29, the moodboard and the gathered knowledge, the ideation on the 2014 concept takes place. The focus is upon sketching the new furniture ideas as realistic as possible with the right dimensional perspective including details about surface finish and materials. See the sketches in App. Ideation d.29.4.2014. The sketches present different kinds of coverings, work surfaces, stationary and dynamic solutions for the work areas. Because of the large dimentions of the concept the lightness and transparancy are considered. As well are soft and hard materials tried combined.

ill.49c- Extract from ideation



Sum up Iteration1

The ideas are going to be evaluated upon the MUST´s, but because of the wide definitions by the defined points in the MUST, it is hard to evaluate and sort out the ideas. The MUST's needs to be specified.

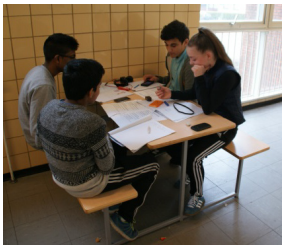
MoSCoW - UPDATED

The MoSCoW model is updated to clarify the related demands that are needed to solve the problem statement. The demands related to the problem statement are all supported by the theories and the observations from school visits.

MUST

Related to problem statement:

Group work (of four pupils)



Use of technology

Hallway solution

Worksurface for both technology and books/papers

Suitable for fifth grade and up

In the age of 11 the cognitive development has reach the stage of being able to think abstractly. In the year of 12 the pupil begins to think problem oriented. (The measure of man & woman p.7.)

Equal participation
Shared work surface

Makes the pupils active during the group work which gives them a more effective learning see p. 19.

3 work constellations of the pupils and Movement

The best sitting position is the next. Changing positions creates more energy for the pupils, during the day, p. 18.
- The four pupils sitting in levels for presenting for each other
- The four pupils facing each other for participating in work together.
- The four pupils working individually or as buddies, while being a part of the group.

The constellations are decided from observations of which types of group works are needed

Technical parameters:

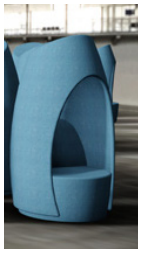
- **Wear resistant - materials**, joints, use, life expectancy
- **Safty** - According to pupils. Demands according to sizes where children can get caught also moveable parts must be considered. Fire safety in schools
- **Cleaning** - Needs to be easy to clean and possible with the schools available cleaning tools. Demand from schools.

MUST continued

Encourage social relation through shared seating

Observations showed that shared seating might supports social relation.

Højer - Create an environment



Suit to product range and visions for schools according to four levels of freedom by Højer.
Create a "cosy cover feeling" intended for giving a feeling of safety and concentration.
Past observations showed pupils like doing group work in this type of environment.

Scalable

More value to schools when it is scalable and the solution suits more environments. Increases life expectancy. Upgrade and downgrade to both need, size and economy in the school.

Work surfaces and Projectors

Vertical and horizontal surfaces is needed to support a dynamic workflow - Visibility for everone, which gives the option of everyone to participate.
Projectors must not be reachable for students.
Observed according to vandalism.

SHOULD

- **Common areas**
- **Suit the moodboard** app. Moodboard concept ideation.
- **Use existing furniture** Højer often uses the schools existing solution to give them more value for money

COULD

- **Classroom solution**
- **Several entering access**
  Easy in and out of the furniture. None is captured
- **More groups using the solution**
  Suitable for more pupils than four
- **Small groups/buddies**
  Broader use
- **Individual work**

WONT

- **Not for vocational facilities**
- **Not for frontal teaching**
- **Not for fourth grade and down**

ill. 50a

Problem statement – updated

To narrow down the problem statement "How to do group work equally when using technology" a new detailed one is made. The new problem statement is not only focusing on the group work and the use of technology, but also including statements that encourage and motivates the pupils, which has been possible to include during the ideation found during the past research.

"It is wanted to create a safe environment in the common areas for pupils in elementary schools, when they are doing group work, while using today's available technologies equally, with the option of changing positions. The solution should fit to Højer Møbler's product range."

ITERATION 2

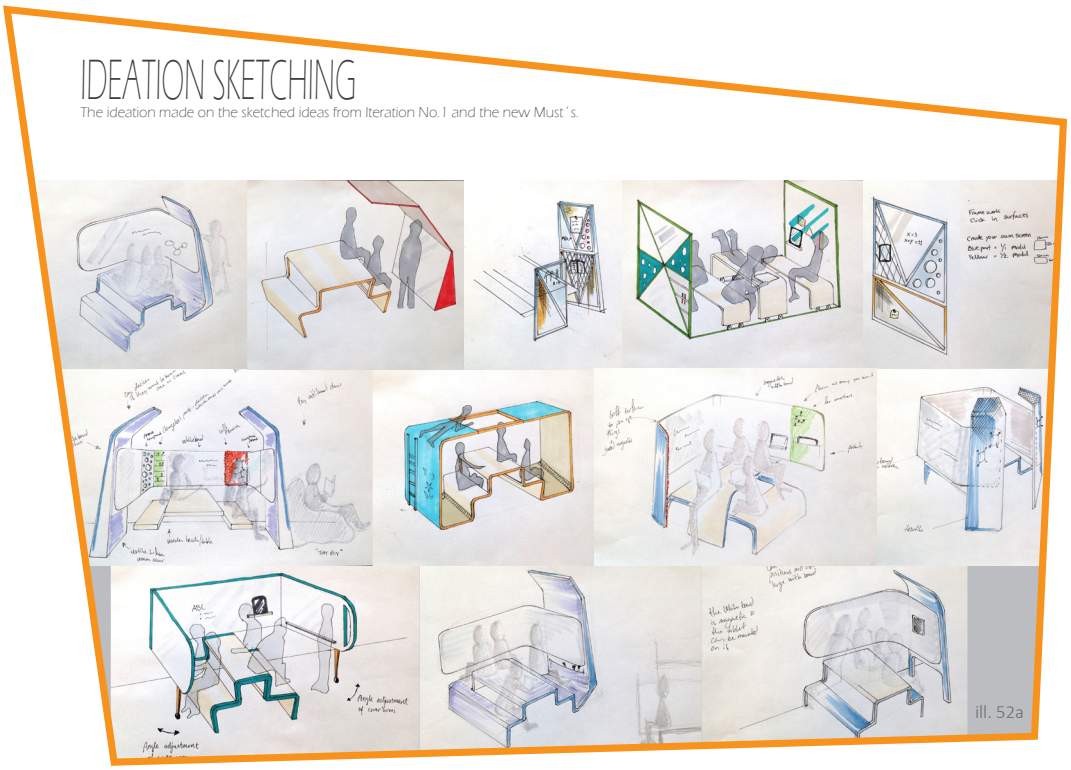
Due to the wide MoSCoW model, which should have been used to evaluate the sketched ideas from iteration 1, the *Problem statement* and the *MoSCoW model* has been clarified and detailed. The updated MoSCoW model is used to ideate further and evaluate all the ideas.

Ideation

With new inspiration from the updated MoSCoW and the sketches from iteration 1 the second ideation takes place. The focus is about showing the opportunities in the ideas by sketching pupil silhouettes using the furniture as intended. See the sketches in ill.52a. The sketches present different ways of modular systems making it possible to combine cover arms with different work surfaces and different possibilities in use and positioning during work.

Four categories

First all concepts are evaluated upon the MUST´s and the ones not fitting the MUST's are discarded. These were either too big, creating too much or too little room feeling or having a lack of values. The approved concepts are categorised in four. See the related sketches in app Four categories.



ill. 52a

Big white board

The solutions offers large work surfaces, which gives the pupils the opportunity of working at every surface they want. The continuously work surface gives the furniture a coherent expression. The solution presents the opportunity of a modular system, where the school can decide what they want as surfaces in the solution.

Modular arm giving cover

A furniture with movable cover arms, which the pupils can arrange as they want according to their need. The advantage of having a covered solution gives a increased cave feeling which helps the pupils to concentrate.

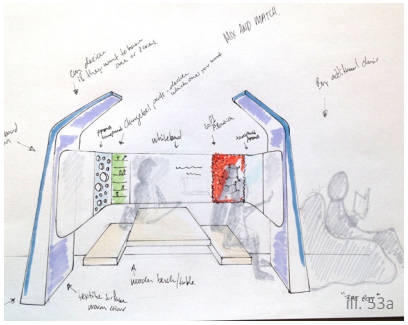
Rolling bench and table

The solution offers cover arms, which consist of modular surfaces which the school can decide by them self. The rolling benches and table gives the pupils the freedom to move around in between the two cover walls and decide where and how they want to work.

Big module

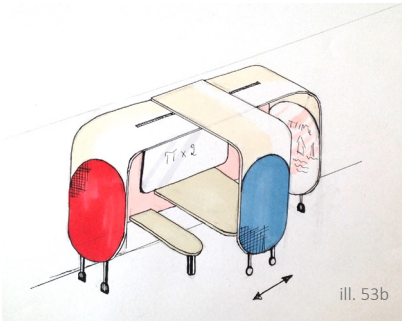
The big module is a furniture solution, which can be used as it is for two pupils or when placed together with a similar module as a group space for four pupils. It can be placed wherever and don't need the wall to support it as some of the other solutions.

Big white board



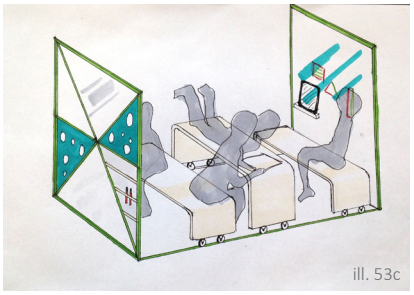
ill. 53a

Modular arm giving cover



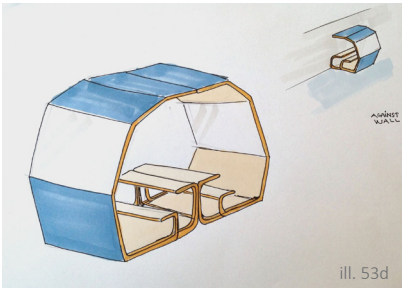
ill. 53b

Rolling bench and table



ill. 53c

Big modul



ill. 53d

Sum up Iteration 2

The MoSCoW is specified along with the problem statement for more precise evaluation.

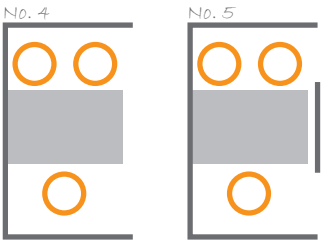
After finding the four categories, all consisting of good values, it is difficult to evaluate them according to the MUSTs they already are fulfilling. For further selection new parameters must be set.

ITERATION 3

The four concepts are all fulfilling the MUST's. For further selection an understanding of the room perception is needed- how much cover is needed to create the cosy cave feeling? For this reason a test is conducted. The test is in app. Illusion of a room. The test is conducted by the group by sitting in a hallway working during one hour each with different types of covered environments. After each test environment the situation is evaluated in evaluation scheme by each participant along with comments.
The test results in two acceptable cover situations for a hallway with one minimum acceptable cover, see ill.54b. The minimal acceptable cover is a three wall solution, where the backs of the users are covered.

For easier evaluation a scaled moodboard is constructed according to perception of the created room in the concept. See ill.54c:
Transparency vs. closed: The ideal concept is a balance between creating the closed cosy cave feeling and the transparency.
Another scaled moodboard is created to deal with styling, where the solution is wanted to be in between playful and serious work space. This is based on the school environment today and Højers innovative universe which is an in between style- symbolising the purpose of the furniture, but brings in elements of play. See ill.55a.

ill.54a from test. Here are no walls in the hallway

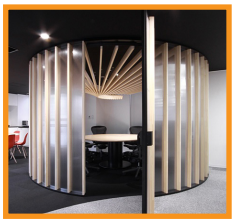


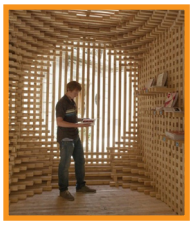
ill.54b Solution No.4 the minimum acceptable cover. No.5 increased concentration and safety feeling.

Room perception open vs. closed

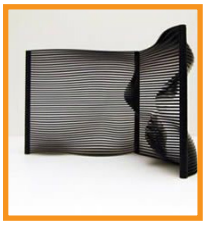
Max transparency — middle — Max closed

"It is in use"
Giving light
Understanding of what is going on in the room





Matted glass
Breaking lines
Holes
Gaps
Room with understanding of what is happening outside



Silence
Concentration/focus
Safety feeling
Limitted space - own space
Room in room

ill. 54c

Style: Playfull vs. serious workspace

Playful — middle — Serious

ill. 55a

Evaluation of the four categories

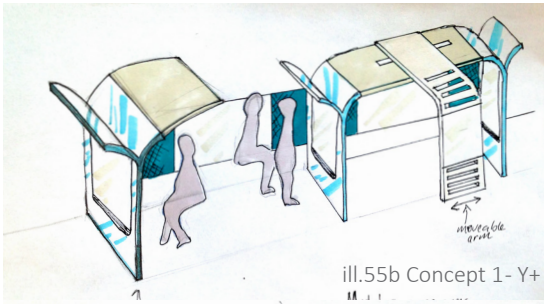
Each of the categories are evaluated according to the scaled moodboards and values mentioned at p. 54 that can be implemented across the concepts. The evaluation leads to a new ideation, where the concepts are combined into three concepts. The concepts are focusing on the cover function aspects and big work surface elements, which is why the bench concept is taken out and developed independently. The three concepts are discussed:

Concept 1- Y+- Modular system, which has the possibility of being open or closed, big or small, fitting many types of schools. Possibility of many work constellations

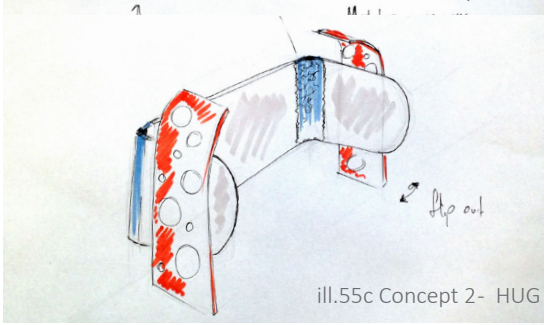
Concept 2- HUG- Good combination of workspace look combined with cosy materials. Big work surfaces. Possibility of modularity according work surfaces.

Concept 3- BIG- Possibility of placing in different positions, Only one module to relate to. Challenges according to transparency- the module exudes as heavy. Style is an issue.

Resulting in concept 3 being discarded because it is not at this point working as a product on the market and according to aesthetics. It is decided not to put more time and effort into this direction of concept. Y+ and HUG will be evaluated after a meeting with Højer, where the concepts are presented.



ill.55b Concept 1- Y+



ill.55c Concept 2- HUG

ill.55d Concept 3- BIG

Presenting the concept to Højer

The two concepts presented to Højer is showed in ill.56a and ill.56b. At the meeting is attending Heidi Jensen, Product Manager, Jens Højer, CEO, Lisa haslund-Larsen, industrial Designer, Mette Petersen, Business project manager, Lars Simensen, constructor.

After being introduced to the development process the attendants expressed that the direction of the project is good according to covers and focus on work surfaces. They are finding the thoughts of the two concepts being well in line with the values of Højer. They also express interest in some details in the concepts such as the magnetic tablet holder and use of racks to place things into. Højer does not have capacity of implementation of technology and the life expectancy and maintenance of such product would be worrying.
The attendants saw potential in both ideas. The potential was discussed leading to separated favorites among the attendants.

Talking to Lars Simensen gave insights in some complications that could occur according to furniture used in school environments, according to fire safety, cleaning, use of materials and construction techniques. Lars point out that the fire safety rules are interpreted differently in each municipality. The summary is shown in app. Presentation at Højer

Choosing one concept

The concepts are evaluated according to different parameters:

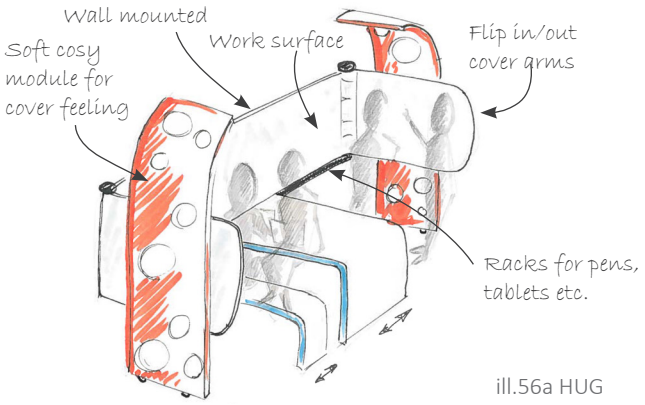
- *Safety feeling*
- *Teachers access to help the pupils while working*
- *Size flexibility according to different school environments*
- *Size flexibility according to fire safety*
- *Modularity*
- *Højers opinions*

Choice

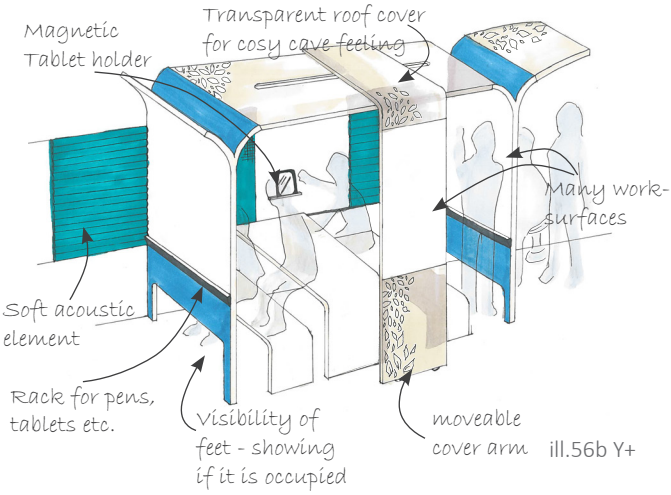
HUG: is fitting the minimum criteria for the safety feeling according to the test. Pupils have the possibility of defining their own space. It is transformable with the movable arms in the moment (not being fixed when first mounted.) It has easier access for the teachers. Possibility of the school using their own furniture inside: Both high and low furniture. Possibility of flipping the arms away for fire safety. It is easier to access to clean the floors and elements.

Discarded

Main reasons for discarding Y+: it fulfills the criteria for the safety feeling more then the HUG. Because of the thoughts about: “when is enough enough” it is decided that there is no reason for overdoing. How the idea is now it has issues according to the fire safety – products/ furniture including a roof are dealing with the dust and rubbish which can be left on the top of the furniture.



ill.56a HUG



ill.56b Y+

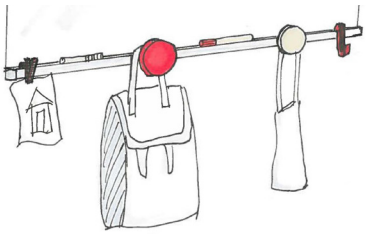
The rack

The rack is a rail in which different items fit into. The items are such as hooks for bags and clips for posters. In the rack has the possibility of holding the whiteboard markers.

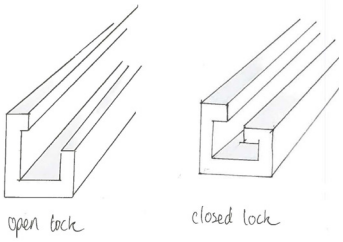
The rack has different possible designs, but either an open lock system, where the items can be clicked into or a closed lock system, where the items needs to slide in from the side.

The closed lock system with an end brick closing the rack might be preferable in a school, so the items don't get lost.

The racks has potential of being used in many scenarios, under the whiteboard, over the whiteboard, on walls and other furniture.



ill. 57a Accessory on rack with personal things

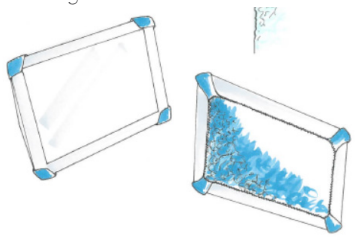


ill. 57b Rack system with different possibilities of mounting

Tablet holder

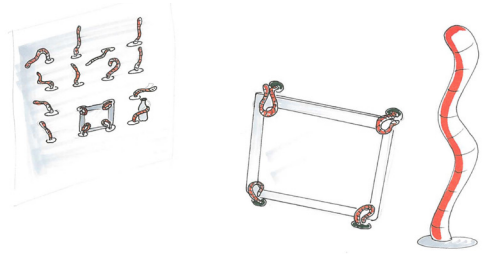
The tablet holder is for mounting the tablet on vertical surfaces. This gives the opportunity of making the tablet visible for all the group members. Different mounting ideas are considered, but the magnetic tablet holder is the chosen solution, since it is easy to move and can be mounted on all the whiteboard surfaces. The tablet holder makes it possible of mounting any size of tablet. It can also hold a book or a poster.

Velcro mounting



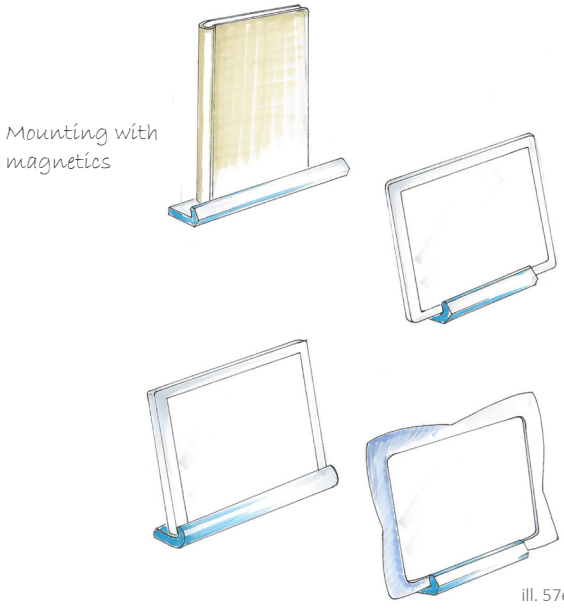
ill. 57c

Mounting with elastics



ill. 57d

Mounting with magnetics



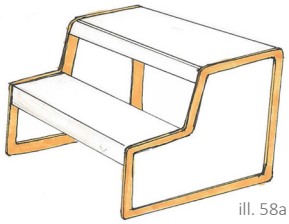
ill. 57e

Benches and tables

At this point it is chosen to work with a bench and table system, since this gives both a good shared work surface for equal participation and shared seating for possibility of increased social relation. See p.39 It gives the possibility of sitting both across each other and in levels facing one of the whiteboards on the cover arm. Below is shown drawings from an ideation on the table and bench system. The ideas are from very childish playful solutions to serious work spaces. Some of the ideas are working with the idea of the interpretation of stairs to make it clear that you are allowed to sit on the table, other ideas is a mix between hard and soft materials.

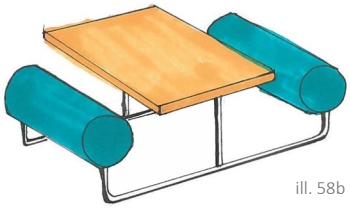
Selection of bench and table solution

1 - Interpretation of stairs in modules

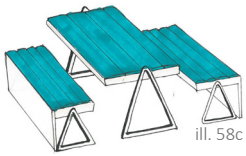


ill. 58a

2 - Playfull invites to different sitting positions soft vs. hard materials

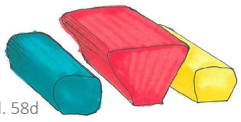


ill. 58b



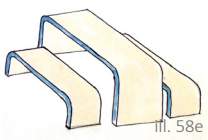
ill. 58c

3 - Flip table and seats - soft vs. hard materials



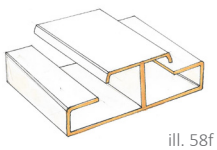
ill. 58d

4 - Rotational moulded plastic parts playful in inspiring shapes



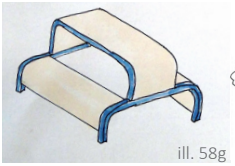
ill. 58e

5 - Simple bench and table system. Easy tomove around



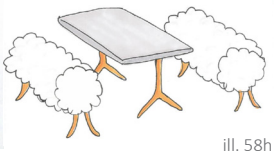
ill. 58f

6 - Big module with easy access in and out of the furniture



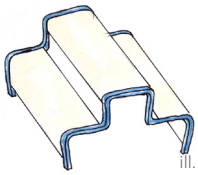
ill. 58g

7 - A solution inviting to different sitting positions



ill. 58h

8 - Playful furniture with inspiring shaps



ill. 58i

9 - interpretation of stairs

A selection is based on a set of criteria

- *Place on the scale playful style vs. serious workspace according to the moodboard scale at p.55. wanting a product placed in between*
- *Invites and indicates the sitting in levels function*
- *Cost price roughly estimated according to choice of materials and production methods*
- *Fitting to the product range of Højer with the possibility of adding something new. moodboard in app. Højer moodboard is used.*
- *Supporting different sitting positions*
- *Fits to the HUG solution according to styling and size.*

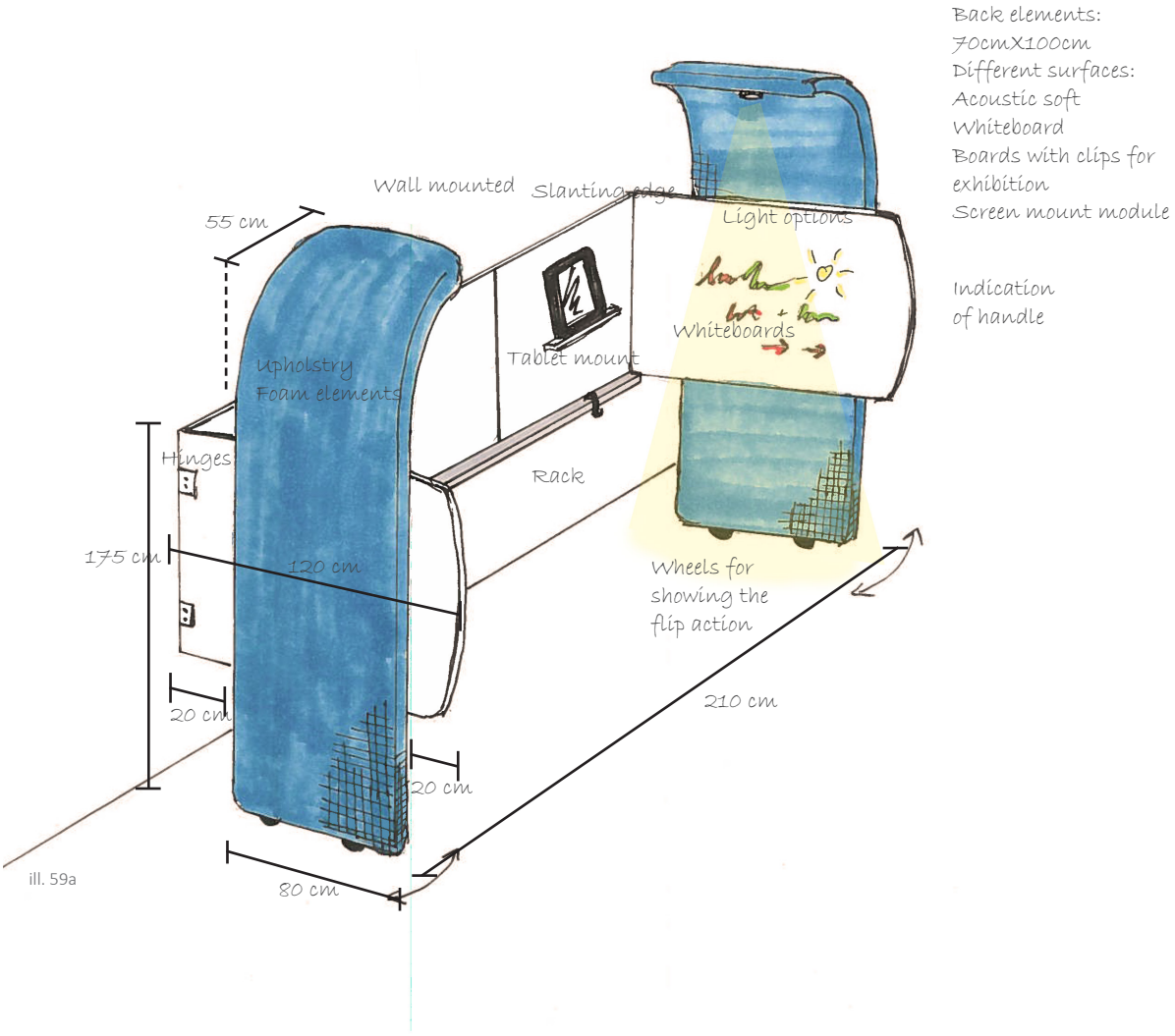
The selection is displayed in app. Selection of bench and table solution. Concept one and two are chosen on the basis of scoring high in all criteria. The next steps will be to develop the two solutions and combine some of the good parts. Concept ones good parts are the intuitive stair recognition along with a light construction. Being a product where two components create the group work table is interesting giving many possibilities of use. In concept two the good parts are considered to be the soft seating, which invites to many different positions. Also the mix of soft and hard parts references to the HUG solution. To become more interesting the form must be further developed to fit HUG.

Sum up of iteration 3

Iteration 3 deals with the development of the concepts through testing the cover experience along with comparing to moodboards. Resulting in 2 concepts presented to Højer. Otherwise are accessories detailed and the bench and table solution considered.

ITERATION 4

HUG+ is the chosen concept. Now called HUG+, since it is more modular because of the added racks and changeable back elements. It supports the idea of big sharable surfaces and giving the possibility of different positions while working.
The textile arms gives the cover feeling and by bending in the 55cm they are fulfilling the cover feeling explored in test in the dimension section p.49. 20cm on each side on the arm to give the transparent feeling. p54.
With the flipping arms it is possible for the pupils to create the illusion of a closed room or open up. When the arms are open it can be used for exhibition of the pupils work.
With the magnetic tablet holders and racks it is possible to mount tablets to the whiteboards making it possible to the group to equally see the screen. The white boards can also be used for projection by installing a projector in the ceiling. One of the module based back elements has a screen mount making it possible to install a screen as well. These big screen possibilities gives the group better equal access to the work when using technology.



ill. 59a

AESTHETIC DEMANDS

To have a guide through the aesthetic development demands are set.

A light and elegant expression

When HUG+ is hanging in the hallway the furniture must not be a visual disturbance, but instead an interesting object suiting the hallway.
Smooth surfaces are preferred for an elegant look.

A contemporary but still classic expression

The design must be contemporary and express a tension giving it a classic appeal. This leads to an aesthetic design that will meet the demands of a long life expectancy.

Fitting Højer's product designs

Højer's products are shown in the app. Højers modboard, given an understanding of the direction of aesthetics.
Højer uses clear shapes with recognisable details. Each furniture stand out and signalise an intended use.
Colors are used with neutral parts.

Fitting the school environment

The aesthetics must fit the school referring to the moodboard playful vs. serious work space p. 55.

Hard vs. soft

To obtain a contrast the hard vs. soft expression is developed.
The cover arm being the soft element: Giving a warm and cosy feeling. Symbolising the HUG around the pupils.
The whiteboards being the hard element: A smooth clean surface symbolising the work situation.

ill.60a- Extraction from Højer moodboard

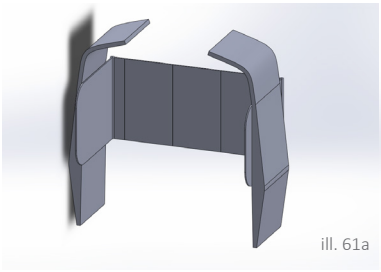
Form Development

The form is developed in Solid Works and rough renders are made of the interesting shapes. The form of the arms develops from thin bended plates to thicker elements of 7cm making it possible to include a steel frame inside for construction. Some of the detailed form development is shown in app. Detailed form development. As showed below a relatively edged form is developed along with a more curved shaped form. The chosen one is the edged form which has a well-balanced form and is recognisable. The shape is also fitting into Højer's universe containing edged elements. See app Højer moodboard.

The form is modeled in foam 1:10 for better interpretation.

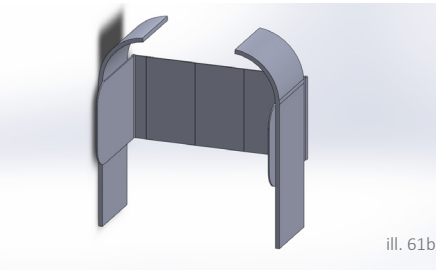
It is considered whether to make standing or floading arms. For selection 3D model is made.

Edged

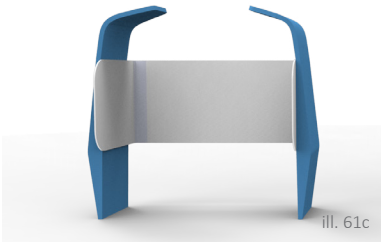


ill. 61a

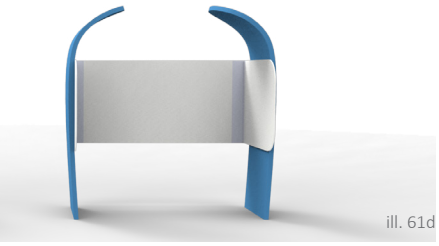
Curved



ill. 61b

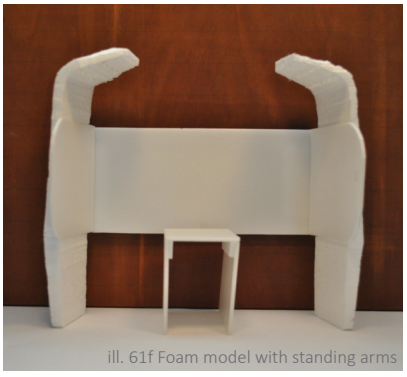


ill. 61c

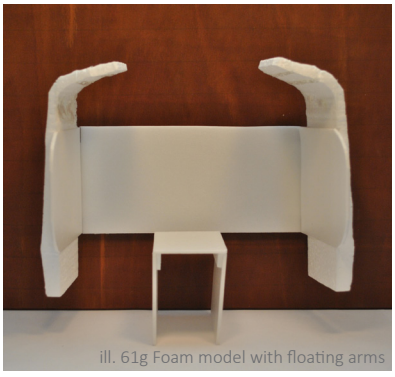


ill. 61d

ill. 61e



ill. 61f Foam model with standing arms

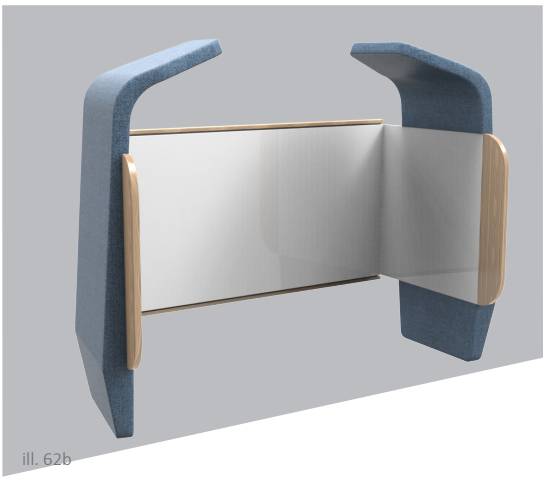


ill. 61g Foam model with floating arms

The model is rendered with the rack, since it is considered to have influence of the interpretation of the form. This gives a form that seems heavy and the smooth surface is broken. This results in a test of a rack that only goes to the edge of the whiteboard as a smooth edge.

ill. 62a

The heaviness of the arm modules are tested as leading to a form cut from the bottom. This gives a lighter expression. Handles on the side of the arm-whiteboards gives the indication of a handle.

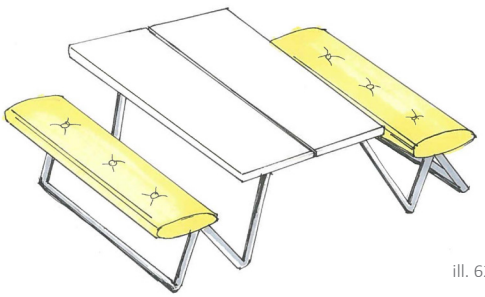


ill. 62b

The bench

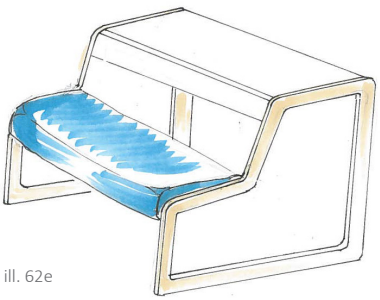
The bench is further developed to a combination of the two benches selected in iteration 3. The new ideas are discussed and the form of idea one with the possibility of a upholstered seat are chosen. During the further development different types of frames are considered, but leading to the thick frame which seems school minded and where some of the steel frames leads the minds to old-school picnic tables.

The bench invites to different sitting position and have the indication of stairs. The look fits the modern school and Højer's port folio according to the aesthetic demands.



ill. 62c

ill. 62d

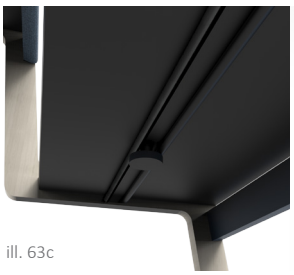


ill. 62e

The final bench has the possibility of either an upholstery seat or a wooden one. A hook is used to connecting the two benches so they will not be parted if the pupils are climbing around on them. As well is the possibility of placing the benches as wanted according to each other or use separately. The seat is attached to the bench with the use of a frame. A foot support is placed on frame for both foot support as well as support to the construction. The bench is named B+ relating the B to ”be” and + to all the many variation of ”being” on the furniture.

ill. 63a

ill. 63b



ill. 63c

ill. 63d

Conclusion - concept ideation

The ideation started with the 2014 concept and runs through a development process of detailing with the use of moodboards, scaled moodboards, tests and modeling. In total of five iterations. In iteration 3 two concepts are presented to Højer, giving positive and constructive feedback.
The MoSCoW is specified for better understanding of the values.
The ideation leads to the final concept HUG+, which is considered according to aesthetics and form design.
HUG+ is developed and ready for construction.

Reflection

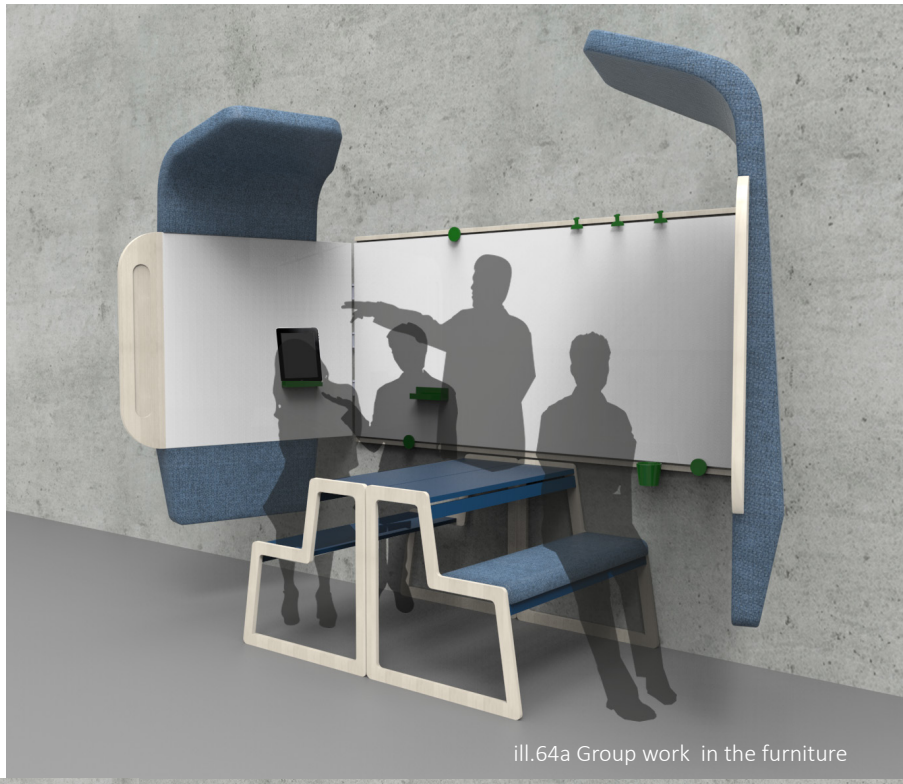
The beginning of the concept ideation was not as structured as the idea ideation, which was realised during the first iteration. This leads to a specification of the MoSCoW which leads the ideation in right direction.
Not many physical models has been made during the process, which is considered as a lack in the process. It is tried compensated with the use of 3Dmodeling, though it is not the same. The lack of models happened because of a time issue, since building one to one models in this size is time consuming. A model would have been used for understanding the actual size and tried placed on a hallway for seeing the size in context.

DIFFERENT SITUATIONS OF USE

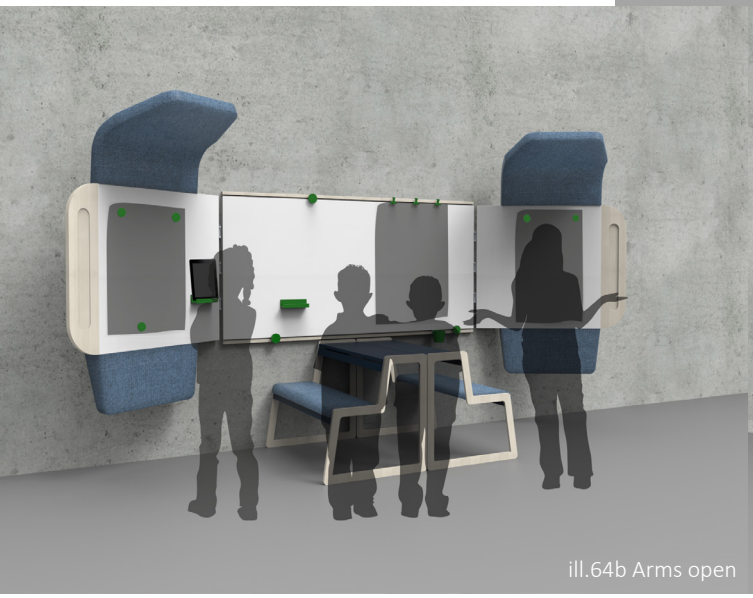
The different situations of use ill.64a, 64b, 64c are showing some possibilities in the furniture solution. When working in groups it is possible to sit in levels and work on the whiteboard in front. The tablet is placed in the tablet holder.

When the arms are open it is possible to use the furniture as a exhibition or presentation area, where poster can be hanged with magnets or the clips on the top rack of the whiteboard.

When the cover arms are closed a more closed room is created for better concentration. The pupils can sit differently on the furniture. On the backside of the cover arms it is possible to hang poster and etc. with the elastic bands attached to the arm.



ill.64a Group work in the furniture

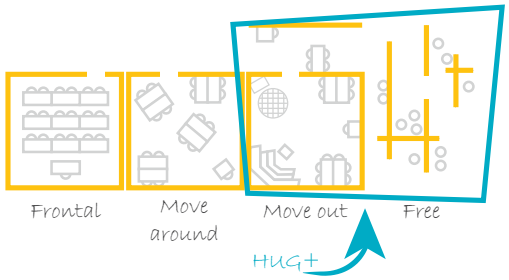


ill.64b Arms open

ill.64c Arms closed

BUSINESS STRATEGY

The solution is aiming towards Højers existing business strategy. See app. Business canvas of Højer.
The solution fits the strategy according to being modular and to be supporting the active learning methods. It supports Højer's new thinking of interior design in schools where passive areas are taken into use and learning environments are used rather than classrooms. It is considered that HUG+ is a product fitting the "move out" and "Free" stage see ill.65a - Four Levels of Freedom. HUG+ fits the thoughts of being able to combine old furniture with new, by having the possibility of using the old tables and chairs instead of investing in the whole solution.



ill.65a - HUG+ in Four Levels of Freedom

Sale

HUG+ is to be sold along with the other modern furniture in Højer's product catalogue. This means that the salesmen needs to present HUG+ actively when out giving proposes for interior design possibilities. Højer now has close relationships between salesmen and designers and Højer uses their developed model "the four levels of freedom" p.20 when presenting new interior designs.

Fitting to Højer's product range

HUG+ fits into Højer's catalogue of furniture for schools: In the part presenting the furniture for hallways are no solutions presented for cover options. In range of space dividers Højer has varieties hanged from the ceiling or standing on the ground. They are either stationary or meant to be moved around.
For providing big shared work surfaces does Højer uses normal black boards and whiteboards, the space dividers with different types of surfaces or painted whiteboard surfaces on the walls. (Højer's product catalogue)

Fitting to competitors port folio

The competitors (mentioned in competitors analysis p.16) show products on their website in range of space dividers standing of the floor some of them are moveable. Vanerum SIS shows a whiteboard solution possible to flip out from the wall, but with the focus of frontal teaching making it possible for teacher to turn the boards in different angles.
Holmris Flexform has a web shop showing prices on their products. A furniture like Smalltalk3 cost 39.996DKK eks. VAT. The space divider "Edge" cost 3300DKK eks. VAT. Prices on furniture on Holmeris Flexform acoustic furniture: http://www.holmrisonline.dk/akustik.

Competitors' solutions


ill.65b - Big surfaces to flip out from wall by Vanerum SIS


ill.65c Smalltalk3- 39.996DKK by Holmris


ill.65d Edge- 3300DKK by Holmris

TECHNICAL DEMANDS

Before construction is started the technical demands are decided and specified.

Wear resistance

The school is a rough environment and this area is considered to meet the standards for public places. The furniture must be able to be used daily during 20 years. Parts not as strong must be possible to change and have a minimum life expectancy of 7 years. (Højer's business case, ill. 13a)
Højer distinguish between misuse and wear and tear, where the furniture must meet high demands to wear and tear, though extreme misuse is the schools own responsibility (Heidi Jensen, Højer). Worst case scenarios must be considered to fulfill the demands. The demands are set as following:
Two heavy boys hanging from the top of the cover arm or running into the arm. maximum 150kg. See ill 66a. of boy hanging from arm.

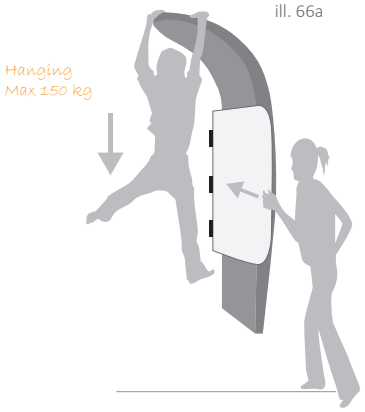
Expected main critical points in the construction:
The critical points are where possible applied excessive load is causing a big torque. This is estimated to be in the arm part.
Top stress: A large applied force on the top of the cover arm would cause a large amount of stress on the top corner furthest away from the wall mounting. The top element will tend to bend down depending on the materials and framework strength. Also the fixed hinge must stand the torque. See ill 66b. Top strain. In this case it can be considered where it is "most convenient to break", meaning the most optimal part to break must be the easiest part to change and might also be cheap.

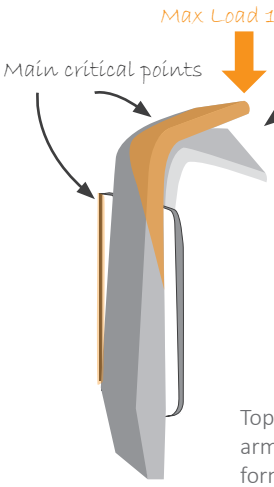
Side strain: By bumping into the cover arm horizontally the hinge fixed to the wall and cover arm will be affected. see ill66c. Horizontal strain.

Fire demands

The standards must be followed:
DS/BS EN 1021 1&2 and DIN 4102:B1 according to fabrics being flame retardant.
Each country has their own standards to follow. But by fulfilling the standards above most other standards are

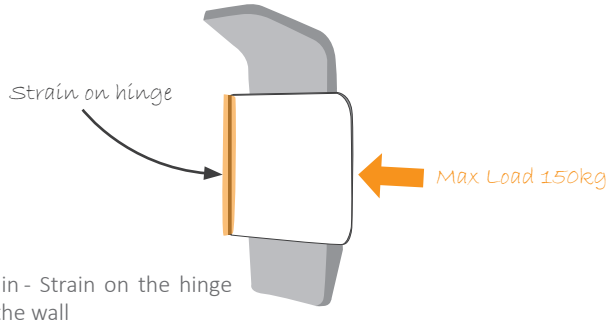
ill. 66a





Top strain - Strain on the cover arm which results in plastic deformation and elastic deformation

ill. 66b



Side strain - Strain on the hinge fixed to the wall

ill. 66c

fulfilled. Fire inspector at Aalborg fire department classify a furniture in hallway at the school as class two meaning- normal flammable.
The Danish building regulations according to fire safety must be fulfilled:
If furniture is placed in a fire exit, which some hallways are in schools, some demands must be fulfilled. The clear passage must be 1cm pr. person needed to get out. Meaning a hallway with capacity of 150 puils needs a 150cm free passage. The minimum required free space is 130cm. (http://anvisninger.dk/Publikationer/Sider/Anvisning-216-om-BR08.aspx/5-Brandforhold/5-2-Flugtveje-og-redningsforhold and Fire inspector at Aalborg Fire department). The maximum size for the furniture outwards in the hallway is estimated to 120cm making it possible to use the furniture in many situations. Estimated at p.37.
The top of a high furniture must not be horizontal so stuff can lay on top and be inflammable.

Environment

Both Højer and the schools care about the environment that the pupils are surrounded in. It is important that the materials does not release gasses, which means not containing the substances on the Danish ministry of environment's list of unwanted substances. (http://mst.dk/virksomhed-myndighed/kemikalier/stoflister-og-databaser/listen-over-uoenskede-stoffer/)

Cleaning

The furniture must be easy to clean with the schools existing cleaning supplies. All surfaces must be able to be cleaned with water and soap. As less small holes and cracks are preferable and top edges must be slanting so as little dust and dirt get collected.

Maintenance and installation

Assembly and mounting must be as easy as possible, since lowering the cost for wages. The furniture must have the possibility of changing numbers of parts for longer life expectancy. The furniture must before assembly be sized for transportation in van and fit into an elevator. The construction is aimed to be fixed, so pupils is not given the oppurtunity of removing parts.

Standard components vs. designed components

The discussion about standard components vs. designed components is discussed to understand the difference and when it makes sense to use designed components. Using standard components is to prefer according to low development costs and tool investments. Special designed components are used when they provide an extra value to the final solution – e.g. by assembly, mounting, use etc. In the process of choosing the types of components these thoughts are important.

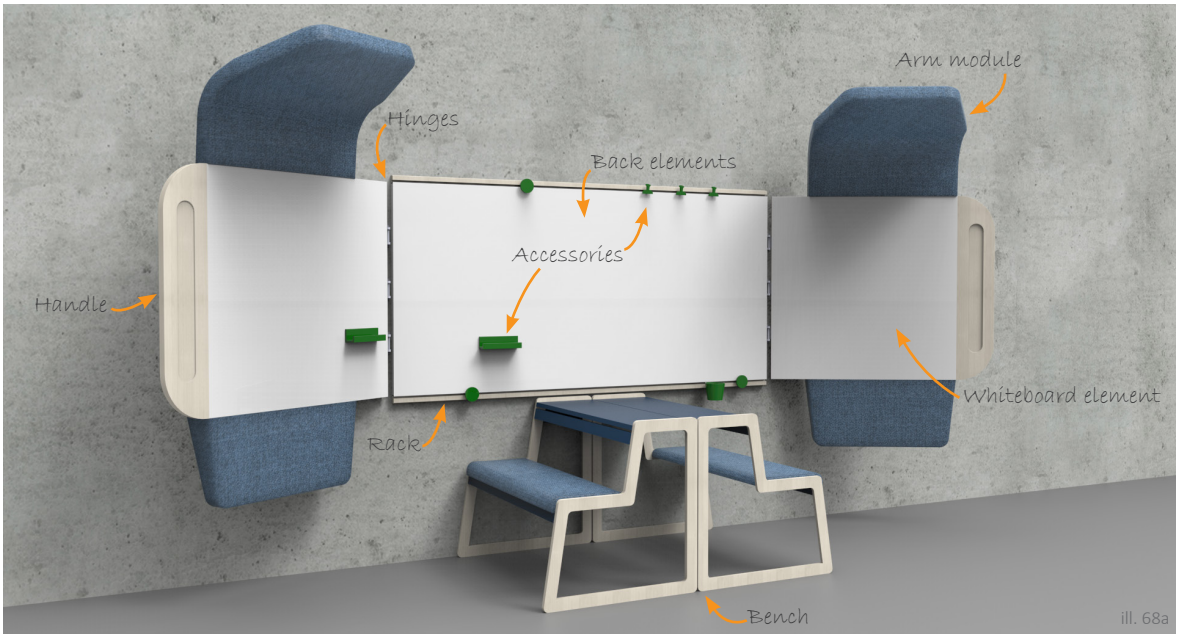
Sum up of what needs to be considered

- Changeable parts
- Strength for worst case scenario
- Wear resistant materials
- Fulfill fire standards
- Fulfill building regulations
- Not contain unwanted substances
- Easy to clean with the schools existing supplies
- Easy installation
- Standard or designed components

MAIN CONSTRUCTION

The main construction is defined with a line-up of different options, which solves the concept behind the furniture and where the most suitable solution is chosen. How the parts look like and how they are joint together, is discussed and solutions are developed. The procedure is described chronological within each elements. The construction takes certain reservations in the aesthetic and technical demands. See aesthetic demands p. 60 and technical demands p. 66.

Main construction consist of



ill. 68a

Wall mount

To choose the right wall mount for carrying the elements, a discussion about the customisable modularity needed according to the school and how the furniture will be mounted and assembled is made.

The elements influencing the wall mount are:
Back elements: Through the process of defining the wall mounts the back elements are developed simultaneously.
Rack: Is closely connected to the back elements while developing.
Hinges: Body-hinges are needed, p. 71.

Cover arms

It is wanted to construct a cover arm representing the cosy feeling in the created environment. A discussion about the construction strength and how the cover arm is assembled and mounted on to the back element is made.

The elements influencing the cover arm are:
Whiteboard element: Closely connected to the arm module while developing.
Arm module: Is depending on the technical demands within strength, p.72.
Handle: Ending part and interaction module.

Back element

The back element needs to provide a work surface in the length which fits the solution and the school's needs. The minimum length is 210 cm, due to the measurements on p.59. Because of the modular system, the school can expand the back element if needed. Considerations about whether to use one big back element or use modular elements with different options for surfaces are made.

Options for the big element is to order a customized length or order in fixed length. Choose a surface fitting the length, and not having the possibility to change parts of the surface. The advantage is a continuing surface. The options for the modular elements are to adjust length to the need and easily add on if the need is changed. The advantage is to have the possibility to change the surfaces or expand the length when wanted. The cons is that the modular elements can disturb the continuing surface.

The chosen back element consists of singular elements, which will fit the different school's needs. These give the school the option of extending the furniture over time or change the back elements if new surfaces are wanted.

The optional back element consists of work surfaces with:

- Magnetic whiteboard, with the option of holding posters and the magnetic tablet holder.
- Soft textile surface with elastic strings for posting the pupils work and to get better acoustics.
- Installation of digital screen- for mounting a screen to a back element.

Dividing the back element in three gives an element dimension of 70 x 100 cm. The middle element indicates the centre of the furniture and the placement for the table.
In the further development the whiteboard will be used as an example of a work surface for the back element.

Mounting whiteboard

The development of the white board and how to mount the whiteboards on the wall is developed simultaneously.

Although the back element is divided in three it should look like a whole surface with a pure and undisturbed work surface. See aesthetic demands p.60. Due to functionality the whiteboard must have magnetic force.

By describing HUG+ to whiteboardshoppen.dk, they recommended a metal grey or enamel whiteboard, because of the long life expectancy, app. Whiteboards options. Most existing whiteboards are including a frame, to cover sharp edges, see ill.69a. By using white boards with frames as an element, the overall impression of the undisturbed surface will be broken. Glass boards do not have a frame, but is missing strength in the magnetic force, see ill.69b.

ill. 69a Whiteboard with frame

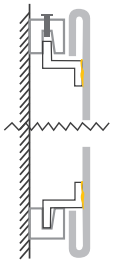
ill. 69b Glassboard edge

ill. 69c Whiteboard with bended edges

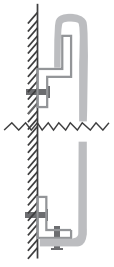
To avoid frames and sharp edges a possibility of bending a metal sheet is looked into. When bending the metal sheet, the mounting possibility is several; see three considerations within different bending methods and mounting solutions on ill.70a.

The advantage with bending is: to have a nice round finish on edges. The cons with bending a metal sheet is: it is expensive to bend a metal sheet in special bends. The bend must be made before the enamelled treatment, because the enamelled surface is as hard as glass, and then it will crack in the rounded edges.

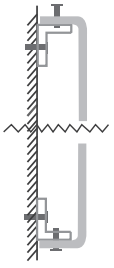
3 Mounting possibility



A standard Z-profile is attached to the bended whiteboard backside, both in top and bottom. The bend on the whiteboard is identical. The Z-profile is mounted into a special bracket, which is mounted to the wall. A tolerance is made in the top to make it possible to get the whiteboard in the brackets. To lock the whiteboard, so the pupils cannot dismount it, a screw is put in the top.



On the wall is mounted: standard Z-profile in the top and L-profile in the bottom. The whiteboard is having different bends in top and bottom. The top is hooked onto the Z-profile. The bottom is moved against the wall and locking the whiteboard with a screw.

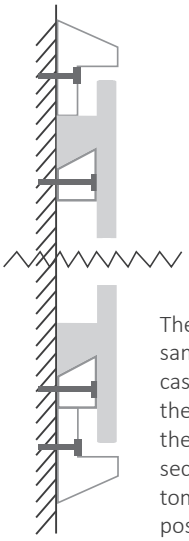


L-profile mounted on the wall both in top and bottom. Whiteboard bend is symmetric. Push whiteboard against wall and lock with a screw in top and bottom.

ill. 70aMounting possibility

Lintex is Højers supplier of boards - mainly glass boards, Heidi Jensen, Højer. Lintex.as is working with a whiteboard solution, Air whiteboard see ill.70b, with magnetic whiteboard surface on the front, no frame and plywood at the back, se app. Air whiteboard. This solution will fit perfectly to the HUG+ solution as it can be places next to each other without creating gab, and thereby create the pure and undisturbed work surface. The Air whiteboard principle is mounted with the same principle as the Montana bookcase (http://www.thorsen.dk/montana-ophaengsbeslag/), see ill. 70d. Customised whiteboards must be made to fit the HUG+ furniture, p.60 aesthetics demands.

ill. 70b Air whiteboard



ill. 70d Montana bookcase mounting principle.

The chosen mounting method is using the same mounting principle as Montana bookcase mounting. Brackets are mounted in the top and bottom on the wall. By sliding the whiteboard down on the brackets it secures the placement. On top and in bottom a rack is added to lock the whiteboard position. Development of the rack on p.71.

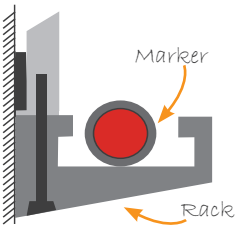
ill. 70c Mounting principle

The rack

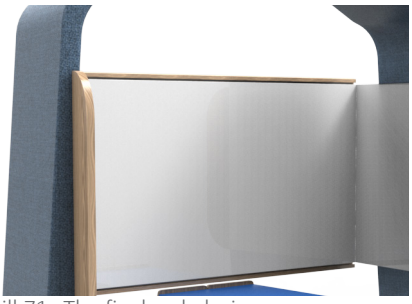
As a modular feature the schools have the option of mounting a rack below and on the top of the back elements. The rack will be used for the whiteboard markers and additional hook-on that only can be slide from side to side. This is the main parameters for the rack profile. To avoid dust collection on the top of the rack when placed on the top of the whiteboard the rack is angled on one side. The rack will be screwed on the same way on the top and bottom.

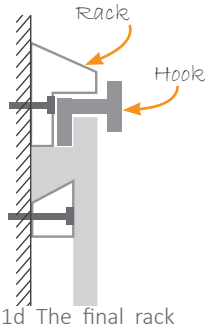
During development of mounting whiteboard different kinds of racks is developed according to the possible mounting solutions, p70. The first rack has space for a whiteboard maker. The shadow created when the rack is mounted on the top of the back elements makes the back elements look like an old-fashion blackboard. The final rack has a double function by working as the lock for the whiteboard position and as the rack for additional parts and accessory. This rack fits both the technology demand, according to having a slanted edge on top, so nothing can spontaneous combust and the aesthetics demands due to the simple minimalist of the furniture solution.
To close the gab between the whiteboard and the wall a closing part is added. This will also function as a stop for the rack, causing the pupils not being able to remove the accessories.

ill.71a The first rack design create a shadow.



ill. 71b First rack with maker


ill.71c The final rack design



ill.71d The final rack design with a hook

Mounting the hinges

The hinges are the bearing part to hold the cover arm in place in the furniture solution. The requirements for the hinges are: easy mounting, as it is important that it cannot be mounted wrong, so there will be no mistakes and no accident when using the furniture. It is also important to stay stable as long as the lifetime for the furniture. According to technical demands, it is a must that the pupils under no circumstance can be stuck in the hinge.
With inspiration in larger installations including hinges, like doors, windows and fire doors, a hinge are found. The hinges in fire doors is called a body hinges. Commonly doors have more than two separate hinges installed. As to the demand about safety it will be rational to have one long hinge in the length of the whiteboard on the cover arm.

It is discussed how the body hinges are going to be mounted to the whiteboard and on the wall. The hinge is fixed to the wall, with the right screws according to the wall type. The other part of the hinge is mounted into plywood on the backside of the cover arms whiteboard. If the plywood cannot hold, reinforcement can be added. An example of this can be to choose a thicker plywood and stronger screws, or reinforce with steel or glue.


ill.71e Body hinge in door

Whiteboard for the cover arm

The whiteboard for the cover arm will be constructed as the back element whiteboards p.69. The dimension of the whiteboard is 100 x 100 cm, so that it will make cover for the pupils using the furniture. The hinge is mounted on the backside of the whiteboard.

Cover arm

Considerations about construction possibility within durability of strength are made. See technical demands p.66. The composition of the whiteboard and upholstry is considered in proportion to aesthetic demands, p.60. The cover arm will work as a soft element a contrast to the hard whiteboard element. The principle for the cover arm is that it should create the cosy cover feeling for the pupils that uses it. Through the development of the cover arm different constructions are considered. Discussions about making the cover arm exclusively of foam, making a steel frame in centre or reinforce the cover arm with other materials.

The construction possibilities are estimations: Sources are in app. Cost considerations.

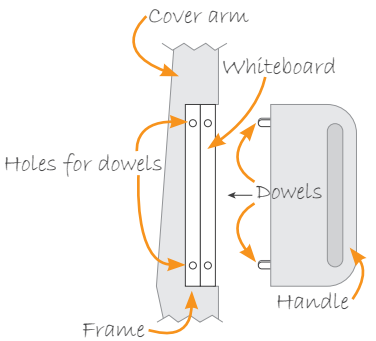
Molding, PUR: Steel frame with PUR foaming. Needs moulds. Good with high quantity of items. Needs upholstery afterwards. Contact to BPI - Bramming Plast. They have machines to make it possible and makes both complex steel frames and molding of PUR. If enhanced strength is needed it is possible to reinforce with glass fibers. Needs upholstery afterwards. Prices 2500-3000 DKK per each cover arm and 250.000 DKK for the mold.

Molding, fleece: Form-fleece by Becker Brakel (http://www.becker-kg.de/en/products/becker_formfleece). Needs moulds. Price 750 DKK per cover arm and 750.000 – 1.125.000DKK for the mold - Rough estimate on large component.

Manually: Steel frame with cut foam around. Can be expensive in man-hours. Needs upholstery afterwards. Based on the prices the option of getting it either moulded by BPI or through a manually process is chosen.

Handle

A handle will be the closing finish on the whiteboard outwards in the room. The handle will be made of wood with a turned in indication of where to grab, see ill72b. The handle will also gather and lock the whiteboard and the cover arm. See ill.72a.

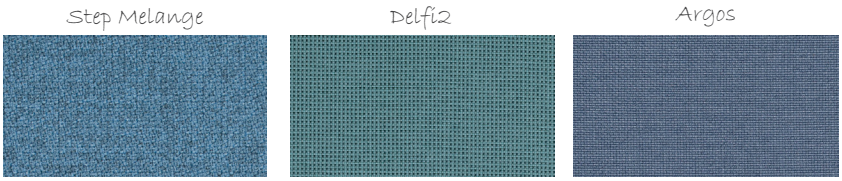


ill.72a Gather handle, whiteboard and cover arm


ill.72b Indication of where to grab

Upholstery

To meet the demands as fire retardant different materials are found. The most used fabric for these situations are all made of the fiber Trevira CS made by Trevira (http://www.trevira.com/en/textiles-made-from-trevira/home-textiles/flame-retardant-textiles-trevira-cs.html) The product is polyester fibers which sustains cleaning with soap and water along with machine washing. It is an ecological material and there are no heavy metals in the fabric. Gabriel has a range of fabrics meeting the demands. Product samples are collected on three different options: Step Melange, Delphi2 and Argos, see ill.73a. Johnny Aarup, salesman at Gabriel recommended the step melange because of the highest durability, though all samples are meeting the demands.The upholstery is a customised option for the schools to choose colour and texture, which fit the schools current interior.



ill.73a Fabric swatches from gabriel

Conclusion

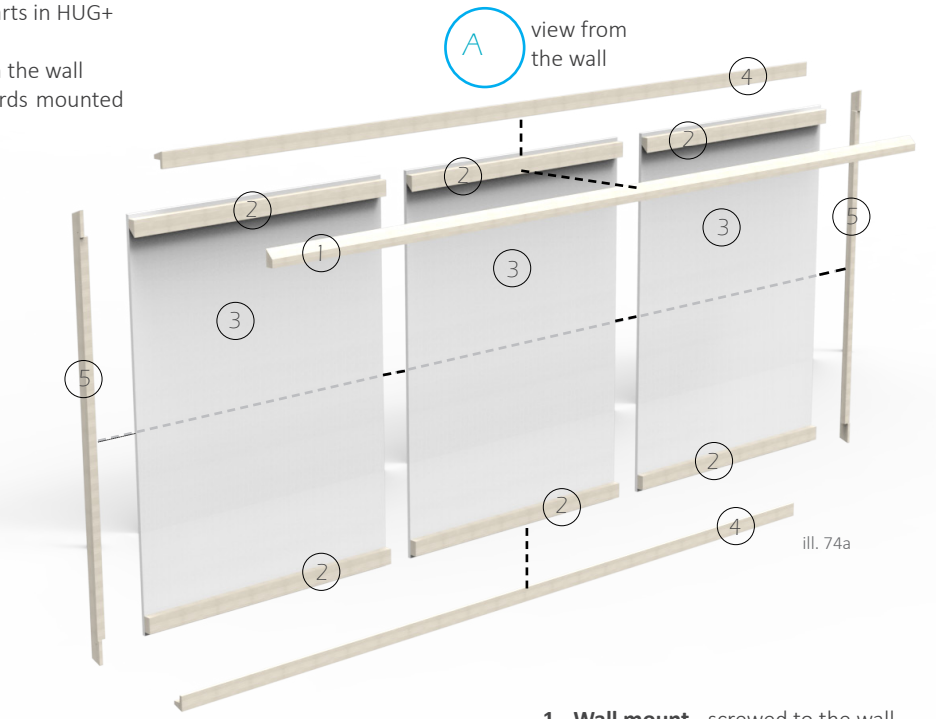
Before the construction development started, technical demands are made to guide the process. The research is considering the use of standard component vs. customised. Existing solutions are found on the market for the construction, where the principle of the mount or part already is proven. At this stage the chosen construction solutions are not fully defined but have the main principles set. The requirements related to the concepts aesthetics have an impact on the construction development too.

Reflection

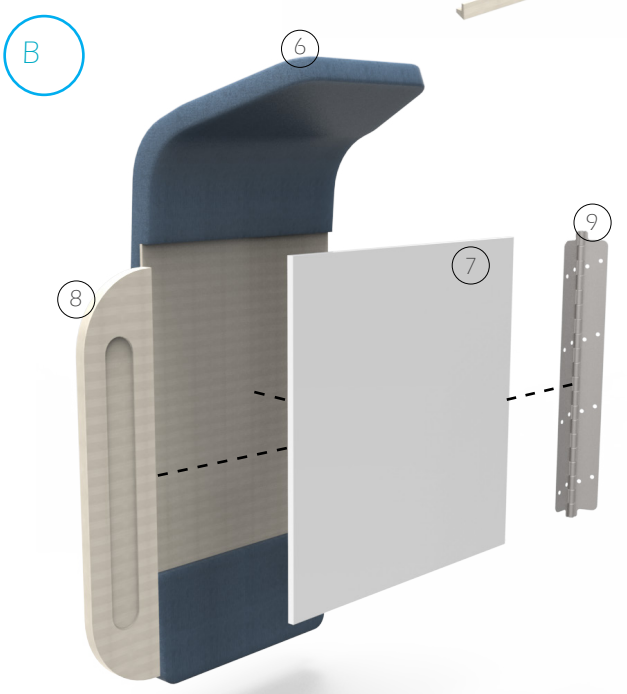
The construction development process runs a big discussion about the elements in the furniture. The best construction solutions are tried to be developed/connected for the furniture, but the process is affected by different small confusion about when to be focusing on standard or special designed components. At the end, the lack of time for developing is the main factor for the stage of the construction development.

PRODUCT ARCHITECTURE

Product architecture shows the parts in HUG+
HUG+ is divided in two parts:
A: The back elements mounted on the wall
B: The cover arms with whiteboards mounted on the wall with hinges
See technical drawings in app.



ill. 74a



ill. 74b

1 - Wall mount - screwed to the wall
2 - Back elements mount - giving the right distance to the wall. The top part fits into the wall mount.
3 - Back Element (here with whiteboard on), back element mount is glued to the back element
4 - Rack screwed to the wall - locking the back elements to the wall - creating a rack for accessesories.
5 - Closing part - closing the sides of the back elements and fixing the accessories to the rack.

6 - Cover arm with a board for mounting whiteboard.
7 - Whiteboard
8 - Handle - mounted to the whiteboard and board on the arm
9 - Hinge - mounted on the back of the whiteboard and screwed to the wall

COST CONSIDERATIONS

When having an understanding of the components HUG+ consists of, it is interesting to see the costs related to it. Connections are made to different suppliers and manufactures related to some of the components, see p.72 cover arm, where three different ways of producing the cover arm is mentioned. This section shows insights about Højers economic thoughts about HUG+ and the considerations about its cost.

After a meeting with Højer evaluating HUG+ and describing their expectancies to the cost price it is noticed: Højer needs to earn minimum 50% on the furniture. The maximum target price for HUG+ should be 25.000 – 30.000DKK. The expected amount of furniture sold to the schools is between 100-150 pieces. Højer expects to expand their market to outside of Denmark, since participating in european fairs. (Heidi Jensen, Højer)

From the contacted manufactures and research on the Internet various price estimations is gathered according to the HUG+. The manufactures had some times difficulty in giving a close pricing and some of the components found on the Internet are extreme expensive unless the company achieve a good agreement. See app Cost considerations – which shows the different price estimations according to components, manufacturing costs etc.

The three cost estimations on two cover arms without the whiteboard element:
BPI – Bramming plastic industry. Price estimate of moulded cover arms including mould, transportation from Poland and upholstered in Denmark – 10.126DKK
Becker Brakel – Moulded form-fleece – Rough estimate including mould – 9000DKK
Manually upholstery – Price estimate by Pernille Rosenberg own company – 4930DKK with out the inner steel frame, which she recommend to have.

Sum up

Even though HUG+ components are known and cost estimations on the product is made, there are many factors, which influence the cost considerations. First when specific offers are giving by the manufacturing companies it is possible to estimate realistic cost prices, caused by the divergence between list prices and offers with discounts. Based on the complex situation the cost understanding is going to be developed while the project prototype is going to be discussed and developed.

SCALABILITY

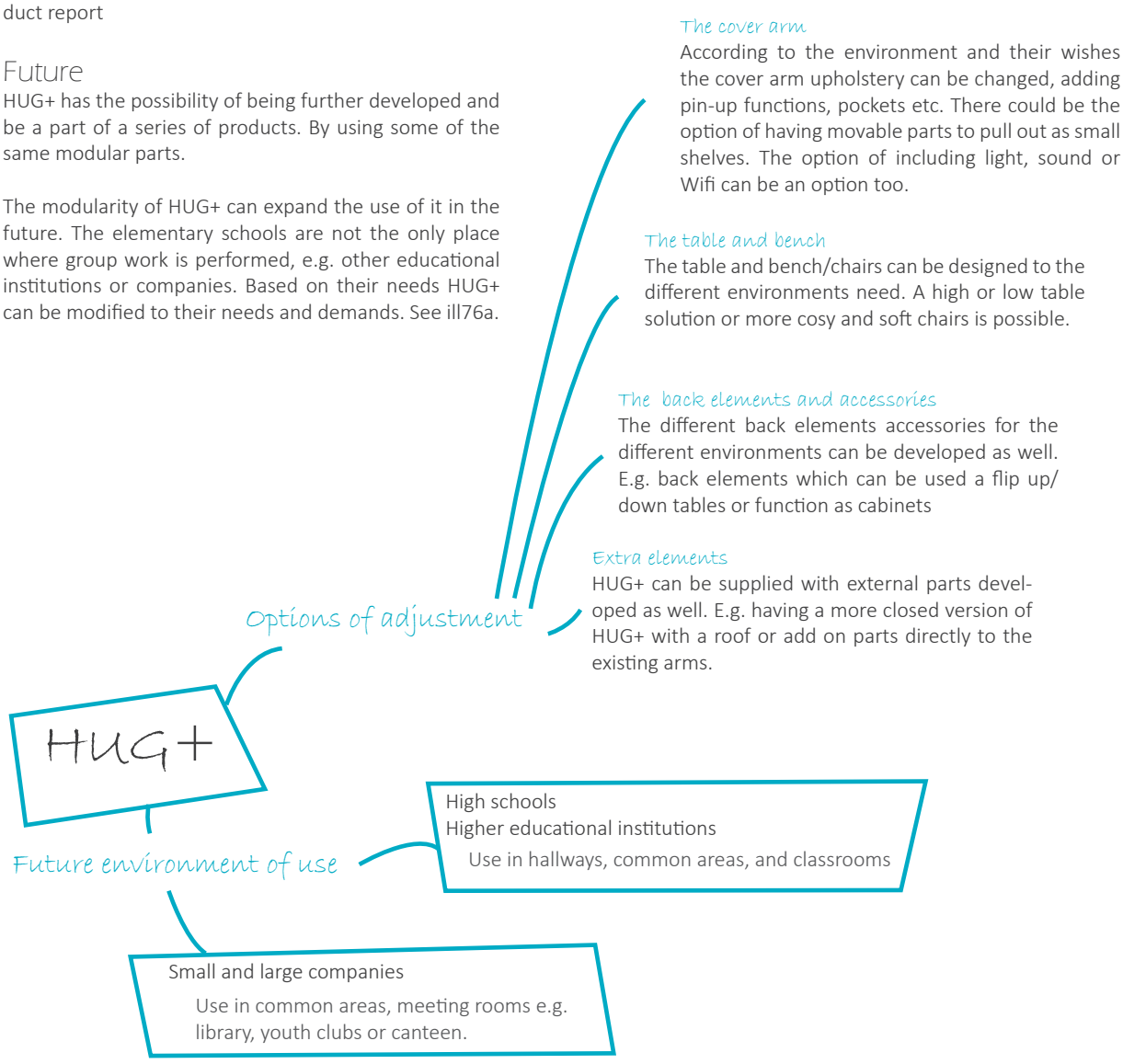
The scalability shows how HUG+ can be developed to fit more enviroments suitable for group work.

HUG+ is a solution for the future with technology. As it is presented, it is ready for schools right now, but with adding technology it is possible to take it into the next generation of furniture for schools. See scalability in product report

Future

HUG+ has the possibility of being further developed and be a part of a series of products. By using some of the same modular parts.

The modularity of HUG+ can expand the use of it in the future. The elementary schools are not the only place where group work is performed, e.g. other educational institutions or companies. Based on their needs HUG+ can be modified to their needs and demands. See ill76a.



ill 76a- The possibilities for HUG+ in the future

CONCLUSION

The problem statement:
“It is wanted to create a safe environment in the common areas for pupils in elementary schools, when they are doing group work , while using today’s available technologies equally, with the option of changing positions. The solution should fit to Højer Møbler's product range.”

HUG+ fulfills the problem statement:

- HUG+ is developed for fitting into the hallways of the Danish elementary school.
- The solution invites to group work in many constellations and sitting positions.
- This is provided through the options on the seating B+ and by the big shared work surfaces placed around the group making it possible to stand as well.
- When working they can bring tablets to place in the tablet holder on the whiteboard making it visible for everyo ne in the group.
- With the added soft elements on the whiteboard arm outwards in the room a cosy feeling is created, embracing the pupils so they have the possibility of feeling safe and to be concentrated when working.
- By the arms being able to be flipped in and out the pupils can close the arms and create a room for immersion and with high privacy, when opening the arms to each side gives the possibility of showing work, which could be used for presentation.

The solution is based on observations and theory about learning. It is made into product fitting to Højer Møblers product range and as well fitting into their innovative line of thinking - the four levels of freedom.
HUG + is estimated as a succesfull product at the presented stage, though it still needs testing and final development.

REFLECTION

Reflection on the product

The product is stated to contain many values, but one must ask herself whether it is really tru- At the point the values are pointed out according to theory or observations and then translated into the product. Testing of the values in the product is needed for verifying. Some of the values are hard to test (e.g. social relation) which needs testing over a longer period of time. The more easy values to test is the accessibility when using the furniture. To conduct such a test a prototype would need to be installed in a school environment. It could be considered whether tests can be made without the furniture being used, but by setting up similar principles testing specific parts.

A full scale model could add a greater comprehension of the product's room. A such test would make it possible to try out the dimensions. The full scale model is the next step in the process.

Construction needs to be fully defined. The principles are at this stage pointed out but exact component needs to be found. Along with this a detailed price estimation is possible.

The problem statement had great focus on the use of technology while doing group work. HUG+ deals with this with the added tablet mount and the possibilities of the school installing projector, smart boards interactive screens and similar on one of the surfaces. It does not deal with the use of laptops, which also where observed in many of the schools. It is considered to have ended like that because of the focus on shared surfaces.

Reflection on the process

The process contains massive ideation causing less time spend on the actually product development. It caused a lot of stress since it was hard to accept the process to move slowly. The frustration of going from the known to unknown repeatedly through iterations

The collaboration with Højer started well, but during the first two months we asked ourselves whether we were critical enough to the information gathered. This occurred since the group had been seeing themselves as a consultancy company making a product to Højer, rather that a critical master thesis project. The turn changes the conception of the board-solution-task into a more critical project.

The collaboration with Højer Møbler and Heidi Jensen has been interesting for the group members, since giving insight to a well-functioning furniture company. Højer has given the group constructive criticism and been showing great interest in the product. It is considered whether the collaboration could have been closer if more physical time was spent at Højer Møbler, which also might would have helped the progress of the process.

The contact to schools was challenged during the process since many schools have tight schedules. Though going out observing pupils is possible, since it requires very little of schools are testing another case. A main problem for the schools have been the changeover to the new school reform, which requires a lot of adjustments to be able to fit the demands in august 2014.

Source criticism

Højer Møbler is used as source many times during the project. It is a balance to get a lot of knowledge from them since the field is their core competence as well as other sources are used to get a varied information.
Web-pages are used and always tried verified whether to be serious or not.
The theories used to verify the problem are well-known theories in the subject of teaching methods and learning styles. Though critique is also explored

APPENDIX INDEX

APPENDIX CD

SOURCES

Title	Source
Information from Højer	Heidi Jensen, Product Manager www.hojermobler.dk Hand out confidential material from development of the board solution Visits at Højer Møbler Meeting with: Product Manager, Jens Højer, CEO, Lisa haslund-Larsen, industrial Designer, Mette Petersen, Business project manager, Lars Simensen, constructor.
School Reform	http://www.uvm.dk/~/media/UVM/Filer/Udd/Folke/PDF13/130607%20Aftaleteksten.ashx
Schools visited	Nordstjerneskolen, Frederikshavn – Peter Munk, head of department Nordstjerneskolen, Frederikshavn – Kasper Bagnkop, teacher Bangbostrand skole, Frederikshavn – Anette Nedermark, School manager GL. Lindholm skole Svenstrup skole Skipper Clemens skole Sulsted skole Vestre skole, Silkeborg, Ole Krogh Mortensen, vice-leader Vestre skole, Silkebor, Kristian Toft, School leader
Schools budgets	Malling School, Per Bisgaard Pedersen, School leader Esbjerg municipality
Actorsmap	Konkurrence og forbrugerstyrelsen Københavns Kommune - https://subsite.kk.dk/PolitikOgIndflydelse/ Moedemateriale/Boerne-OgUngdomsudvalget/12-10-2011/404779c8-d3c4-466c-b4ee-a8 3beb2e09b3/0fb-704de-c23d-4da0-af98-7f88acefd43b.aspx
Competitors	Websites of: Holmris Flexform Kinnarps SIS Functional Furniture Kolon / FJ Trading
Learning Pyramid	The Learning Pyramid – from the National Trainung Laboratories. Bethel, Maine
Theory	http://www.laeringsteknologi.dk/?p=333 Dunn and Rundle http://www.emu.dk/modul/cooperative-learning Cooperative Learning – Undervisning med samarbejdsstrukturer by Spencer Kagan and Jette Stenlev, 2009 digitaliseringsstyrelsen Politikken, PA-tillæg, “Den moderne folkeskole, 2.marts 2013” Politikken, PA-tillæg, ”En folkeskole I tridt med tiden”, ”Digitalt liv I dansk undervisning” and ”Elever skal undervise hinanden” 2.marts 2013 David Truss, http://www.laeringsteknologi.dk/?p=333
Measures of pupils	Measure of Man & Woman by Henry Dreyfuss Association
MoSCoW	http://businessanalystlearnings.com/ba-techniques/2013/3/5/moscow-technique-requirements-prioritization

Fire safety	DS/BS EN 1021 1&2 and DIN 4102:B1 Fire inspector at Aalborg fire department Danish building regulations http://anvisninger.dk/Publikationer/Sider/Anvisning-216-om-BR08.aspx/5-Brandforhold/5-2-Flugtveje-og-redningsforhold and Fire inspector at Aalborg Fire department
Environment	http://mst.dk/virksomhed-myndighed/kemikalier/stoflister-og-databaser/listen-over-uoenskede-stoffer/
Construction	whiteboardshoppen.dk Lintex Montana mount: http://www.thorsen.dk/montana-ophaengsbeslag/ BPI- Bramming Plast Becker Brakel: http://www.becker-kg.de/en/products/becker_formfleece Trevira CS made by Trevira: http://www.trevira.com/en/textiles-made-from-trevira/home-textiles/flame-retardant-textiles-trevira-cs.html Gabriel- Johnny Aarup Upholsterer- Pernille Rosenberg

PICTURE AND ILLUSTRATION SOURCES

All pictures and illustrations not mentioned are made by the group.

Page	Picture	Sources
10	Development of board solution	Højer
11	the chairs	Højer
14	Højer moodboards	Højer
16	Stools and chairs	Holmris Flexform, Højer, Højer, Holmris flexform, Kinnarps
33	Tech moodboard	http://www.newsday.com/opinion/oped/bernstein-high-school-future-is-high-tech-1.3756151 http://olhosolitario.blogspot.dk/2014/01/bett-2014-explorando-sala-de-aula-do.html http://www.bbc.com/future/story/20121023-the-end-for-keyboard-and-mice http://www.designbuzz.com/rm-delta-workstation-desk-concept-for-the-classrooms-of-the-future/ http://www.ecnmag.com/product-releases/2012/01/zytronic-touch-sensors-specified-multi-user-workstations-classrooms-future http://bixbux.com/page/11/ http://www.eduscience.pl/bundles/edusciencemain/files/events/Program%20konferencji.pdf
33	Problemstatement moodboard	http://www.theaustralian.com.au/higher-education/mobile-learning-fails-to-compute/story-e6frg-cjx-1226416167174#mm-premium http://www.webanywhere.co.uk/blog/2011/09/5-games-sites-enhance-learning/ http://www.planatoffice.nl/Products http://www.ucl.ac.uk/teaching-learning/news/ucl-academy-building-behind-brains http://www.inavateonthenet.net/article/73792/Reflex-partners-up-to-offer-FIT-furniture.aspx
35	Research on technology	http://sub-cult.com/daily-news/5-most-anticipated-gadgets-in-2013.html http://snoopspeephole.wordpress.com/page/40/ http://www.offprod.org/ http://want-that.com/lg-g-flex-vertically-curved-smartphone/ http://blog.domadoo.fr/2012/04/30/samsung-sort-sa-table-tactile-surface/
37	Table	Højer
38	Measure of 11-16 year old	Measure of man & woman, Dreyfuss Association
42	Moodboard 2020	http://www.sztuka-architektury.pl/index.php?ID_PAGE=16765&tpg=2 http://www.designerblog.it/post/5725/joven-de-la-vega-sedia-o-scrivania http://www.theregister.co.uk/Print/2013/09/20/office_furniture_100_per_cent_design_expo/ http://www.multitouch.ws/multitouch/ http://realhealthydiets.com/federal-fmla-laws-maternity-leave/

44	Moodboard 2014	http://tosaken-inc.com/news/page/2/ http://www.pinterest.com/carmenfarrando/swing-hammock/ http://sirtilc42.wordpress.com/2011/06/03/interesting-inventing/ http://www.paiandesign.com/archives/4489.html Højer
49	Moodboard of covers and space dividing	http://openbuildings.com/buildings/below-the-snow-profile-43356 https://raddblog.wordpress.com/category/furniture/page/2/ http://www.furnitonic.com/tag/thinkk/ http://inhabitat.com/wed-love-to-work-in-oleros-modular-geodesic-atmos-cubicle/atmos-cubicle-olero-design-4/ http://inhabitat.com/wed-love-to-work-in-oleros-modular-geodesic-atmos-cubicle/atmos-cubicle-olero-design-4/
54	Room perception open vs. closed	http://koreaninterior.blogspot.dk/2011_02_01_archive.html http://www.designcurial.com/folksonomy/fx http://www.dezeen.com/2009/07/11/x-block-by-planet-3-studios-architecture/ http://www.contemporist.com/2012/07/17/pavilion-for-the-festival-of-lively-architecture-by-atelier vecteur/?utm_source=feedburner&utm_medium=email&utm_campaign=Feed:+contemporist+(CONTEMPORIST) http://mecagoeneleixample.blogspot.dk/2010/04/jacques-tati-playtime.html http://www.dwell.com/profiles/slideshow/designer-spotlight-vera-kyte#3 http://www.oddee.com/item_96925.aspx
55	Style: Serious vs. playfull	http://innovation.ed.psu.edu/ http://box566.bluehost.com/suspended.page/disabled.cgi/fourlittlethiiiings.com http://www.archdaily.com/271485/york-university-learning-commons-levitt-goodman-architects/5049781828ba0d0c620001c8_york-university-learning-commons-levitt-goodman-architects_york_library_image_9-jpg/ http://theblogonthebookshelf.blogspot.dk/search/label/chair
60	Aesthetics	Højer
65	Competitors	Vanerum SIS, Holmris Flexform, Holmris Flexform
69	whiteboards	http://www.ebay.co.uk/itm/Ikea-Spontan-Magnetic-Board-/140945237114 http://www.dockdesignshop.nl/lintex-mood-glass-board.html#.U35by_l_tws whiteboardshoppen.dk
70	Mounting and new whiteboard	http://www.thorsen.dk/montana-ophaengsbeslag/ http://martela.com/products/other-products