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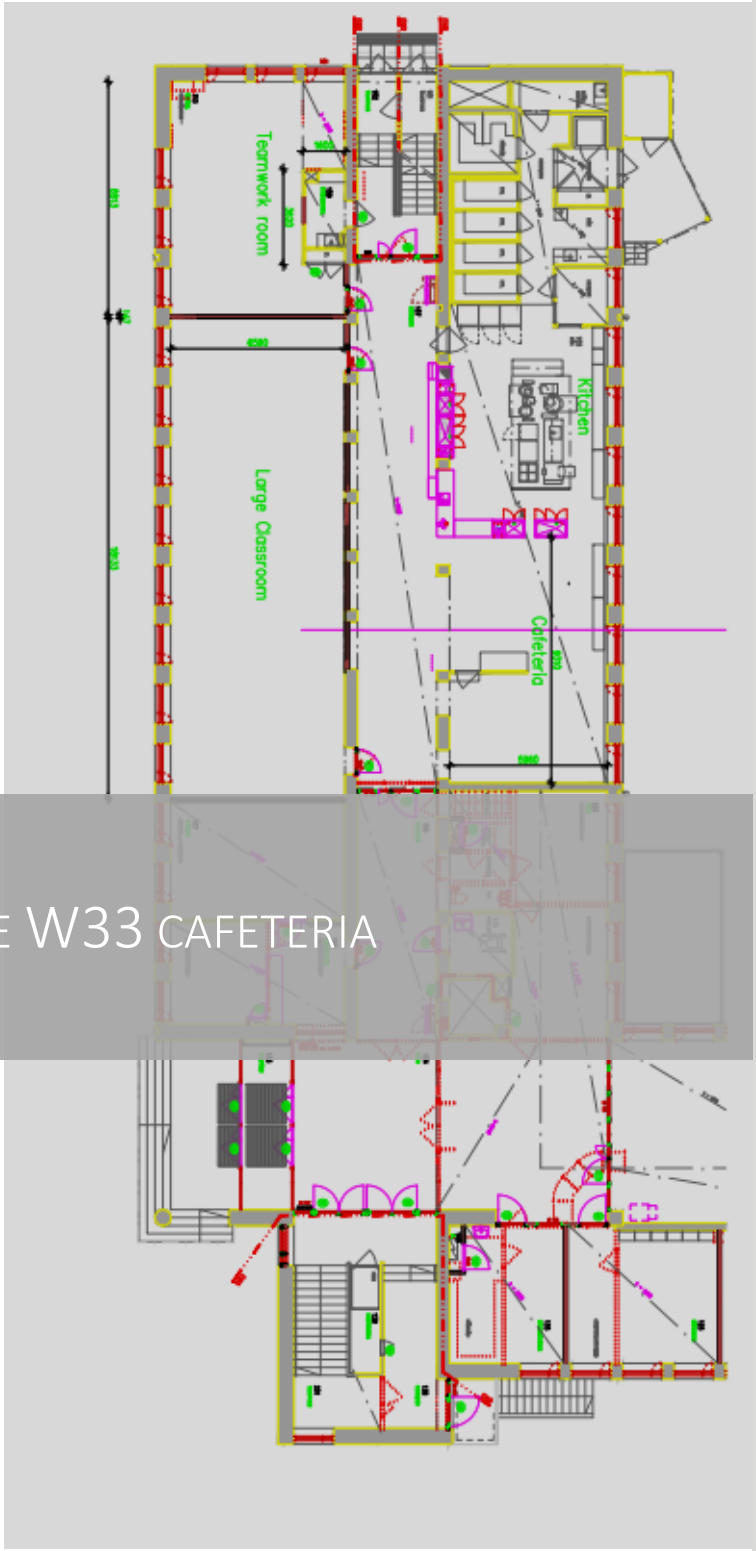

RENEW

RENEW OF THE W33 CAFETERIA

16th May 2017, Final Report

EPS Project 2017, Novia University of Applied Sciences |
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EPS Thesis

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Programme: European Project Semester

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Title: The Renew of the W33 Cafeteria

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Summary

There is a vacant space within the W33 building that is currently being used as a cafeteria. The cafeteria is no longer an essential requirement as a bigger one has been built within the Allere building, so the room will be used for another application. The project objective is to create an optimally beneficial space that is required within the campus. Team members will combine their skills and knowledge to create a solution.

”The Renew of the W33 Project” report will entail all the steps required to create the new space for the old cafeteria. The purpose of the study is to create a solution for the vacant W33 cafeteria that will provide the most benefits for staff/students.

The group began the project with management in order to complete work in an efficient concise manner within the time limit. Planning also helped with making sure tasks were completed within the correct timeframe. In addition, risk evaluation minimized the change of a risk becoming detrimental to the project. After this, a survey displaying classroom options was created and the most popular options were chosen. Many factors needed to be considered so research began in order to address these factors. Each individual was assigned a task, this task needed to be completed and documented. Weekly meeting with the supervisor allowed the group to stay on track and present progress. Any shortcomings were pointed out and addressed.

The survey allowed the group to narrow down the options to a large classroom, a small teamwork room and a cafeteria. Each individual researched their respective task and documented the findings. After the research had been completed, a solution was provided for all the major factors regarding the design of the new room. Both the interior design for the large classroom and small teamwork room has been completed including furniture options, distribution of classroom equipment and room layout. As well as this, the distribution of kitchen equipment has been completed. The choice regarding the type of food that will be sold has been stated as well as the type of equipment required. In addition, all the legislation regarding these issues have been researched and followed throughout the design process.

The room lighting, floors and walls were also investigated and a solution regarding the optimal lighting level within the space has been provided.

The results of the project are: a physical structure in order to easily visualize everything, using wood for the structure and 3D printing the rooms; and also a virtual model in order to give reality to the project.

Language: English

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1. Introduction

1.1 Project definition

The title of the project is "The Renew of the W33 Cafeteria" and there is a group consisting of four members combining their skills together to complete the project. Novia University is going to have a vacant cafeteria and there are no plans regarding the use of the room. The group's task is to design and implement a use for the vacant space. The design will need to be approved by the appropriate body. Also, the space must be used in the most beneficial manner possible referring to the needs of the university. There are many things that will prove to be beneficial for the university students/staff so finding the optimal solution will be part of the task. The needs of the students/staff must be taken into serious consideration as well as many other things. Making sure the work is conducted efficiently and economically will be crucial.

Group members will need to use communication skills to relay information to one another. The group must work together as well as individually. Certain members have certain skills so each member should be allocated tasks that suit their skill sets.

Contacting the appropriate people will be imperative regarding the success of the project. This is because there are certain people that must be in agreement with the proposed plan in order for work to go ahead. The project must be completed before the deadline.

1.1.1 Vision and mission

The mission is to create a use for a vacant space within the w33 cafeteria that will be optimally beneficial for students/staff. Finishing the task within the timeframe is essential.

To design such a project, communicating and relaying information between team members will be critical. The team must conduct work as a group as well as complete individual tasks. Keeping in contact with the group supervisor will also have to be done to ensure work is being carried out in the correct manner. The group will need to obtain certain resources such as software, floor plans, contacts and such. Research will be conducted, recorded and distributed between team members and presented to the appropriate person. Tasks will be given time frames in which they should be completed and the time taken for tasks will be recorded. This will ensure the project will be completed before the deadline.

Planning will need to be done as well as risk evaluation. This will limit the amount of time wasted and provide a clear direction for the project. One of the most important aspects of any project is planning so this will need to be done. Also risk evaluation is very important due to the fact that if a risk is clearly identified, precautions can be put in place to mitigate the likelihood of such a risk causing a significant problem.

1.1.2 Expected result

The group is expected to work together and create a space that is economically viable as well as optimally beneficial to students and staff. The renewed space is supposed to be comfortable, innovated and useful. The main result has to be demonstrated as a 3D model, which can be physical, virtual or both. This task as stated previously will have to be completed within the timeframe, so it has to be finished by 16th May 2017. Finally the development of the project within the timeframe was a success.

1.2 EPS introduction

The European project semester (EPS) combines students from different countries from 18 different universities around Europe to take part in a team project composed from 3 to 6 members. Individuals will conduct work abroad with students from other cultures with varying levels of English and fighting cross-cultural differences, as often the students within the group come from different academic backgrounds and can be in different years of study. This type of project will allow the participants to deal with many real life scenarios that will occur within a working environment. Group members will need to deal with different tasks as well as relay and communicate information to each other in an effective manner. Many obstacles will be presented within EPS and these will test the students ability to problem solve, adapt and communicate in order to overcome any potential problems.

EPS will not only provide the participants with experience regarding team work but will provide them with a cultural insight. This will be another thing that will indirectly benefit students regarding professional life. Often times, people will have to travel to different places on work related trips. The ability to interact with other people from different places in order to complete work is an important skill that will be developed throughout the EPS.

1.3 Team introduction

1.3.1 Teamwork definition

Teamwork describes a group of individuals which combine their skills to complete a task. Each group member will have certain attributes that will contribute to the completion of the task. There are many variables regarding successful teamwork that must be taken into consideration as the success of teamwork is heavily dependent on each member having both individual skills as well as group work skills.

The most important skill regarding teamwork is communication due to the fact that relaying information to one another is imperative to produce a shared piece of work. Each team member should know what the others have done and should be in sync with each other's work. There will be certain situations that an individual will have greater knowledge in a certain field, this information may need to be distributed to other team members; this means individuals who possess the particular knowledge must possess the ability to share it with others. On top of this, group members should be able to share research by means of communication. This will save time and will allow the team to work on individual tasks while

sharing the combined knowledge gained. Also, when making important decisions, every group member should contribute towards the decision. In order to come to a final decision group members must be able to discuss and compromise in order to come up with the best solution. Being able to disagree with another team member is important but as long as this is done with the best intentions of the overall project. One of the best communication skills is being able compromise with fellow colleagues to create an optimal solution.

Another very important skill regarding teamwork is intuition. There are often scenarios that will present themselves within group work that require executive decision making. Some individuals/teams have excellent intuition and can progress and overcome issues that have become stagnant. This is an important skill to have when deadlines need to be met and there is no time for long drawn research and in-depth discussion. The ability to show intuition is a key element of most creative projects and is a very important skill to possess.

Creativity is a skill that will be necessary for most team projects. When beginning a project, an important thing to do is allow all team members to come up with ideas, develop these ideas and even combine them to produce an end vision. Many creative ideas will be irrelevant, not useful and ultimately not used within the final project. This is okay though as this process will allow useful ideas to be created and will allow for full development of creative ideas.

1.3.2 Group members

The team for this project is composed of four students from different fields of study and countries. They are going to work together fighting the cross-cultural differences, working as a real team with a real life project and relying one on others.

Benjamin Boutonnet

Nationality: French

Age: 21

University: Ecole Nationale d'Ingénieurs de Tarbes (ENIT)

Field of study: Mechanical and Industrial Engineering

Jean Eyharts

Nationality: French

Age: 21

University: Ecole Nationale d'Ingénieurs de Tarbes (ENIT)

Field of study: Mechanical and Industrial Engineering

Aina Alcaide C.

Nationality: Spanish

Age: 21

University: Universitat Politècnica de Catalunya (UPC)

Field of study: Mechanical and Industrial Engineering

Liam Moore-Milne

Nationality: Scottish

Age: 20

University: Glasgow Caledonian University (GCU)

Field of study: Electrical power engineering

1.3.3 Belbin test

1.3.3.1 Blebin test roles definition

The Belbin Team Inventory is a behavioural test, also called the Belbin Self-Perception Inventory. It was devised as a measure to establish Team Roles. The different roles are Coordinator, Shaper, Plant, Resource investigator; Monitor evaluator, Implementer, Completer finisher and finally the Team worker.

This is used to identify the roles of all the people in the team and will allow the team members to assume certain positions.

- **Coordinator:**

Is needed to keep the focus on the team's objective and delegate the work as well as he or she can. The coordinator is mature, confident and can clarify the goals if the team is "leaving the road ". The coordinator can be seen as assertive and offloads personal work.

- **Shaper:**

Will ensure that the team keeps moving and goes forward with challenges. This person is dynamic and has courage to overcome the obstacles for all the team. He or she work well under time pressure. The shaper is prone to provocation and also can cause offence in certain situations.

- **Plant:**

Is the creative and imaginative member of the team. He or she can solve a problem because they can view the problem from a different point of view and this is the reason why he or she can solve the problem. However, the plant could be too focused on his/hers own ideas but can ignore the consequences too.

- **Resource investigator:**

This individual is an extrovert and enthusiastic. The resource investigator can have a lot of good ideas because of his natural instinct and will be able to propose these ideas to team members. Although enthusiasm is a good property, in certain circumstances these people can lose enthusiasm therefore lose focus.

- **Monitor evaluator:**

Is the most logical member of the team and he or she has a great critical view. The team monitor will provide impartial standpoints and be able to analyse ideas without having a predetermined bias. He or she can judge and analyse situations accurately. This comes at a cost because the monitor can be too critical.

- **Implementer:**

This team member is the most strategic of the team because he or she is disciplined and efficient. This member will know the priorities moving forward on the project and is reliable and practical. Because this person is very conservative, he or she could be inflexible and slow to respond to new possibilities because these will change the organization.

- **Completer/finisher:**

The finisher is the perfectionist of the team. This team member will finish and correct the work to be sure that work is of quality. This person is a hard worker and will not stop any task if it's not perfect. Even with these qualities they can be prone to create some tensions within the team.

- **Team worker:**

This person will create the link between all the members of the group. Co-operative, perceptive and diplomatic are the qualities of the team worker and are the reason why they are useful within the team. The team worker will be able to share ideas confidently as well as get others to share ideas. This person cares about the team dynamics but can sometimes overly avoid confrontation with others.

1.3.3.2 Belbin test applied to members

Each member of the team has taken part in a Belbin test in order to allocate certain roles and positions. This test will allow the team to have knowledge on their skills/weaknesses in certain areas. The results obtained from the test are displayed below.

For each team member it is showed the graph of the Belbin test result as well as a brief description of their results and how they can contribute to the project.

Jean Eyharts

Belbin test graph:

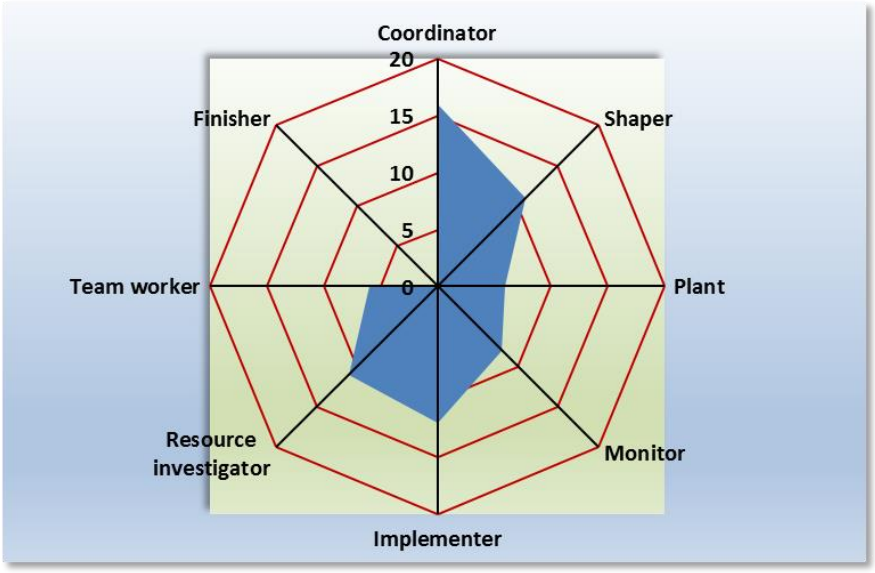


Figure 1. Jean's Belbin test

He falls under the category of a coordinator. This means that Jean is someone who will be focused on the objectives and be able to guide the team in the correct direction. He is confident about his decision making ability and will be able to apply these skills in a positive way which will be beneficial for the group and the completion of the project. It is important that every team has a coordinator.

Aina Alcaide C

Belbin test graph:

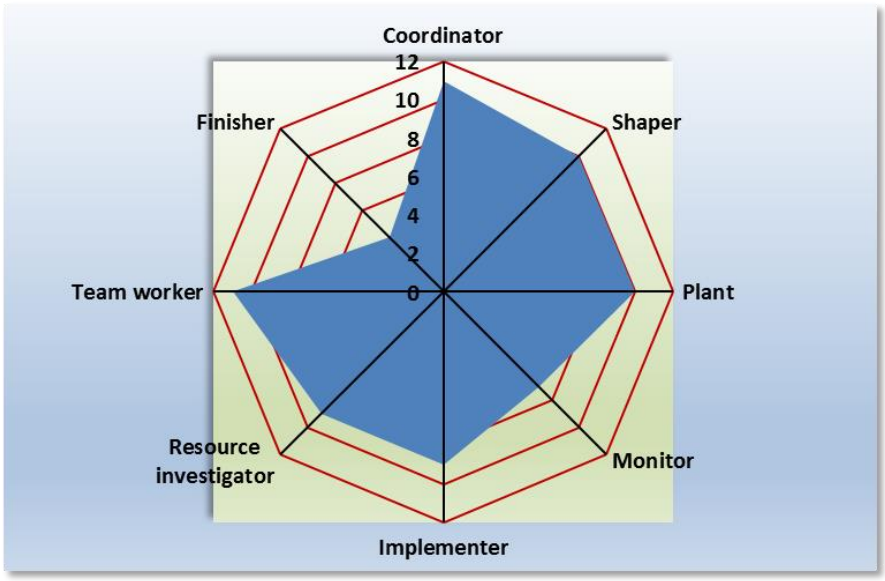


Figure 2. Aina's Belbin test

She is a well-rounded team member. This means that she will be able to contribute in multiple different areas. It is very useful to have a well-rounded individual within the group as they will be able to focus on different aspects of the project as well as having good communication.

Benjamin Boutonnet

Belbin test graph:

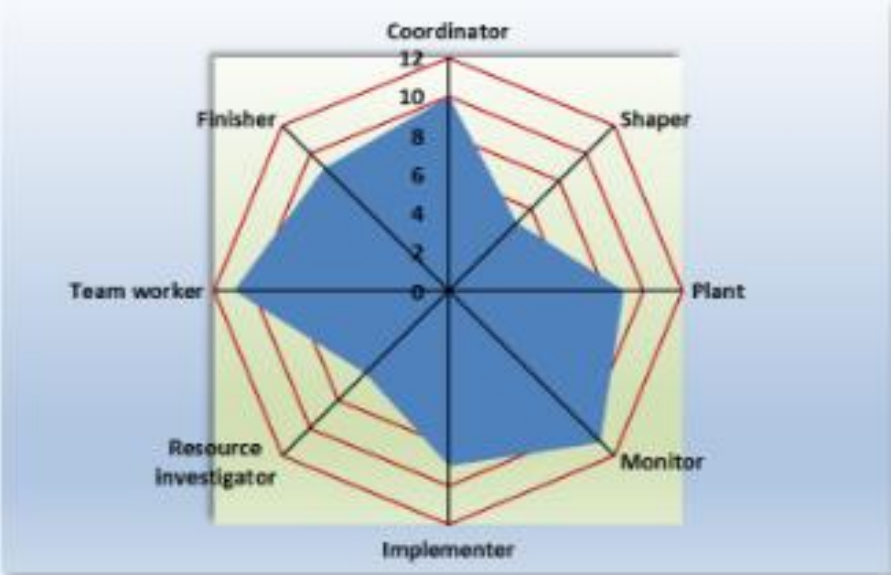


Figure 3. Benjamin's Belbin test

He is another well rounded member of the team. Although well-rounded, he has a few specific tendencies. He falls under the category of a team worker and monitor. This means he will be able to communicate well with other team members as well as looking at issues from a logical perspective. This is a very good combination of skills.

Liam Moore-Milne

Belbin test graph:

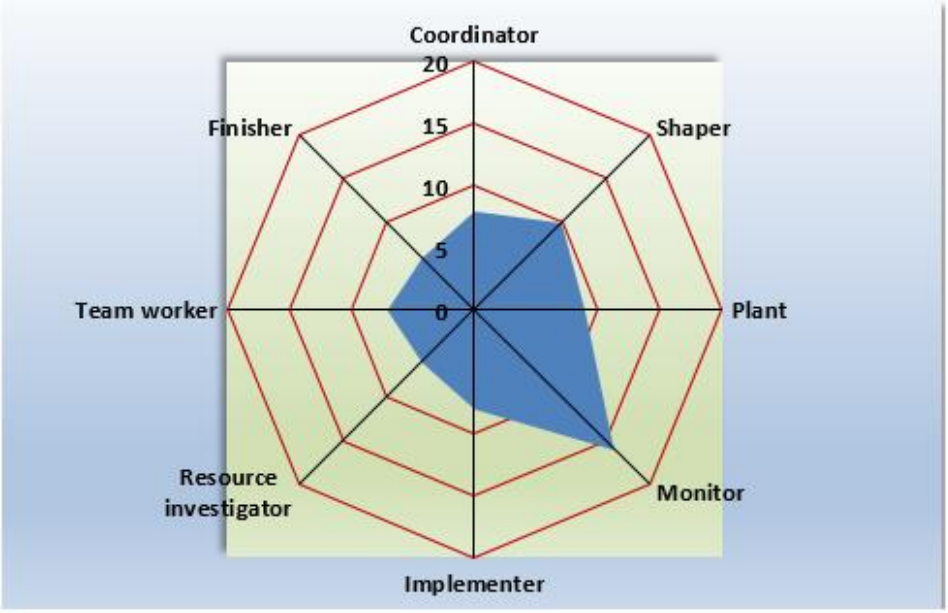


Figure 4. Liam's Belbin test

He falls under the category of a monitor. This means he will analyse issues from a logical point of view. Monitors will spend time thinking about the best way to approach issues and diplomatic ways to solve problems which will prove to be a useful skill when conducting work.

1.3.3.3 Global conclusion

As a general impression, it's thought that the group can work fine as the skills of the members are quite balanced. Half of the team are "team workers" so they can boost the group to work as a team in the beneficial way. One of the members appears to be a good coordinator, so members can rely on him to what team management concerns and the last one has a lot to do as a "monitor" as he can guide the project solving the more logical problems.

Although the team is not composed by as many members as the Belbin test roles describe, it's not possible to have a complete skilled team, but as the members are aware of the roles missing, they will assume these roles even though they are not naturally skilled for them.

2. Management of the project

2.1 Scope of the project

2.1.1 Objectives

As it's been explained before, the main objective is to renew the old cafeteria from the W33 building because of the construction of a new building (Allere) which includes a new bigger cafeteria. To achieve this objective, some indicators have been defined:

Process indicator

-Number of options to choose.

-The number of people answering the surveys.

-Amount of space to renew.

Outcome indicator

-How much time it would take to complete the renovation.

-How much money will be spent overall after all costs have been considered?

Impact indicator

- Proportion of users that could use the space.

- The number of satisfied clients.

The finishing date for this project is on 16th May of 2017, when it has to be presented and provided to the client. There will be a midterm revision on 3rd April of 2017.

Regarding the budget, there's no established price in this project as the budget is something that must be provided. Nevertheless, the project will not be feasible if the budget rises too much, so it should be taken into account accurately.

2.1.2 Stakeholders and clients

Stakeholders are typically people involved in a corporate setting and are investors. The stakeholder is an individual that will invest money into a business or project if they feel it is worthwhile; the actions made by the investees can affect or be affected by the stakeholder. Presenting an idea in a clear and interesting way will be key in gaining the approval from a stakeholder. It's important to gain their approval as they will provide the funding. The fact that they provide the funding also means they will have a very big say in the work that can take place. A stakeholder could be creditor, an owner, a supplier or a government body.

The main clients of this project are the students and teachers of the university, they are the ones who are going to use the space and they are the ones which are intended to satisfy. As the

room has to be used for an educational purpose, teacher's wishes will carry more weight than the student's.

This project could have a big impact for everyone that is a university user, but it would not be able to be done without the owner's permission. So, after a bit of research, it was found out that the main owner of the building and the main stakeholder was the City of Vaasa, but as it was not a huge project and as the team could not get into political issues it was decided that the project would just involve the university staff and managers, so they became the stakeholders.

The team has a tutor in charge of the project and he is the one which needs reports of the project as well as helping the team to get in touch with influential people at university.

If these stakeholders and clients are finally satisfied with the result, then the project will be a success.

2.1.3 Deliverables

Deliverable is a term that is commonly used when referring to project management that describes a tangible or intangible product or service produced as a result of the project which is delivered to a customer internally or externally. Project deliverables could include several things such as documents or even physical prototypes.

Some deliverables have been defined to satisfy the stakeholders depending on their criteria. The main result must be an easily understandable prototype based on a 3D model by computer. This way, it will be easy to know how the room look at the finalization stage and all the stakeholders can visualize it.

In order to achieve this result, five deliverables have been defined:

-Management: The project needs to be well structured if success is to be achieved. Management is one of the most important parts of the project and it is present during the whole development of it.

-Study report: Research is needed in order to know all the information about the space and also if it's wanted to build a budget. The team needs to find out and learn about new designing programs, as well as looking for the building plans.

-Digital Model: Before the construction of the physical prototype, a digital model has to be designed. It will include the building structure as well as all furniture and all renews.

-Physical Prototype: With the help of 3D printers and laser cutters, and basing it on the digital model, a physical prototype has to be built. This prototype has to be easily understandable and well structured.

-EPS Documents: In order to explain how everything has been developed, it's important to have a written report and to do a presentation about it. It would include all the information about the project and regarding to all the deliverables above.

These deliverables are the main structure of the project, so they need to be complete in order to achieve the success.

2.1.4 Technical requirements

Referring to the project, some programs and technical requirements are needed, so the team has created a table where all of them are named. These programs have been used to develop all the tasks in the project. As some of them were payable, the team has managed to download them in some other ways or they chose a similar program to work with.

These are the next ones:

Table 1. Table of Technical Requirements

Tasks	Technical requirements	Tools
Management	Lectures	Assist at the lectures and use the documents given
Survey	Software for the Survey	Google Forms
Fire security research	Legislation documents, Plan of the building	Internet, books from the library
Furniture research	Legislation documents, ergonomic documents	Internet, books from the library
Aeration research	Legislation documents, Plan of the building	Internet, books from the library, software: Autocad
Wire plan research	Legislation documents, Plan of the building	Internet, books from the library, software: Autocad
Budget report	Some example of budget	Software: Microsoft Excel
Midterm report	Midterm report from the last semester	Software: Microsoft Word
Sketching	Skills on drawing and architecture	Material for drawing, Software: Sketchup
Designing	Tutorials	Software: Sketchup
3D printing	3D Printer, plastic	Software: Sketchup, 3D printers
Building structure	Skills on modalism, painting	Material for painting for modalism, Laser Cutter
Final report	Final report of the semester	Software: Microsoft Word, Microsoft Excel

2.1.5 Limits and exclusions

What is a limit? Limits describe a limiting circumstance that is present within the project that cannot be controlled by the project participants. Instead of being controlled, work will be conducted with the limits in mind. Limits within a project could be anything from a predetermined budget to a timeframe in which work must be completed.

So, what is an exclusion? An exclusion describes factors regarding a project that have not been discussed or included within the main report. These are normally things that are either irrelevant to the main body of work or are too insignificant to address with serious concern.

2.1.5.1 Applied limits and exclusions

Most projects will have limits and exclusions and the "The Renew Of The W33 Cafeteria" project is no different, below describes them.

Limits

-The dimensions of the w33 is a limitation. This is due to the fact that there is a limited amount of space, so all the work taking place will have to be done with the room dimensions in consideration.

-The project must be completed within the allocated timeframe so work can only take place within this period.

-The group was given a guideline of what is to be done with the room so this must be followed and work cannot majorly digress from the given plan.

Exclusions

-Current staff members working within the space is an exclusion. This is not a factor that the group will need to consider so will not be discussed or considered within the project.

-Certain construction costs will not be considered. Things such as demolishing the walls will not be covered within the main body of work.

-The current furniture within the room will have to be either moved or disposed of to implement the new design of the room. However, this is not a thing that the group will take into account.

- The budget will be stated without the inclusion of taxes.

2.1.6 Risks

When managing risks, certain precautions must be followed in order to avoid further problems during the project, that's why these risks have been investigated and studied, they've been analysed in the proper way to not have to deal with them during the development of this project.

2.1.6.1 Potential risks

First of all, risks were listed separately by fields involving the project and the team as they were thought to be the most important potential risks:

Risks related with the team

- Misunderstanding
- Lack of communication
- Language problems
- Lack of responsibility
- Poor time management
- Lack of knowledge (Design programs, architecture skills, etc.)
- Sickness or traveling

Risks related with the project

- Lack of time
- Misinterpretation of objectives
- Poor writing skills
- Poor research skills
- Denied access to certain resources (maps, programs)
- Problems with the physical prototype

After the listing, all of these risks were evaluated and classified by their level of risk (according to their level of impact and likelihood).

2.1.6.2 Risks definition

Next step would be to define these risks and try to find the right precaution if they want to be avoided. At the same time, they have been classified by colours regarding their level of impact and probability towards the project: *Tables 2 and 3. Explanation of risk's colours*

Colour	Level of impact	Explanation
	Small	It has a small influence on project, it can be easily prevented
	Medium	The problem can become critical on project, so it has to be prevented
	Big	If it appears, it's a critical problem to the project, so it needs to be avoided with efficiency

Colour	Probability	Explanation
	Unlikely	It has a little probability to happen
	Likely	This problem can appear easily, but it does not have a very big probability
	Very likely	It's very probable that this problem appears, so the team has to deal with it and try to handle

Table 4. Risks definition and classification

RISKS DEFINITION				
Risk	Definition	Level of impact	Probability	Precaution
Risks related with the team				
Misunderstanding	Work being done at the same time. Related with lack of communication.			The team should have an accurate and apropiate way to communicate in order to not having this problem.
Lack of communication	When team individuals have difficulties relaying information to one another.			Team members must rely ones on others and trust them.
Language problems	Team members can have difficulties with expressing their English.			Team must try to make everything understandable for others, by the use of a dictionary or a traductor.
Lack of responsibility	Someone who does not feel like he/she does not have to uphold his/her duty.			Other group members remaining vigilant regarding an individual unwillingness to work
Poor time management	The team does not spend enough time allocating an appropiate time scale.			A lot of time should be spent on managing the timeline, it's one of the most important parts of the project so it needs time to be prepared.
Lack of knowledge (Design programs, architecture skills, etc.)	Team members do not have the enough knowldege in certain fields.			Preparation and research are the most important activities when starting a project. Team needs preparation and information.
Sickness or traveling	The absence of any individual can affect the progress of the project.			Preview this absence (when traveling). Ask the member to recuperate this hours of work.
Risks related with the project				
Lack of time	Not having enough time to finish the project.			It's important to follow up the timeline. This requires compromise and work on the management. Follow up in weekly meetings w/ tutor.
Misinterpretation of objectives	To misunderstand the goals of the project.			Team must ask the tutor the correct questions regarding the objectives. The project can only be started when goals are clear.
Poor writing skills	Team members not enough experienced in writing in English.			One of the team members is a native speaker, so he can be in charge of reviewing the project.
Poor research skills	Team members not enough experienced in researching			There are a lot of resources at university available and a lot of people that can help with the research. Team needs to be motivated.
Denied access to certain resources	Inability to obtain important information/resources.			Try to explain your objectives. If these documents are not available try to find other ways to reach your objectives (Plan B).
Problems with the physical prototype	Poorely structured prototype so it presents deficencies			Team have to do a perfectly well structured design in order to build it physically. They must take into acount all the pros and cons.

2.1.6.3 Risks matrix

Once the risks are defined, a risk matrix is done in order to easily see which risks are the most dangerous for the project.

Here is the matrix:

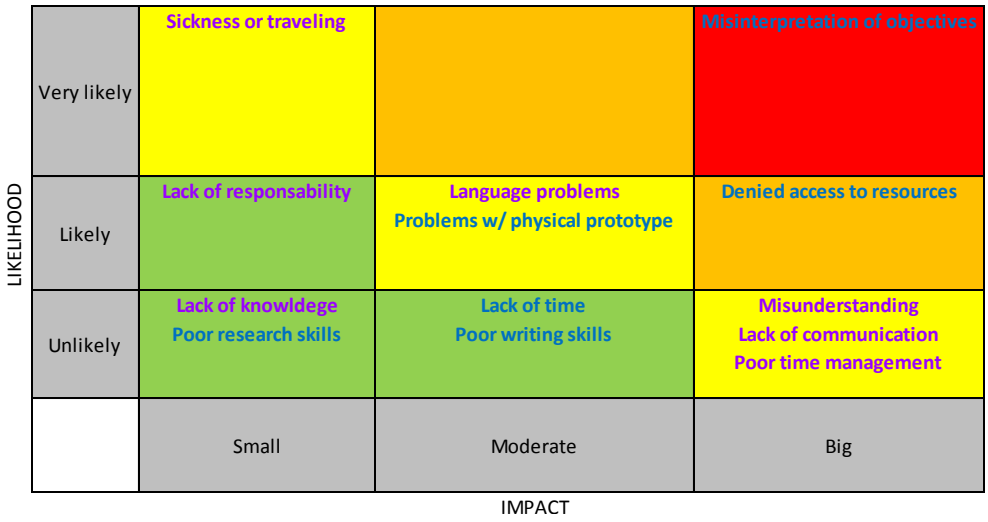


Figure 5. Risks matrix

Table 5 and 6. Risks matrix definition

	Acceptable as a low risk
	Acceptable as a medium risk
	Unacceptable as a high risk
	Completely unacceptable as an extreme risk

	Related with the team
	Related with the project

2.1.6.4 Measures for those unacceptable risks

According to the classification of risks in the matrix above, it is seen that two of them need to be prevented from the beginning as they can appear as unacceptable risks. The team has managed to find a "B Plan" or a complete solution if these risks occur.

<u>Misinterpretation of objectives:</u>

As the project has been presented as a free alternative to renew the W33 cafeteria, there is a possibility for the team to get confused with the objectives. The information the group receives is brief and it can lead very likely to confusion, but the project can't be started if the objectives are misinterpreted

To avoid this, a must-do for the team is to communicate everything related with the scope to the tutor in every weekly meeting. In this way, the tutor will be able to guide the team to the correct objectives so that risk can't turn into a high risk. Anyway, the group can contact the tutor by email if something looks very confusing.

Denied access to resources:

When developing the project, the team needs to have access to certain resources that may have denied access, such as plans or many other programs. This problem can't be avoided if it appears, but the group can develop a "B plan".

This B Plan would be separate in two subsections:

-"B Plan for denied plans": If the team does not achieve the plans, they have the chance to visit the space and take their own measurements. With the results, they are able to draw a general plan of the space. For sure, this plan will not have the exact measurements but at least the team can develop an idea with it.

-"B Plan for programs that require payment": As the team can't afford to pay a lot of money for that kind of programs, they should find an alternative source. That would mean to find another program with same tools (or similar) and to learn how to use it.

It's important to be aware about these risks because they can appear easily, so they need to be detected quickly in order to take the corresponding measures.

2.1.6.5 Exposed risks

While developing the project, the group has faced some of the risks described above as unacceptable and some others which were not defined as really important ones but they have become quite critical.

These risks have been detected and solved in the best way possible:

-Misunderstanding the objectives

At the beginning of the project, it was known that the goal was to renew the old cafeteria but the team had no idea of what should be on the inside of the new space. The first thought, as they had no clue about what to do, was to build a survey based on their own ideas, but they did not think that this one was a pretty biased survey regarding to students, so they went wrong sending this irrelevant survey and they lost time.

As they were completely exposed to that risk and they could not go back, they decided to ask for help to their supervisor, Stefan Pellfolk, who advised them through the construction of the new survey. This new survey, which is explained in point 3.3.2, is based on teacher's options and influential people at university's opinions.

Once they were exposed to this important risk, they explain everything that they do each week to the supervisor in order not to confuse the way of working and misunderstand the objectives.

-Payment programs

The main idea was to use some payable programs to do the whole design, as NX Unigraphics or CATIA, but the team did not have the budget to achieve them so they thought about some other programs that could allow having an excellent 3D design without paying. Now, the main option for developing the project is using SketchUp, this software will be explained when designing.

Another program that the team needed, even if it was payable, was Microsoft Project. It was a hard work to obtain it, but the team finally managed to do it. Firstly, they downloaded the trial version but it did not last too much, so they needed to find another way to achieve the program. Finally, one of the members of the team managed to download it as it was free if he logged in as a student his home university account.

-Lack of communication between the team

When the project started, the team thought that the possibility of having problems with communication was not very big, but the thing is that this happened so they had to face it. In a real-life project, working teams must face this kind of problems very often, and in this case, it's been added the cross-cultural differences.

When the team realized this problem, they decided to do a meeting between them and to discuss all the issues that were causing the problem. From this first meeting, they started meeting each week because if they were exposed to that risk again it could have a big impact on the project.

-Lack of knowledge

This risk was seen as an unexpected one, but the team got exposed to it. The willingness to use new technologies took the team to fail in different occasions. The main problems flourished with the 3D printing. None of the members had any experience so they asked for help many times until they managed to make it work fine.

2.1.7 Priorities

When a project starts, there are always priorities linked to the content, the cost or the schedule. However, as all these aspects have an important role in the project, they need to be put in a certain order. To do this, it's understood that the project is defined by: content, cost and schedule; and by its level of importance or priority: to comply with, to improve or to approve. So, with these features this table has been developed:

Table 7. Priorities towards the project

	Content	Cost	Schedule
Comply with	X		
Improve			X
Approve		X	

In this table, we can see the priorities of this project. The main priority to comply with is the content, the team has been given a goal that they must accomplish and this goal does not have to do with budget or timeline, but with content.Generally, the priorities are classified by the wishes of the client. In the project the group has no pre-defined budget. Having said this, the schedule is something that is predetermined by the group; also the project should be finished with a physical model which is useful just for the presentation so it's thought that the schedule is less important than the content in this case. So, the content which defines the main aspects of the project can be divided in different tasks: these priorities are allocated a number

signifying their importance. If a priority has the higher number value, it has a higher importance. The scale ranges from 1 – 3.

Table 8. Priorities towards tasks/deliverables

Tasks/deliverables	Priority number
Survey	2
Choosing an option	2
Research	2.5
Digital model	2.5
Physical model	3

These main tasks define the different steps to have the best content as possible.

The firsts ones are not the most important because they are just needed to obtain the result, even though they define the first step in this project and if they aren´t correct the whole project could be compromised. After this, research and digital model are the second most important points because they will define what is possible and is essential to show understanding of the final result. The 3D model can allow the team to have better presentation. The physical model is the most important piece as it will allow the group to have a down scale prototype that will be able to be visualized easily by anyone, so is the representation of the project.

2.2 Planning

In terms of planning, the group will implement strategic timescales where work will take place and will be completed. Using Microsoft Project, the group will create a Gantt chart to keep track of progress made as it will allow the members to actually see if they are making good progress and where there needs to be more progress. When performing a task the group will plan ahead presenting research and findings as well as discussing the best plan of action. Risk mitigation strategies will also be implemented. Graphs and lists have been prepared showing all the risks as well as ways to deal with these risks. The risks have been evaluated and prioritized based on which risks present the biggest problems for the project completion.

Any major task that could potentially be problematic will need to have a lot of consideration and research behind it. Making sure timeframes are in place and risk evaluation is done is essential. The group must have a clear idea of exactly what they will do to complete tasks before they start.

2.2.1 Work Breakdown Structure

Thinking about the organization of the project, a Work Breakdown Structure (WBS) has been done. A WBS is a way to decompose the project into deliverables, which are decomposed into sub deliverables, which are finally decomposed into tasks. It's the best tool to know which things have to be done while doing the project as well as being the best tool to develop the schedule and defining milestones.

The project's WBS is situated on appendix I. It has five main deliverables which lead to thirty tasks. Each deliverable is associated to one colour as they are different issues and it goes on with their corresponding tasks.

2.2.2 Responsibilities

Once tasks are defined, the team decided to do some management with them and that means assuming responsibilities. Every task needs to have a manager because one manager per task it's thought to be the best option as it can't lead to any confusion, although this doesn't mean that just the manager will be working on that task. The team has designed a responsibility table where they have listed all the tasks and defined all the managers and workers (see on appendix II).

2.2.3 Milestones

A milestone is used as a performance control point. They need to be defined in order to know if the project is going well on the timeline. In this project, milestones have been set according to the tasks showed in the WBS. These tasks are the workloads that the team members have to do in order to achieve the goal, so in this case, some of them which are the most important ones are used as milestones. These milestones are defined as thin lines in the Gantt chart and they are used as leading points for the team into the schedule.

2.2.4 Time schedule

The time schedule is an important aspect of any project as this will be essential in ensuring tasks are completed within the appropriate time. Using Microsoft Project the group will keep track of any work that has taken place as well as keep track of work that is lagging behind schedule. The time schedule (See the appendix III) will allow the group to make sure they prepare the mid-term report on the 3rd of April in time and not only prepare it in time but make sure the work is of a high standard. Same for the final presentation on 19th May of 2017. In order to see the completion of the schedules, in the appendix are seen three of them: the initial one, the one for the midterm report, and the final one.

Another way to keep track of what the team is doing, is filling a time statement (see appendix IV) for each one of the members and for the team. So in this way it's possible to know when they were working on which task.

2.3 Monitoring

2.3.1 Monitoring Gantt

Nowadays, the team is working hard to achieve their goal. In order to work in an organized way, they try to follow the schedule as it is the most important management tool that they have.

Up to this point, if the Gantt chart gets summarized, it's seen how the team is doing regarding to the project:

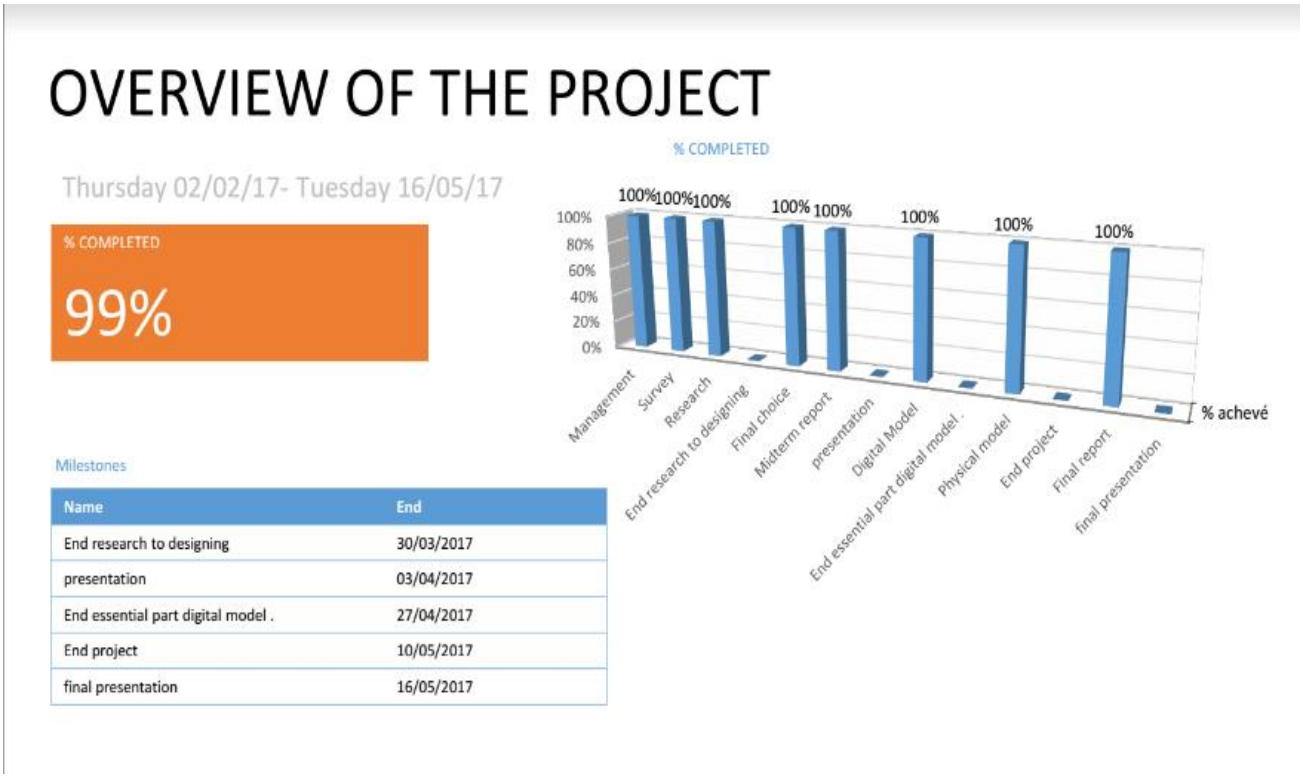


Figure 6. Summary of the schedule processes done with Microsoft Project.

In this summary, it's seen that a 99% of the completion of the project is done. That means that the group is working fine regarding to the schedule although there's a 1% that has not been done. This is because the presentation is not finished when this screenshot was taken, but it will be for the 16th May 2017. Also, the milestones are showed, and up to the date they are achieved.

2.3.2 Cost Management

At the beginning of the project there was strong emphasis on management. The tables on appendice V demonstrate a collective database including analysis, organising the project and industry costs and this will contribute to the final budget.

Moreover, in accordance with the schedules, all the duration of the tasks is calculated to provide the exact price of work for each part of the project.

The final budget for the team management of this project would be 35.286€.

2.3.3 Progress status

The project has been successfully completed. The management including risks and limits have all been completed as well as the priorities and other managerial tasks. This allowed the group to conduct work in accordance with the plan.

Once the planning stage was in total completion, the main body of work began. All the topics that needed to be researched were addressed and all the relevant information was gathered and documented. This information was used in order to create the design.

All the interior aspects of the room have been designed and all the appropriate materials, equipment and furniture has been chosen respective to the previous research. The cost of all this stuff was calculated and added up. The type of lighting that will be implemented within the design has also been researched and chosen as well as the inclusion of the cost of the bulbs, the kW hours used and the distribution charge.

The physical prototype has been constructed. Also, the 3D printed rooms have been created and incorporated within the design. The virtual design has been completed and is able to be explored using a VR headset. There is now a video of a virtual tour that has been created using the virtual design. All of these things that were created will be used to enhance the final presentation as well as visualize the final design concept.

The full design has been completed as well as all the necessary components to display the final design in the presentation.

3. Development of the project

3.1 Business requirements

As the project is developed as if it was a business project, the team must be considered a company. Each company needs to have a meaningful logotype as well as a web page that identifies it, that is why the team has managed to come up with a logo and to develop a web page where it is explained what they are working in.

3.1.1 Logotype

A logo can be a type or a symbol, even a word, which identifies a brand or a company. It translates the impression of it and its representation.

To have a strong and meaningful logotype, the team has done a brain storm about what could appear in the logo:

Figure 7. Logo's name brain storm

The main idea is based on combining the word "RENEW" with the "W33" which is the name of the building. As this brain storm did not give the team a clear idea about the logo, they started doing some weak designs to get some ideas:

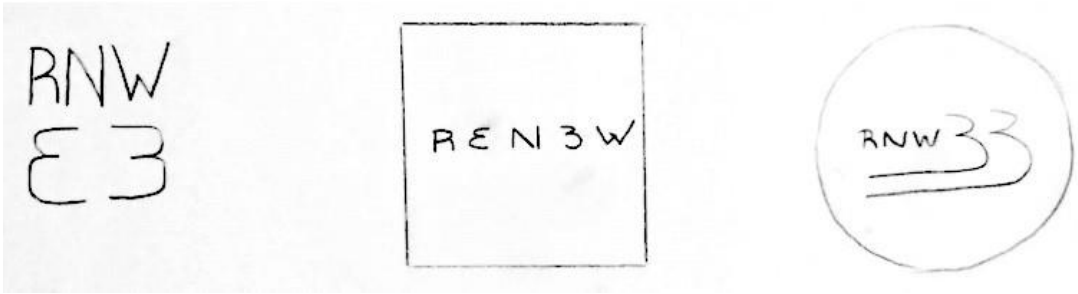


Figure 8. Results of the first logo options

After considering these three models, the one in the left and in the middle were the preferred by the team so they started designing them in a better way. As the project does not have any significant thing to focus on, they decided that the logo should be simple because sometimes less is more, as it's said. So, they were working under simplicity and with simple colours.

Some of the results were the following ones, which are based on the designs above but are done with Adobe Illustrator:

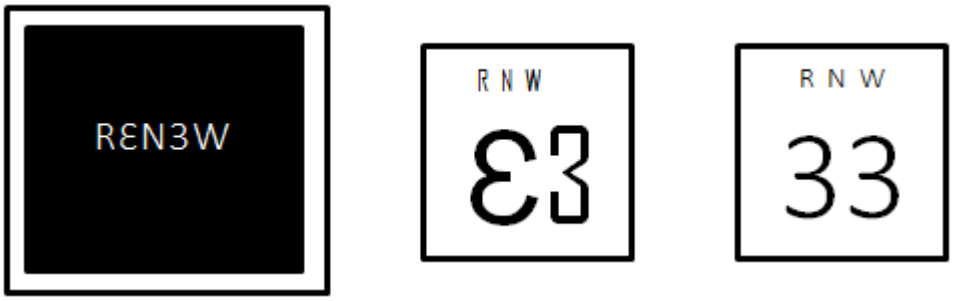


Figure 9. Results of the first logo options made with Illustrator

As the one which liked the most to the group was the first one, more designs were done in order to arrive to a final decision:

Figure 10. Results of the second logo options made with Illustrator

After designing all these logotypes, the team made their selection mixing two of the designs and this one was the result:

Figure 11. Final Logo

The final decision of the logotype on reflects what the project is about and the name of the building that needs to be renewed. So, it's thought that this logo represents the company as well as the work done.

3.1.2 Web Page

As a business company, the project must have an explanatory web page. This webpage has been created with Webnode and filled with the information about the project.

Attachment of the webpage: http://r3n3w.webnode.es/

3.2. Working methods

In order to develop a good project, it is important to define the proper working methods if it's wanted to complete the tasks in an efficient manner. Working methods are referring to the manner in which work is conducted and it has to be carried out in a logical manner to ensure time is not wasted. The team has developed the working methods depending on the doubts that they had and on the deliverables. To develop the working methods, some brain storming has been done until the final agreement it been reached.

Work methods have been represented in a visual way as it's supposed to be more understandable. Green boxes are the result where is intended to arrive at.

Figure 12. Summary of the working methods

3.3 Research on goals

3.3.1 Who are the owners?

At the beginning of the project, there was no clue about who the owners of the building were and the team needed this information as, at the end of the day, the decision about the renovation had to be taken by the owners; so they had to manage to discover it.

They send emails to different people working for the administration of the university, but they did not receive any new information, as no one was sure about who the owners were. They had researched on the Internet as well, but it was the supervisor of the project who finally found the answer. The owner of the building is the City of Vaasa, and that was a problem for the team as they had to go into politics if they wanted to achieve permissions.

After discussing this issue with the supervisor, they arrived to the conclusion that the project will be kept for the university, so then the "owners" were Kimmo Koivisto (who is in charge of the building) and Orjan Andersson (the principal of the university).

The team will take their own decisions during the project but the owners will be the ones who can stop the project, who can deny it or who can approve it.

3.3.2 Survey

The initial survey that was carries out had multiple different options that were presented to staff/students. Options presented within the survey were created by the group members and send via email to students. The survey contained multiple different options from sports facilities to a games room and many more. The image below show the results of the initial survey.

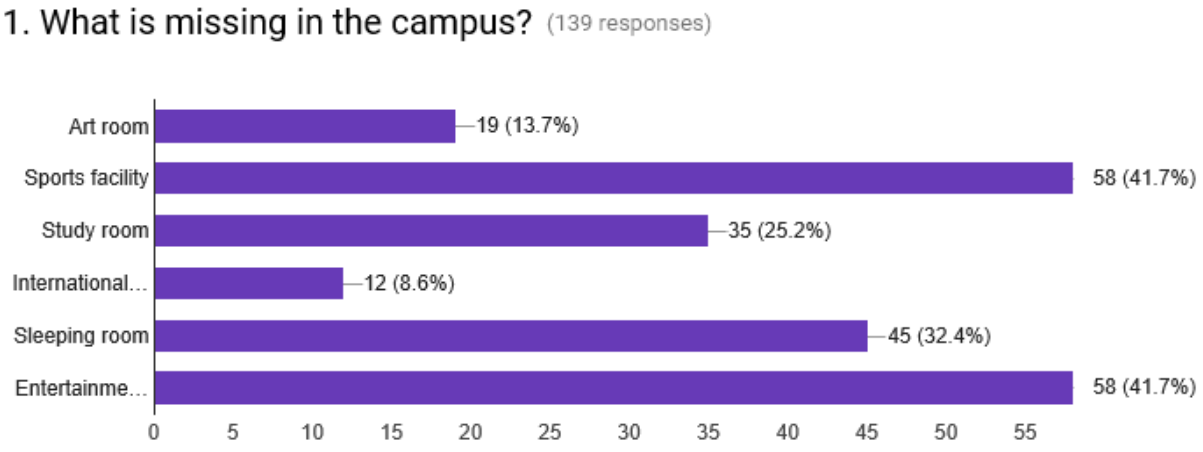


Figure 13. Results of the basement survey (see appendix VI).

The results of this survey show that the majority of students were in favour of a sports facility or an entertainment room. The group started to prepare options regarding these results. Minor

research took place and the team could determine a few possibilities regarding the most popular choices. The research was compiled and prepared ready to present to the supervisor in the next meeting.

When the group met with the supervisor the conclusion was drawn that the survey had inappropriate options. The options within the survey were deemed to be more what students would like rather than what the university needs as stated by the supervisor. Although the options presented would definitely be beneficial to the campus, there are options that are needed so they will be explored instead. Fortunately, this survey can be useful for the renew of the basement (this could be a further project to develop), that's why this survey is adjoined in appendix VI.

Right survey

After reviewing the results of the survey with the supervisor, the group was informed that the survey had bias options. The options were not designed to suit the most needed facility for the university so the team would have to conduct the survey again with more appropriate options. Options presented within the survey should be designed to fit what is most needed rather than what is most wanted.

After a discussion with the supervisor, the group spoke with some senior members of staff within the university, for example Kimmo Koivisto or Örjan Andersson, the principal. The consensus was determined that a classroom space would be the best option as this is the most needed facility. Drawing this conclusion meant that another survey could be created with new, more specific options that will allow participants to contribute opinions regarding the type of classroom that will be used. Also, the old kitchen can still be in some sort of use in theory so this will also may be explored. So, a new survey was created and sent to members of staff to determine what time of learning environment will be chosen. The image below shows the survey responses.

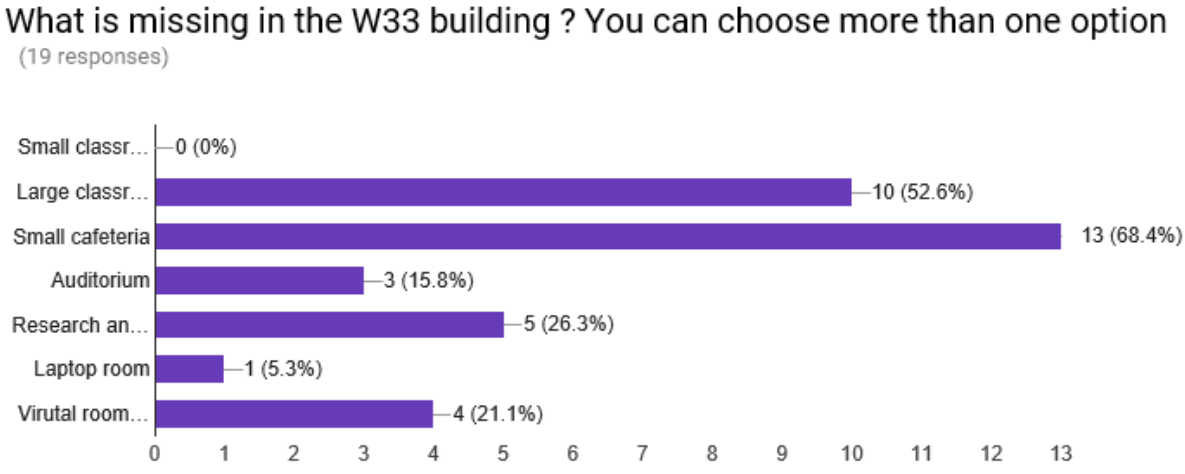


Figure 14. Results of the right survey (see appendix 6.5).

This survey is adjoined in appendix IV.

- Option chosen

Based on the results of the survey, the group has been able to choose an option for the w33 cafeteria. Due to high demand the cafeteria will remain in use but will probably need to be downsized as there will no longer be a large dining area for students/staff to consume food. Also, a large classroom will be implemented as this is also a very high demand option. The large classroom will be designed to best suit the room dimensions. Another thing that will be implemented is a teamwork room that will be used for students that are participating in group work and could be also a mix of a virtual room and a research centre. This room will also be designed to maximize the use of space relative to the room's dimensions.

3.4 Research

The group will conduct research to compile information as well as different options regarding the design of the classroom. This will be a very important process that will require in-depth discussion and comparison to find the best solution both ergonomically and aesthetically. Cost comparison will also be a key component of the research as finding the best equipment at the best price is not necessarily an easy task.

By comparing many different sources and considering different retailers the group will be able to determine the best solution. This type of research must be extensive due to the fact that the pool of information will be deep and cannot be explored within a very short time frame.

Once the research has been gathered and filtered, the group can make decisions regarding purchases. These decisions must be justified when presenting the information to the appropriate individual, therefore evidence of substantial research will be compulsory.

3.4.1 Legislation

When designing an area that is intended to be used by the public, certain legal requirements must be followed. If these requirements are not followed, the legal expectations will not be met and the space could be deemed legally un-usable. This would be detrimental to the project as the room would be rendered useless if the correct legal steps are not followed.

To ensure such a problem does not occur, the group must take the appropriate steps. These steps will include researching the regulations as well as applying them to the project. The project must be sculpted around the laws/regulations not the other way around.

3.4.1.1 Fire Security

The fire legislation is crucial to the design as the escape routes need to be planned respectively to the speed of fire spread. As well as this, the number of the occupants is more important than that of certain physical design factors emphasized in escapes codes and guides. Sufficient interaction capabilities of the communication system with the occupants, effectiveness signposting, and the clarity of the internal layout and routes will minimize the risk of fire.

Within the building all the legislation will be followed. This means that there will be a general alarm for the whole building, fire and gas detector will be put in place, but will need to be reconsidered if changes are made to the organization of the floor.

In this floor, there a big corridor between the kitchen and the dining room. This corridor is the escape route because it's on the extremity and there is one exit of each side. It will be unobstructed by equipment and locked doors. The two doors are highlighted with signs that will indicate the direction of travel. Moreover, it's primordial to integrate some lighting for exit routes. Install « EXIT » signs in legible letters or a light that displays the phrase « EXIT ».

Referring to the dimension of the exit way, the ceilings of exit routes must be at 2.31 Meters high. Within the building this is the case so we don't need to change anything. An exit access must be at least 71. 12 cm wide at all points and this is the case because we have two doors and they are 144.6cm wide. The problem is that if there are 120 occupants, this means that the total minimum width of the exits is 1200 mm yet the width is increased by 400 mm for each following group of 60 occupants, so to be sure it could be beneficial to expand the width of the doors. In addition, the width of an internal corridor leading to an exit is calculated in the same way as the width of the other one. So, in this case, it can be estimated that there will be 180-200 people in the corridor so it needs to be 1600mm minimum.

Each exit must be illuminated to a surface value of five foot-candles (54 lux) by a reliable light source and be a distinctive colour at the level of 0.21 cd/m^2. Moreover, the electricity for the light has to be supplied by an autonomous source even in the case of a power failure.

Also some buildings are designed to hold a maximum number of people but it is necessary to make an assessment of the maximum numbers who might be using the space. In this case, there will be 180- 200 people maximum so the area to be considered in square meters is divided by the « occupancy load factor », giving a rough guide to the maximum numbers to be expected. The space will be a classroom, teamwork room and cafeteria. There will be three square meters per person and there is 500 square meters for the entire floor, so the maximum number of people will be 180.

Table 9. Estimation of the number of occupants based on the area. See the"National Building Code in Finland" in de bibliography

TABLE 10.4.1

ESTIMATION OF THE NUMBER OF OCCUPANTS BASED ON THE AREA

Use of premises	Area of premises (m^2 per person)
Dwellings	10
Accommodation premises	10
Institutions	10
Assembly and business premises	
– in general	3
– premises for arts and leisure and other similar assembly premises	1
Office premises	10
Production and storage premises	30

In addition to estimating the total numbers within the building, it is necessary to identify specific areas where people will be concentrated, for the example the corridors between lectures and lunch. Large numbers of people are not going to move quickly, or at a normal speed, so escape must be accomplished in a shorter distance.

After that the alarm and detectors must be explored. It is necessary to estimated how fast normal healthy people would move, and most common figure is 50-100 m per minute. Therefore the 50 m per minute estimate should be used as a very rough guide of the speed of movement for the able-bodied. So, it becomes important that the fire alarm has a very good response from the occupant of the building. It's

primordial to set up smoke detector if the building is not equipped, gas detector for preventing carbon monoxide leaks, and the speed of the response of the person present will depend on the correct function of the detectors and the alarm so the group needs to do an audit to be sure that all the system is conformed as functional.

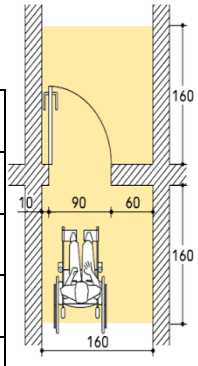
3.4.1.2 Disabled people

To integrate disabled people in the new rooms, some rules must be taken into consideration. Depending on the number of people that occupies a room, some spaces must be equipped for wheelchairs. Also, measurements between objects and walls, defined by the law, which allow wheelchairs to pass by should be taken into consideration as well.

Here we have a table that shows the number of wheelchair spaces per capacity of seating, and an image which shows the measurements for spaces in front of doors in centimetres:

Table 10. Number of Wheel chairs spaces per capacity of people seating

Capacity of seating	Number of required wheelchair spaces
4 to 25	1
26 to 50	2
51 to 300	4
301 to 500	6
Over 500	For each 200 seat 1 more



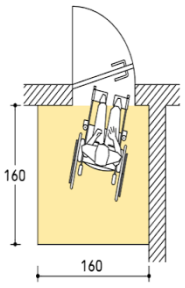


Figure 14. Needed space for a wheelchair in front of a door

Also, the passageways between walls or objects need to be adapted, so the minimum width of a passage is 1,118m for a wheelchair to pass, and 1,60m in front of the area around a door (to allow the wheelchair to manoeuvre easily). Moreover, it can be seen in the image, there are regulation regarding the high and width of the desks.

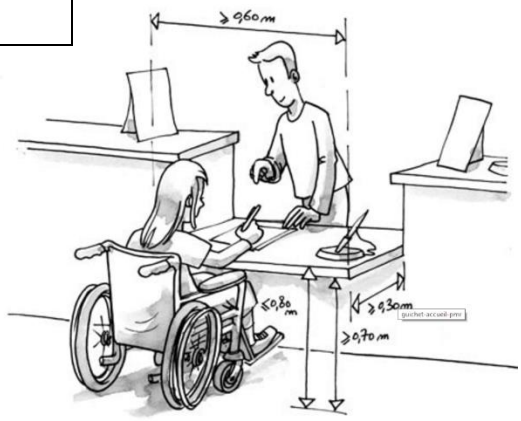


Figure 15. Table height conditions for disabled people.

So, in this project there are different spaces to think about. The large classroom, the teamwork classroom, the cafeteria and the kitchen. According to the room conditions there are a minimum occupant load factor and a minimum of doors according to the people number in the room.

Table 11. Occupant load factor.

Use	Minimum of two means of egress are required where number of occupants is at least	occupant load factor (square meter)
Dining rooms	50	1.3935
Drinking establishments		
Lounges		
Classrooms		1.858
Kitchen	30	18.58

So, during the development of the project we need to consider this information to be in accordance with the law.

3.4.1.3 Ventilation

The ventilation system within the w33 cafeteria cannot be changed or altered as the entire building uses the same system and changing it would require too much planning and work. Designing a ventilation system is a complex and expensive process so it would be illogical to change the system for no worthy reason.

So, in this case the legislation tables are the third, fourth and tenth one on the Finnish legislation about the ventilation.

Table 12. Ventilation legislation and air flow amount.

Space	Outdoor air flow (dm3 /s)/person ± 10 %	Outdoor air flow (dm3 /s)/m² ± 20 %	Extract air flow (dm3 /s)/m²	Air velocity winter/summer + 0.05 m/s	Request
Teaching space	6	3		0.20/0.30	Ventilation must be controllable according to the actual demand.
Team work room	8	4		0.20/0.30	Idem
Food preparation kitchen		15	15	0.25/0.50	Minimum air flows. The air flows are designed on a case by case basis according to the thermal loads.
Restaurants	10	10		0.20	Ventilation must be controllable according to the actual demand. Guideline values for air velocity at fixed workstations are the same as for offices.
Corridor		0.5		0.25	Guideline values for air velocity at fixed workstations are the same as for offices.

This table displays the essential legislation regarding the ventilation. The specifications are different between the teaching space and kitchen space. The space which can be used for the small cafeteria is a part of the kitchen and the space used to the big classroom is actually the old dining area. Also, the ventilation system is adequate for a large cafeteria so will be more than adequate for two classrooms and a small cafeteria. This means the ventilation system will remain the same and will not be altered.

3.4.2 Rooms and plan distribution

Nowadays the space distribution is like this, and with red is marked the part that needs to be renewed (you can see a bigger plan in appendix VII):

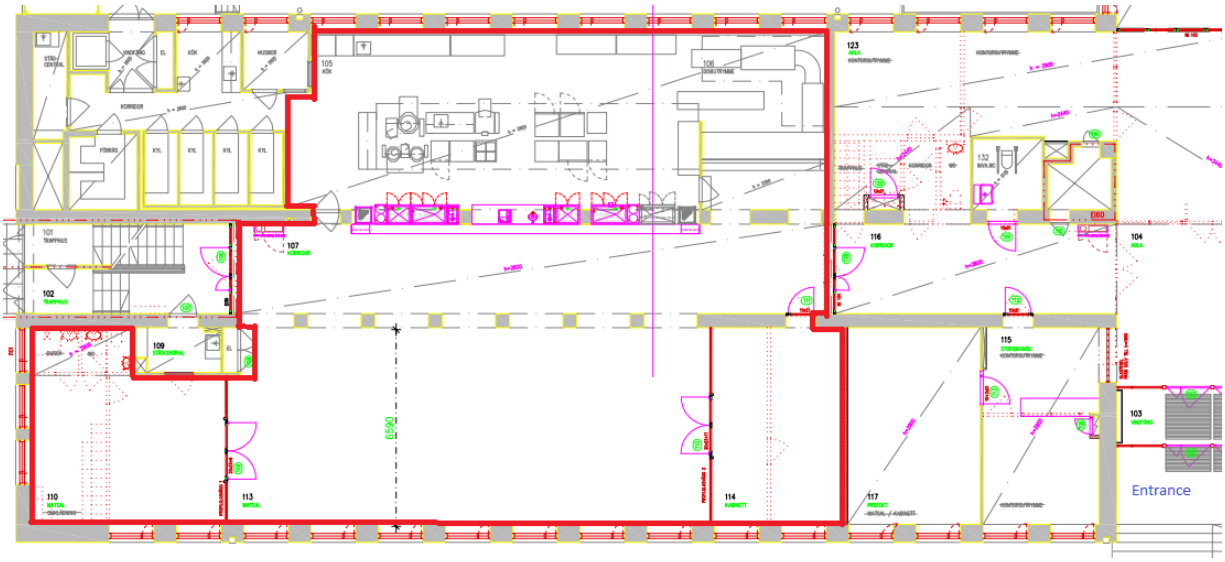


Figure 16. Nowadays plan distribution

And here there are some photos of how it looks:

- Dining room:

Figure 17. Nowadays dining room

-Corridor:

Figure 18. Nowadays corridor

- One side room:

Figure 19. Nowadays side room

After taking into consideration all the information described about Legislation, the plan about how the new space could be distributed was done.

The red frame limits the space which is needed to be renewed (a bigger plan can be found on appendix VII behind the plan of how the space looks right now):

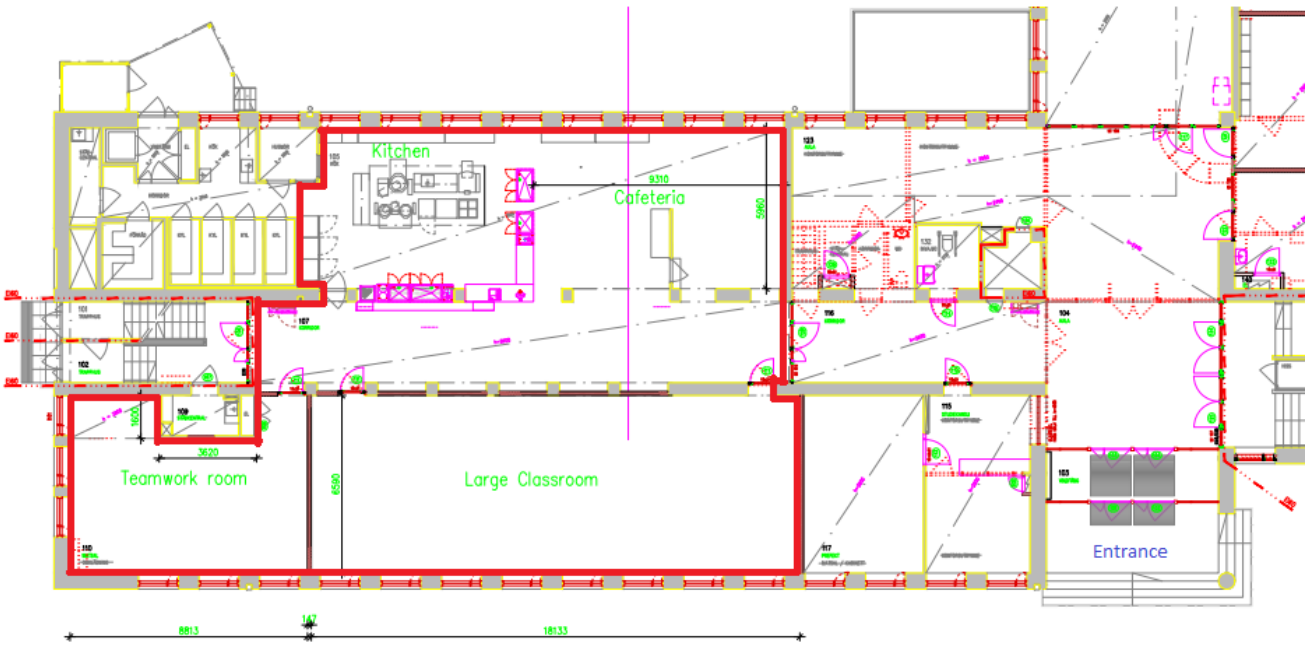


Figure 20. New plan distribution

The dining room has been divided in two rooms, one large classroom and one teamwork room. The large classroom has 18.13 meters of length and 6.5 meters of width, while the teamwork classroom has 8, 81 meters of length and 6.5 of width (without discounting the small space of

5.7 square meters). Two doors are necessary for such a large classroom, so one more has been added.

The kitchen has been reduced to almost the half of its length but the width's been kept. In the space left by the other half of the kitchen, the small cafeteria is going to be placed.

3.4.2.1 Teamwork room

For the teamwork room, the team decided to do some research to know how a teamwork room looks like or what it needs and then some brain storming about what could be on there.

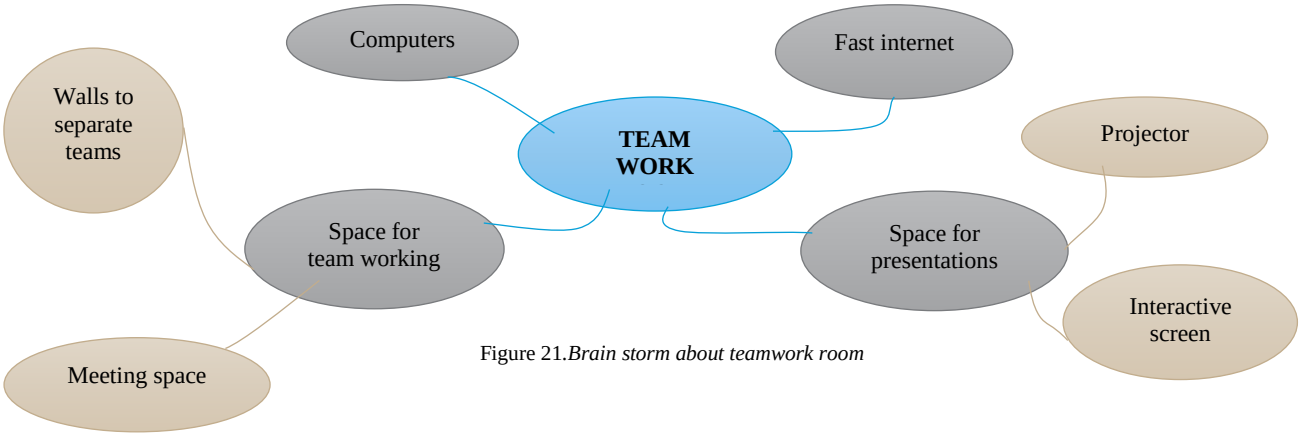


Figure 21.*Brain storm about teamwork room*

While the research, one of the most influential articles in the furniture decision was in *Journal of Personnel Psychology*. In this article[1] it's explained how a meaningful or colourful room creates a better working atmosphere therefore increasing productivity rather than a lean space. This information has allowed reducing the research about furniture options and increasing the imagination skills.

Figure 22. Applied idea of a teamwork room

Also, in another article[2] found in *Journal of Environmental Psychology* it's said that walls should be built in a teamwork space. An open space it's supposed to lead to communication

[1] Greenaway, K., Thai, H., Haslam, S., & Murphy, S. (2016). Spaces That Signal Identity Improve Workplace Productivity *Journal of Personnel Psychology*, *15* (1), 35-43 DOI: 10.1027/1866-5888/a000148

[2] Jungsoo Kim, and Richard de Dear (2013). Workspace satisfaction: The privacy-communication trade-off in open-plan offices. *Journal of Environmental Psychology* DOI: 10.1016/j.jenvp.2013.06.007

and community spirit, but in fact, some studies demonstrate that a little bit of privacy reaches to better results as well as giving more comfort. Another reason it's been explained before and it has to do with the sound reflection. If we don't put any kind of walls between groups, voices can be disturbed easily.

After visiting some web pages with photos and studies of teamwork rooms, the main idea is to have rounded tables with wiring in order to use the computer, some sofas to discuss issues or meet, a screen and projector for presentations, removable walls and a faster internet.

With the information achieved, furniture will be chosen and an idea of the room will be built. The decision will be made depending on furniture measures, colours and prices as well.

Teamwork room distribution

As we have seen before, the teamwork room will be situated on the small room at the left of this map. You can see it highlighted in red:

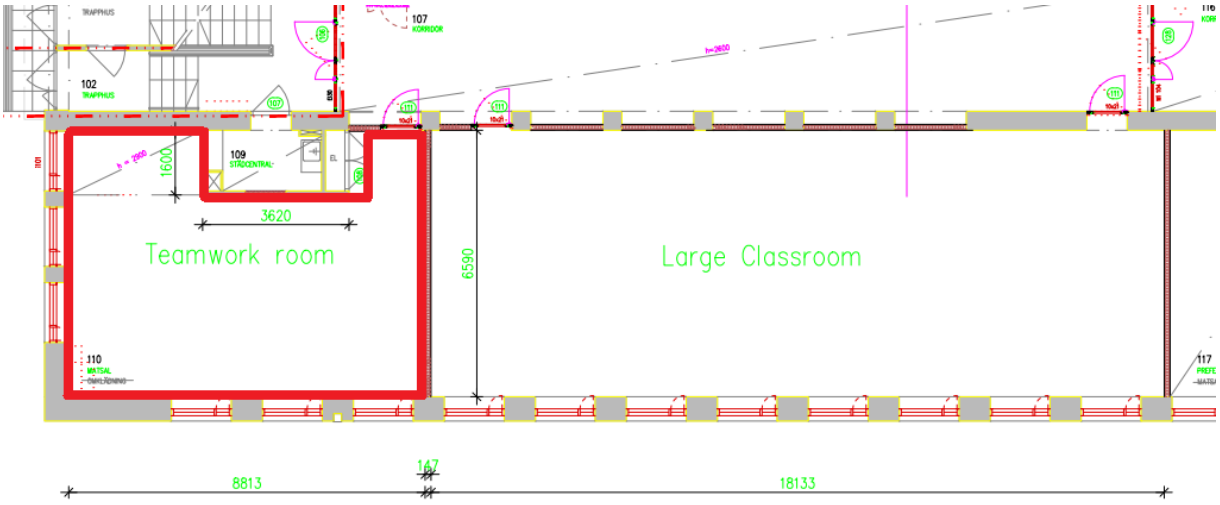


Figure 23. Teamwork room situation (red frame)

It has 52,3 m^2 so that's the space that can be used to distribute all the furniture and the ideas explained before.

Teamwork class furniture

Despite the fact that the research on furniture was very extensive, only a few of the options are showed as they are the better ones for the teamwork room.

Here is exposed the best selection for what would be the basic room: tables, chairs, sofas and a board. These prices take into account the corresponding taxes (in the final decision these taxes are not included):

TABLES

Photo	Brand	Measures	Colours	Price
	"Puzzle Freely-Shaped Table" by VS	29 15/16" Height 1.65 m Length 1.14 m Width		442.6€ each
	"Height adjustable table" by Nansen Group	Adjustable Height 1.06 m Length 1.01 m Width		322.2€ each

CHAIRS

Photo	Brand	Measures	Colours	Price
	"Deskchair" by Steelcase	Width 42 cm Adjustable Height		246.3€ each
	"Node chair with tripod base" by Steelcase	Width 42 cm Adjustable height		294.43 € each

	"Emerson student office chair" by Ave Six	Width 38 cm Adjustable Height		75.5€ each

SOFAS

Photo	Brand	Measures	Colours	Prices
	"Stockholm" by Ikea	Width: 67 cm Depth: 77 cm		369.4€ each
	"Soft low chair" by KFF	Width: 64 cm Depth: 76 cm Height: 79 cm		783€ each
	"k. lounge bench curve" by Knoll	Width: 38 ¾" Depth: 21 ½" Height: 17 ¼"		715.7€ each

BOARD

There is just one option given about the board as it is something that can be reused or even build, so the team just wanted to have an idea about the price. Nevertheless, there is one brand named USMakerboard which they do all kind of boards and they even can create a personalized board with the sizes that are wanted (they also ship all over the world for free over 500$).

Photo	Brand	Measures	Price
	"Drop in tray system chalkboard" by USMakerboards	1.5x3.65 m	636.1€

To make the room look more virtual we could add, as extras: removable walls, televisions, a projector, and some flexi glass boards.

Teamwork class sketching

Some ideas were brought into paper when all the information was recollected. These are the results of the two main ideas:

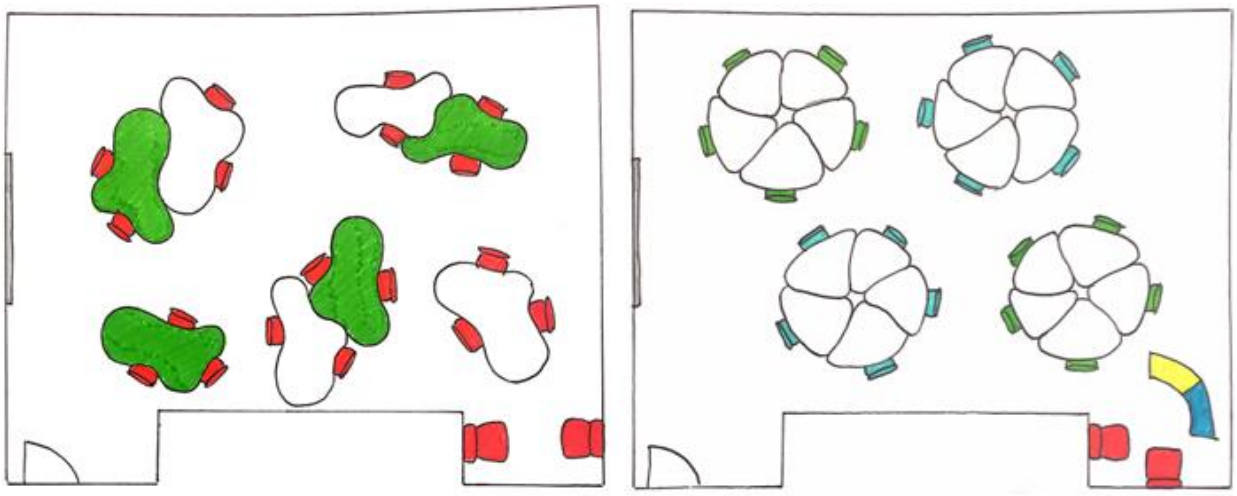


Figure 24. Non-scaled sketches of the teamwork room

Find the 1:50 scaled sketches on appendix VIII.

These sketches were done to plan the distribution and the colours, so objects like: removable walls, TVs or flexi glass boards are not included in here.

3.4.2.2 Large Classroom

The other result of the survey was to build a large classroom. The W33 building needs bigger classrooms so the idea is to build a new one which would fit, more or less, 60 students.

In order to achieve this, the team has thought about what a big classroom needs doing a brain storm:

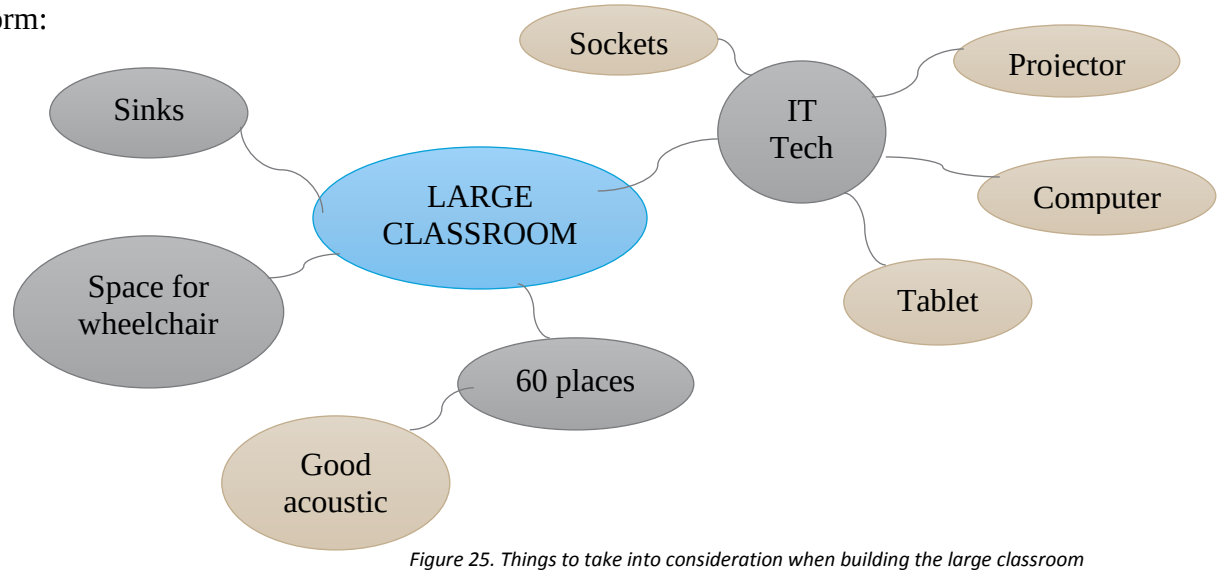


Figure 25. Things to take into consideration when building the large classroom

As there was not so much information about how a teaching classroom should be, the plan was to look at many different kinds of classrooms, to go through universities webpages, to know how much would cost to do some renovations, to look at the acoustics, etc. These facts allowed the team to build some ideas about the large classroom by comparing types of them.

Large classroom distribution

The large classroom will be situated where the red frame indicates:

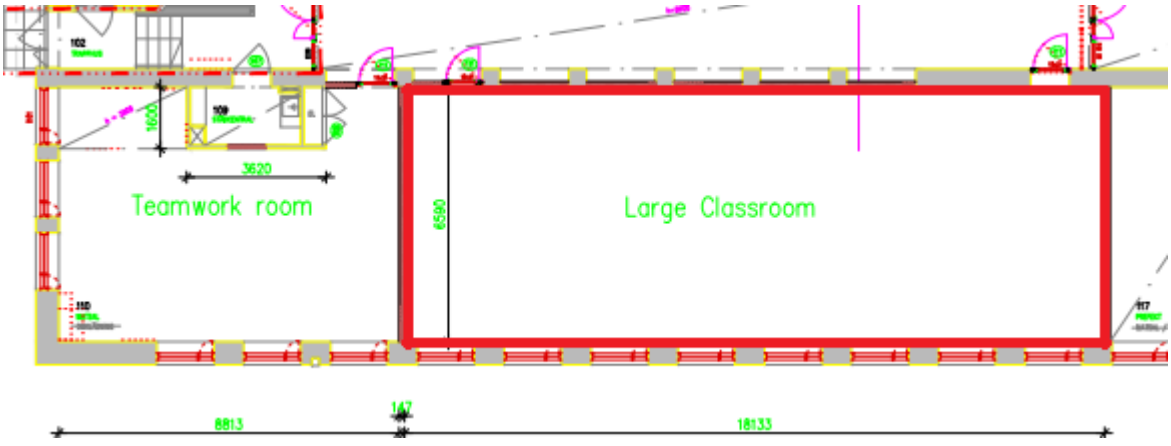


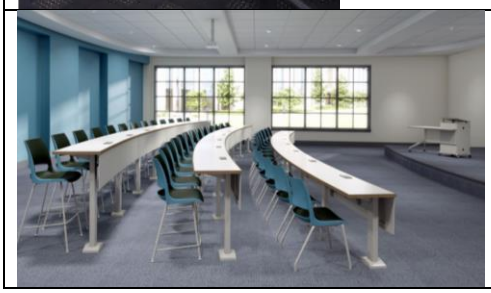
Figure 26. Large classroom situation(red

This space measures 119.47 m^2 and almost 60 students have to be placed in here as is the space that can be used. One more door next to the teamwork room has been added as it's a measure of fire security.

Large classroom furniture

As the interior of the classroom was not as easy as picking some furniture and put it inside the room, some companies which were in charge of building classrooms were contacted. Just one of them answered so the team took that price as an example to build the budget. Anyway some other kind of furniture was researched.

Here we have some examples of what was thought and the one that has been chosen:

Photo	Brand
	"Campus seating" by Audience System
	"Seminar tables" by KI

And here is the option chosen as, not only it's the only information about prices achieved, but it suits better to the room:

Figure 27. M60 by Sedia System with Liberty seats

- This is a Sedia Systems design named "M60 Swing Away". The tables can be displayed in circle or in rows and the chairs are adjoined with the table. The choosing includes the chair seen in the picture which is named "Liberty".

Prices without taxes:

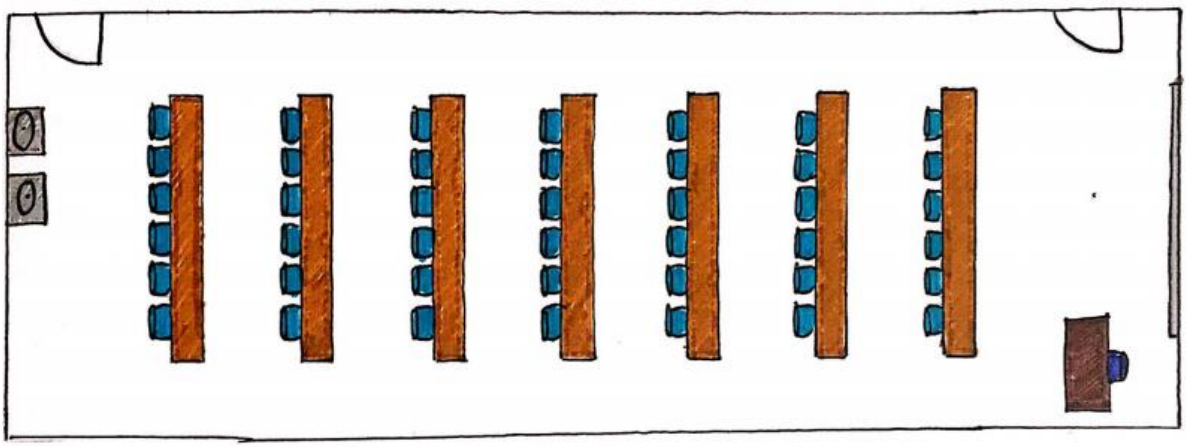
-680$ per position
-5000$ per container because of the freight

So that would be a total of 45.800$, which are 42.070€ in total for 60 places.

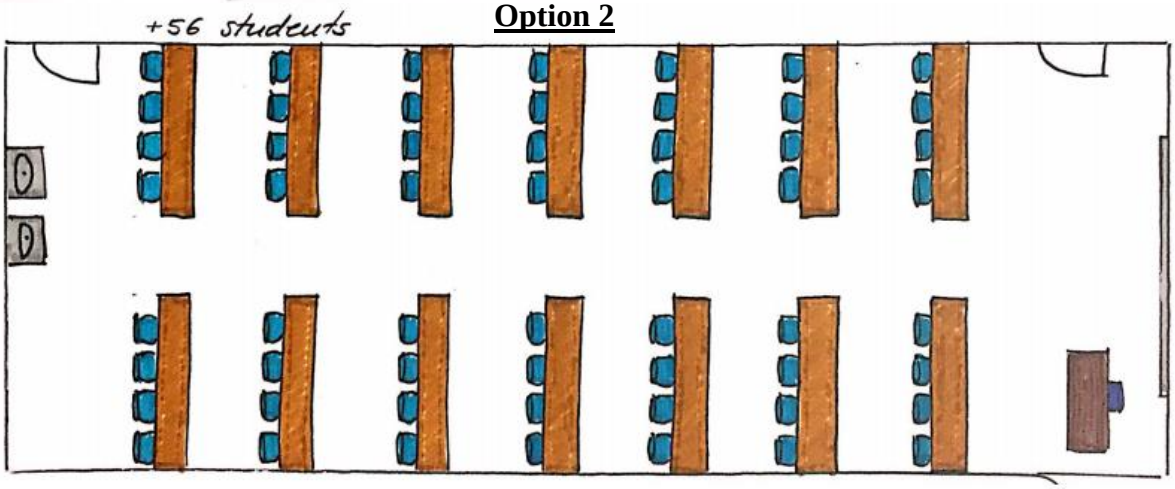
Large classroom sketching

After discussing about the options, the team did some sketching about how the large classroom could look like. Here are the main three ideas:

Option 1



Option 2



Option 3

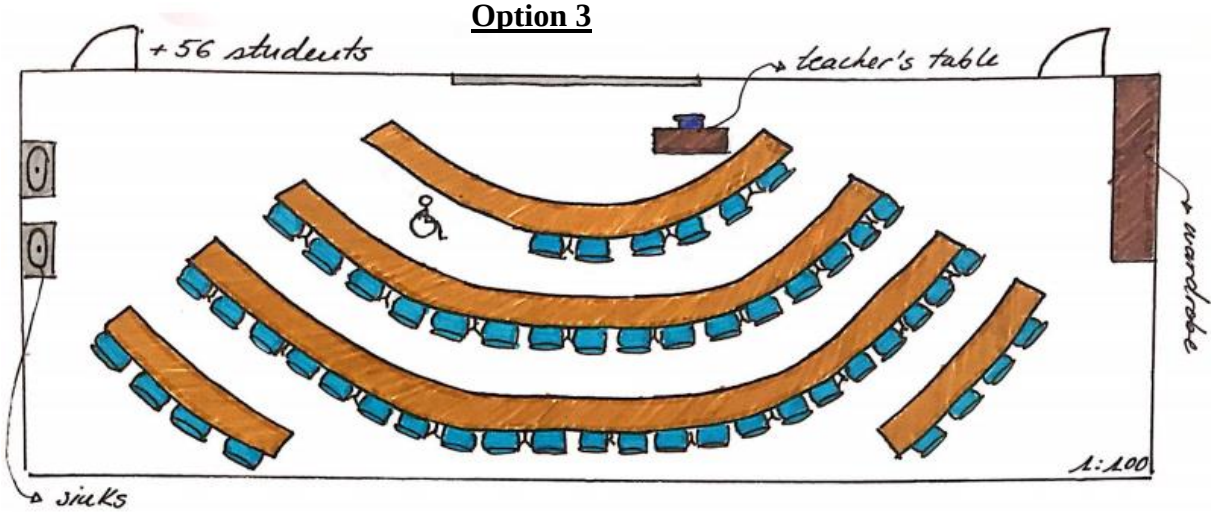


Figure 28. Non-scaled sketches of the Large classroom (see scaled ones in appendix 6.7)

3.4.2.3 Small Cafeteria

Small cafeteria distribution

At the beginning, it was essential to know the exact space of the future cafeteria. Planning was the best way to know precisely the space. Planning regarding changes of the bearing wall, the bulkhead, windows, tables and furniture will take place.

Moreover, the group had to take care of the actual infrastructure that needs to be kept. The group decided to keep the changing room for the workers, the toilet, and the head cooker office.

Also, it was primordial to do an audit of the furniture that must be kept on the kitchen to meet the demands of the student's teachers and the owners. A meeting was organized with the Head cooker to have his point of the view and his professional opinion. In fact, the chef described all the materials of the kitchen that is working, what we can change, and how to downscale to optimize the space and keep sufficient conditions to work.

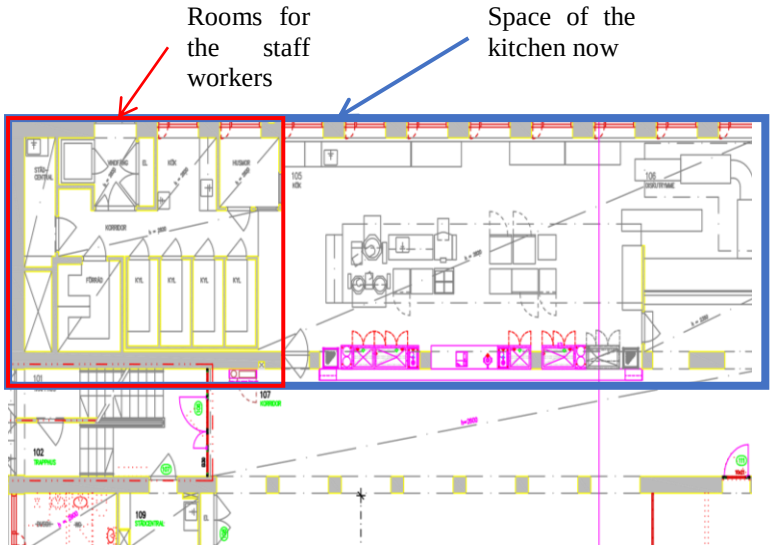


Figure 29. Nowadays kitchen and staff room location.

So, after this meeting the group began to rework the plan to visualize the space and the organization of the equipment. To ensure this, the group dismissed the ideas that didn't work so the two fridges will be beside ovens.

To liberate the space of the oven the group put them next to the changing room because there was a free space near the cooking equipment.

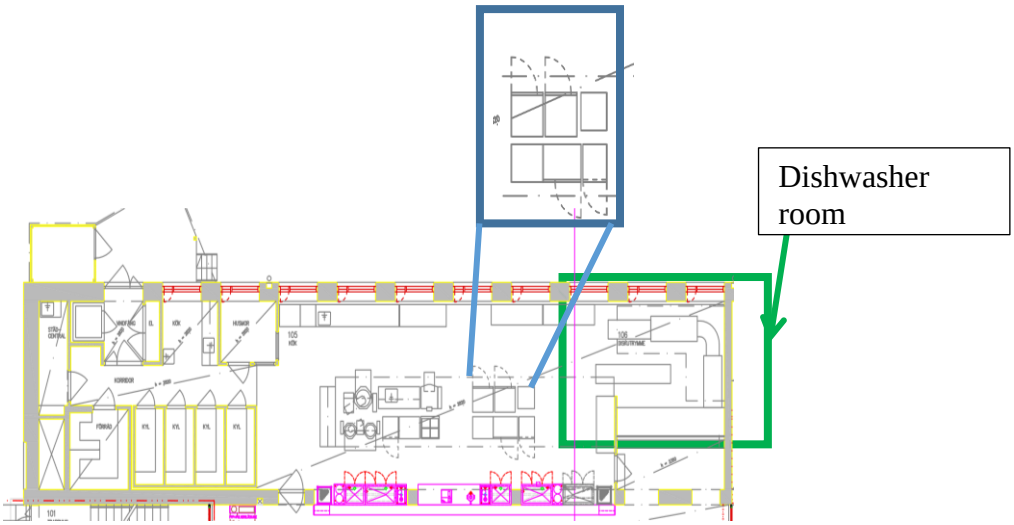


Figure 30. Nowadays kitchen distribution.

Within the kitchen, a large dishwasher occupies a lot of space that could be utilized more efficiently. Therefore, the group considered two options.

Firstly, if the group decided to continue making hot food, the equipment would need to be downscaled.

Secondly, if the team decided that the cafeteria will make just sandwiches or something else that require no plates or cutlery, the dish machine will be removed or move at the new cafeteria from the other buildings. But part of the previous kitchen would be kept because the chef could make some sandwiches with meat or doing burgers and fries. This product would need an oven and gas cooker.

After the discussion with Kimmo and the building manager of the city of the Vaasa, the group decided to keep the second option. The final plan was created to know exactly the form of the kitchen and the size of the dining room.

Small cafeteria furniture

When the space of the kitchen and the dining room were reorganized, some research was done for the organization of the dining room.

For this space, it was important to have some places for seating to eat sandwiches at lunch and places where individuals can stand with tables.

So, the group researched some options for the chair. The reflections were to find high chairs. The team found prices for the chairs so indications of the budget are available. These prices take into account the corresponding taxes (in the final decision these taxes are not included):

CHAIRS

Photo	Brand	Price
	"TRGJ764"	35.00€ each
	"TRGG710"	47.00€ each
	"TRGG653"	104.00€ each

Moreover, to save space the group thought about installing a fixed table on the wall whose. The group thought about a table from Ikea but the problem is the width of the window because the table had had a 1500 mm length. Finally, a 6-foot wooden board was chosen to install on either a pillar or wall.

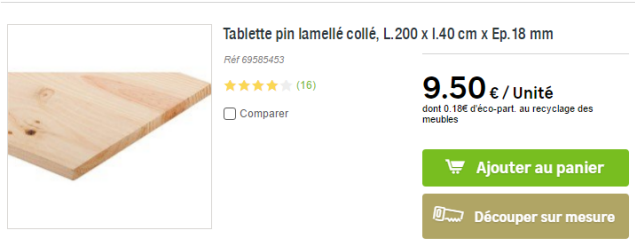


Figure 31. Tablette by Ikea in France. Price w/ tax.

If there is the need for additional people, more chairs can be installed.

Here there are some table's examples:

TABLES

Photo	Brand	Price
	"CLP Table 60 diam"	59.99€ each
	"Bar City"	59.90€ each
	"Vista MDF"	73.95€ each

Small cafeteria sketching

With all the information gathered, a sketch of the distribution inside the small cafeteria has been done. There are a lot of distribution options for the cafeteria; also an option is reusing the furniture that is currently in the w33 cafeteria.

This is one option for the cafeteria:

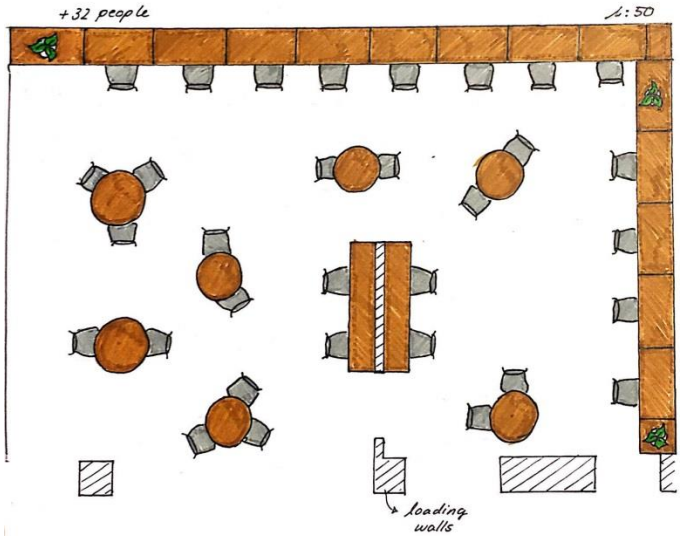


Figure 32. Non scaled sketch of the cafeteria (see scaled ones in appendix 6.7)

3.4.3 Building conditions

3.4.3.1 Walls

After thinking about the distribution and the walls that were needed, a calculation was done in order to know how many meters of wall were required. These measures are taken from the plan (appendix 6.6):

6.6 length m *3.3m height + 0.8m length*2.3m height*2 + 1.78m length*2.3m height*5 = 21.78m2 + 1.84m2*2 + 4.094m2*5 = 45.93 m²

Table 13. Minimum weighted standardized acoustic insulation required between common school buildings

Minimum weighted standardized acoustic insulation required between common school buildings						
DA = Dnt,w+C (dB)	Broadcasting room					
Reception room	Classroom	Study room	Indoor recréation area	Toilets	Passaways used during courses	Meeting space
Classroom	44		56	48	36	44
Study room	48	40	60	52	36	44

Walls regulation:

To separate all rooms' isolation walls will be introduced. There are certain regulations that must still be obeyed as this is an educational facility.

In this case, the team need to separate the large classroom, the study room and the cafeteria. The cafeteria will be in the "indoor recreation area" category to maximise the quality. So, there will need to be a wall between:

-The classroom and the study room

-The classroom and the cafeteria

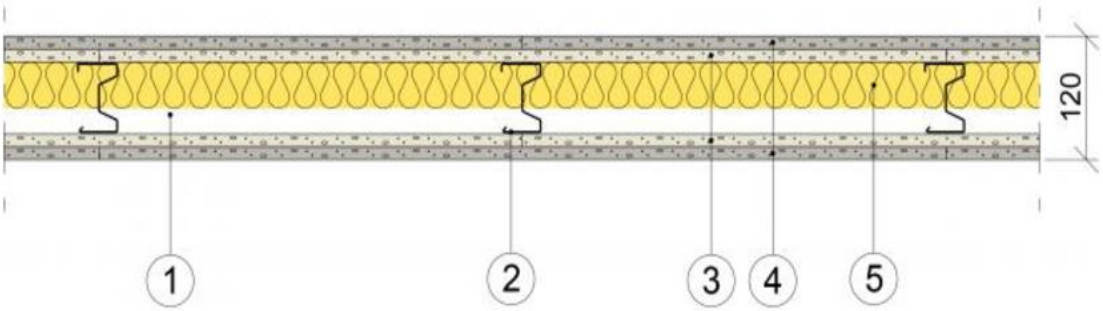
-The study room and the cafeteria

To choose the wall, the legislation must be taken into account. To increase the quality of the classroom and not have too many different walls, the group choose to take the same one to separate classroom/cafeteria and study room/cafeteria.

So to meet the requirements two different walls were chosen, one between study room and classroom and the other between studying place and cafeteria. The best quality plaster walls were chosen with isolation characteristics.

Study room/classroom:

This wall must adsorb 48dB so a wall with the right capacities is required. Due to this, the group chose the Gyproc XR 70/70 (450) RN-NR M45 (*Gyproc XR c 450 med Gyproc och Gyproc Normal*)



XR16R

1. Skena Gyproc AC 70 som kantprofil (i golv, vägg och tak)
2. Regel Gyproc XR 70, c 450 mm
3. 12,5 mm Gyproc Gipsskivor
4. 12,5 mm Gyproc Robust[1)]
5. Min 45 mm mineralull

Figure 33. Wall composition XR16R.

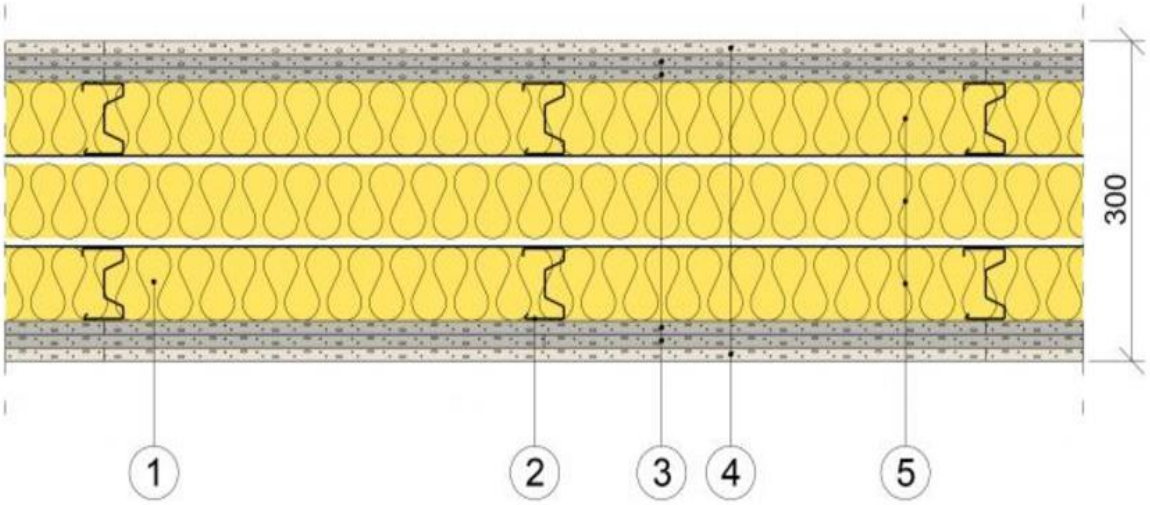
This wall is composed of different part with an acoustic panel isolation, normal plasterboard and robust one to keep in the time, and one metal frame. You can see above it scheme and below it characteristics.

Table 14. Wall XR16R characteristics.

System id	3.1.1:107
Brandklassificering / Fire classification	EI 60
Ljudklassificering / Audio classification	R'w = 48-52 dB
Max vägghöjd, mm / max wall height, mm	4700
Väggtjocklek (mm) / wall thickness, mm	120
Prisindex / price index, €/m²	194

Studying place/cafeteria:

This wall must adsorb 60dB so a wall with sufficient capacities will be required. Due to this, the group chose the Gyproc XR 70/70 (450) RNN-NNR M190 (*Gyproc XR c 450 med Gyproc och Gyproc Normal*)



XR23R

1. Skena Gyproc AC 70x2 som kantprofil (i golv, vägg och tak)
2. Regel Gyproc XR 70, c 450 mm
3. 2 x 12,5 mm Gyproc Gipsskivor
4. 12,5 mm Gyproc Robust[1)]
5. 190 mm Mineralull

Figure 34. Wall composition XR23R

This wall is composed of various parts with 3 acoustic panel isolation, 2 normal plasterboard and a robust one to support two metal frame. You can see above the design and below it characteristics.

Table 15. Wall XR23R characteristics.

System id	3.1.1:112
Brandklassificering / Fire classification	EI 90
Ljudklassificering / Audio classification	R'w = 65 dB R'w + C50–3150 = 61 dB
Max vägghöjd, mm / max wall height, mm	3800
Väggtjocklek (mm) / wall thickness, mm	300
Prisindex / price index, €/m²	305

Walls costs:

The total cost will include materials and the costs of the worker.

First of all, the type worker hired will have to be determined. Workers are classified in distinct categories according to job description.

Table 16. Workers classification in Finland.

		1.3.2016
Palkkaryhmä I	Aloitteleva työntekijä	9,93 €
Palkkaryhmä II	Vähän kokemusta omaava työntekijä	11,28 €
Palkkaryhmä III	Aloitteleva ammattilainen	12,44 €
Palkkaryhmä IV	Ammattilainen	13,78 €
Palkkaryhmä V	Kokenut ammattilainen	15,06 €
Palkkaryhmä VI	Erittäin kokenut ammattilainen	16,17 €

In this case we choose the number IV, because "*Palkkaryhmä IV Ammattilainen : Työntekijä suorittaa itsenäisesti ja monipuolisesti töitä, jotka kuuluvat jonkin ammatin piiriin, tai suoriutuu itsenäisesti useamman ammatin piiriin kuuluvista töistä, olematta kuitenkaan missään em. ammateissa varsinainen ammattimies. Tähän palkkaryhmään kuuluvat perusammattitaidon omaavat ammattimiehet, kuten kirvesmiehet, muurarit, laattamiehet, sementtimiehet, elementtiasentajat, torninosturinkuljettajat, telineasentajat, kokeneet monipuoliset rakennusmiehet jne..*" [3]

Translation: "Pay Group IV Professional The employee carries out work independently and in a variety of ways that falls within the scope of a profession or performs independently of several professions, without being any professional in any of those professions. This category includes basic professionals, such as carpenters, masonry, planners, cement workers, element builders, tower cranes, racking installers, experienced diversified builders, etc..."

The price in the table is without the labour costs. The labour cost is 40€/h for one worker but two workers will be required for this installation so the price will be 80€/h:

Walls part and step	h/m²
Metal frame	0,14
Insulating materials	0,1
Plasterboard	0,32
Final cleaning	0,04
Painting	0,055

The group defined the working time for different parts of the walls and different steps. This table summed it up.

The next table will sum up the global cost and time to build all walls:

Walls	Study room/Classroom	Studying place/cafeteria	Total**
Need to be build (m²)	15,16	28,64	43,79
Materials price*(€)	2940,46	8733,68	11674,13
Time to build it (h/m²)	0,96	1,62	

[3] Extract taken from: RAKENNUSALAN TYÖEHTOSOPIMUS URAKKAHINNOITTELUINEEN 2016–2017

Time to build it (h)	**14,47**	**46,25**	**60,72**
Labour cost (€/h)	**80**		
Total labour cost (€)	**1157,99**	**3699,64**	**4857,64**
Total price (€)	**4098,45**	**12433,32**	**16531.77**
* Without the paint ** Without taxes			

In Finland the working time is average 37.8 hours by week. The wall construction will usually take an average of one week and three days. Moreover, if taxes are added a further 24% will have to be accounted for, so the price will be on average 20 500 €.

3.4.3.2 Floor materials/installation

When designing a classroom, an essential element is choosing the correct floor material. There are actually a few factors that need to be considered when deciding upon a floor material. The type of floor implemented within a design can affect sound insulation, fire safety, general safety and of course the aesthetics of the room.

Before deciding upon a final material, there will be comparison and discussion in order to find the best solution. Looking into different options will be a key component of the research. Analysing the price and the specification of the materials will allow the group to determine the most suitable choice.

Types of classroom floors

There are many types of floor materials that are acceptable for a classroom, so the best option will be explored and found. Retailers specialize on flooring for many applications, so these products will meet all safety requirements. The main thing that will be considered will be the aesthetic properties of the floor. This is due to the fact that the retailer will already be able to confirm that the product is deemed safe and has been manufactured relative to the legislation. There are many different floor materials that are acceptable regarding safety legislation, so the choice of flooring will become subjective to the designer. The type of material chosen will depend on the application of the room as well as the interior design. Different materials will have properties that are appropriate for different applications.

Types of kitchen flooring

When deciding upon flooring material for a kitchen, there are a few specific factors that must be addressed. The material must be water resistant and be able to withstand objects falling on the ground that could cause damage. Also, the material must be stain proof and easy to clean as a lot of food and liquid will come in contact with a kitchen floor.

Laminated flooring

Laminated flooring is one of the most popular choices on the market. It is very easy and fast to install and can be purchased almost anywhere. This is because modern laminated flooring has a click/lock or fold/lock design that allows planks to be slotted together very easily. The planks are generally constructed from soft particleboard meaning they can be cut very easily. Laminated flooring is very easy to clean compared to carpet and other materials, using a dam mop would be sufficient. If the installation is conducted properly, laminated flooring has water resistant properties. When heavy objects are dropped on certain floor materials dents can occur and this is also true with laminated flooring. However, compared to other materials, laminated flooring can resist allot of impact meaning that dents will only occur with allot of force which is unlikely to happen in a classroom setting. Nevertheless, there are a couple of draw backs. Laminated flooring does have some water-resistant properties but if a pool of water is left for a long time or water is consistently on the floor, the material can be damaged so this type of material is not suitable for kitchen applications.

Figure 35. Laminated floor.

Carpet flooring

Another hugely popular flooring choice is carpet. This material is a good option as the design and colours available on the market are endless. Carpet flooring can be used in almost any design. The material is flexible and can be installed in almost any shaped room. The material is soft on the feet and if chosen correctly is aesthetically pleasing. As well as colour and design, carpet comes in a wide range of textures. Depending on the type of carpet used, the price is generally not extremely high and installation is easy and quick.

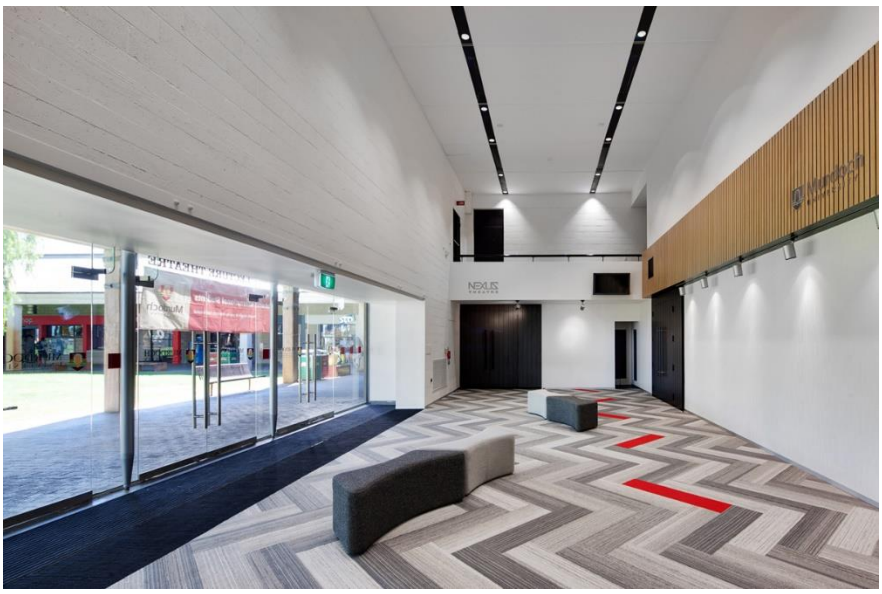


Figure 36. Carpet floor.

There are a couple of drawbacks. The main drawback is that carpet can be easily stained. This is acceptable in a classroom where eating food and drinking coffee or coloured drinks is prohibited. Also, compared to other materials on the market, carpet is not very wear resistant.

Ceramic flooring

Ceramic flooring has a lot of advantages. This material is aesthetically pleasing and comes in many different forms. There are so many options that can be selected so the type of ceramic flooring can be subjective to the type of design. One of the biggest benefits of this type of flooring is that it is very water resistant if the installation is performed correctly. This material is very durable and tough so will last for a long amount of time without receiving considerable damage. Also, installation is fairly easy and fast.

However, there are a couple of drawbacks to be considered. This type of material is very hard and unforgiving so if an individual was to fall on this type of floor, the risk of injury would be higher as opposed to other flooring. Also, ceramic flooring has very little heat insulating properties, if the weather is particularly cold then heat will be lost within the room.

Figure 37. Ceramic floor

Hardwood flooring

Hardwood flooring has many benefits. This option is very aesthetically pleasing and comes is many unique styles. Hardwood flooring is generally very durable and lasts a long time with little maintenance. Unlike some materials, this option has fantastic water resistant properties.

Despite being expensive, the minimal maintenance requirements and durability make this material a worthwhile purchase.

Although the cost is justifiable, hardwood has high initial costs.

Figure 38. Hardwood floor.

Prices per square meter

Each different material will vary in price so it is important to conduct a price analysis in order to weigh up the best option. Although some options will be lower in price the quality and practicality of the more expensive options may outweigh the cost saving benefits.

Laminated flooring – 9.50 – 14 euros per square meter

Carpet – 7 – 30 euros per square meter

Ceramic – 20 – 35 euros per square meter

Hardwood – 25 – 50 euros per square meter

The prices displayed above show the average range of prices for different flooring. This price list is only an indicator but can provide a base level of cost indication.

Examples of different laminated flooring

The option[4] below shows a type of laminated flooring that is £11, 99 (14.20 euros) per square meter.

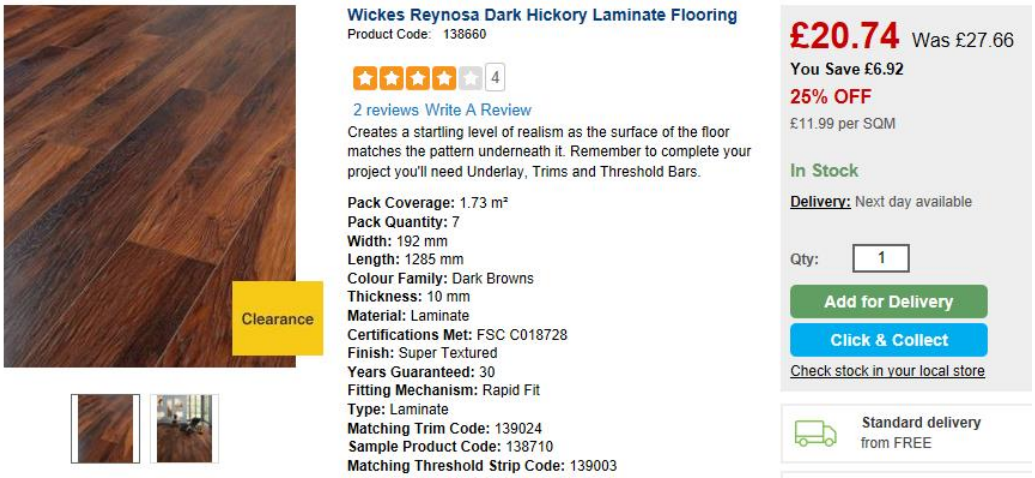


Figure 39. Wood Flooring option taken from webpage.

This is an option[5] of some lower range laminated flooring at £6.35 (7.52 euros) per square meter.

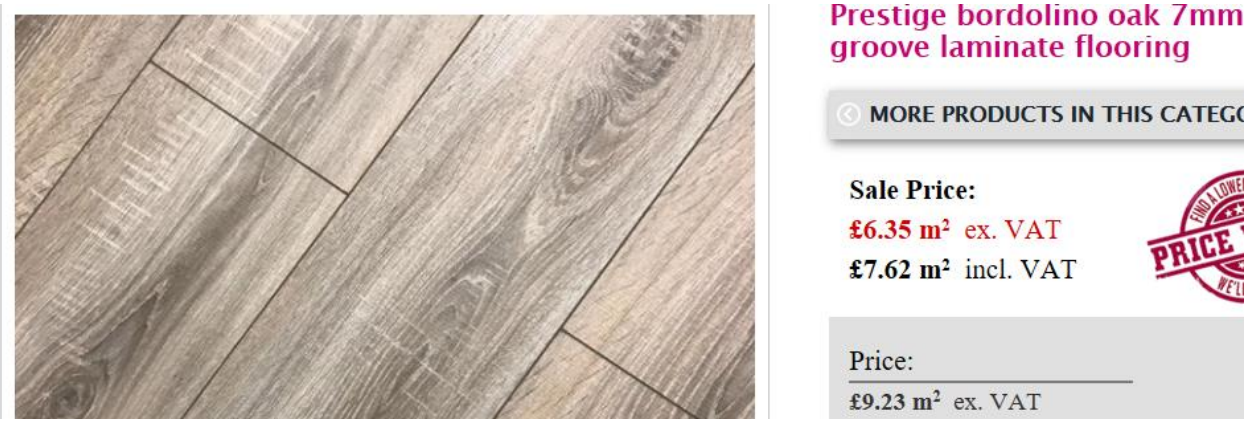


Figure 40. Wood Flooring option taken from webpage.

[4] Option taken from: http://www.wickes.co.uk/Wickes-Reynosa-Dark-Hickory-Laminate-Flooring/p/138660

[5] Option taken from: http://www.floorsdirectltd.co.uk/Prestige-bordolino-oak-7mm-V-groove-laminate-flooring.html

Examples of carpet flooring

This option[6] shows carpet materials that are on the higher end of the market. The price is £42.99 (50.90 euros) per square meter.

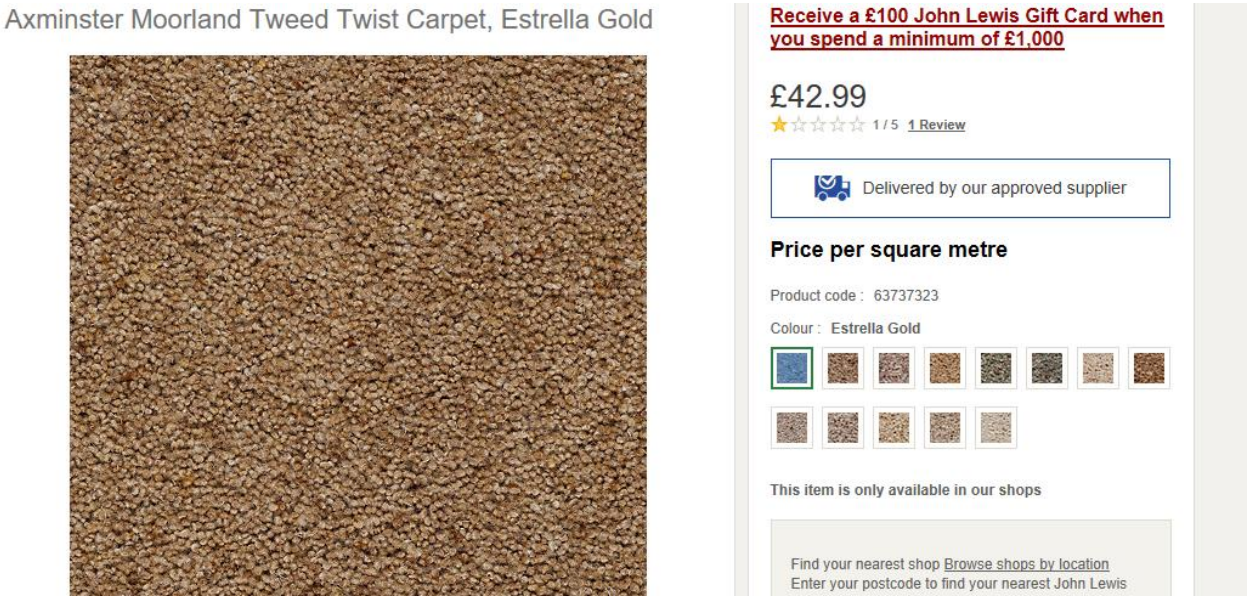


Figure 41.Carpet Flooring option taken from webpage.

This option[7] displays some carpet material that is less expensive than the previous example at £24.99 (29.59 euros) per square meter.

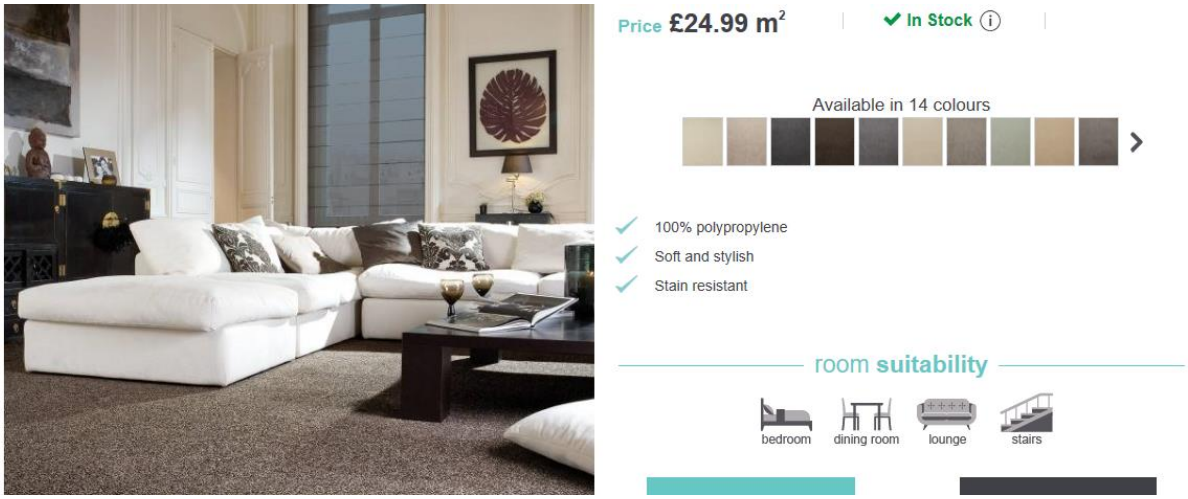


Figure 42.Carpet Flooring option taken from webpage.

[6] Option taken from: https://fi.johnlewis.com/home-garden/carpets-flooring/c700008863?rdr=1&zoneId=1

[7] Option taken from: https://www.carpetright.co.uk/info-centre/blog/professional-carpet-vinyl-laminate-flooring-fitters/

Examples of ceramic flooring

This option[8] shows some lower cost ceramic flooring that costs around £8.81 (10.43 euros) per square meter.

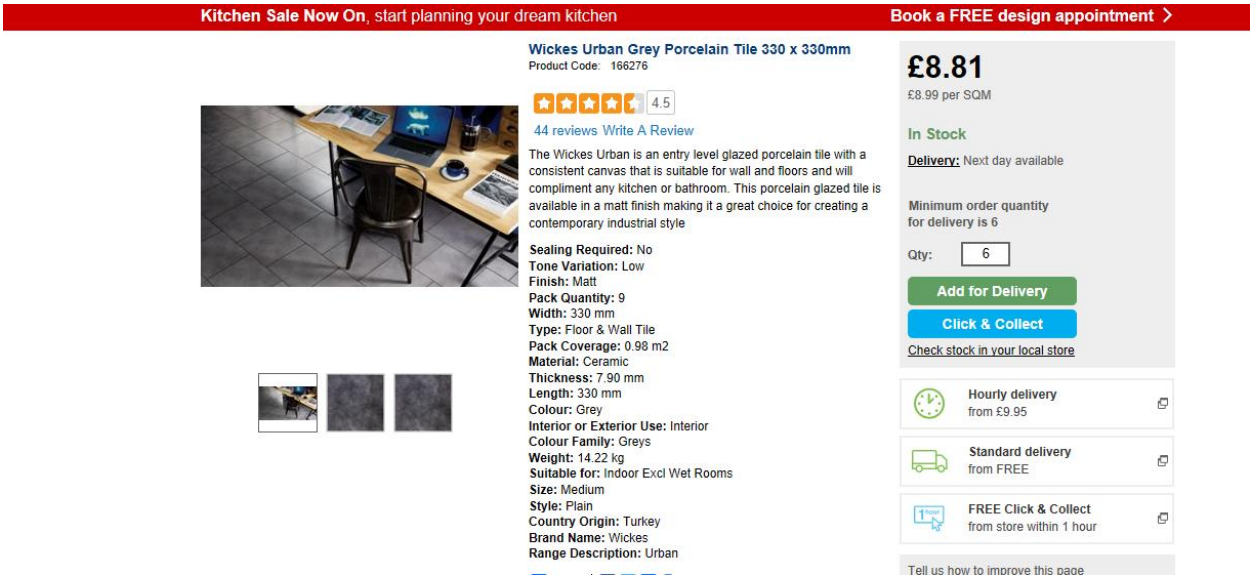


Figure 43.Ceramic Flooring option taken from webpage.

This is another option[9] of ceramic flooring at around a similar price at £8.95 (10.60 euros) per square meter.

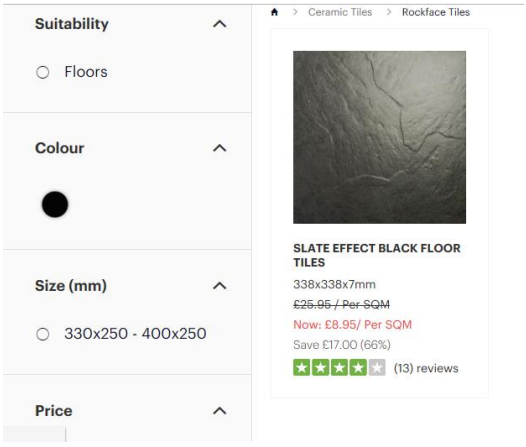


Figure 44.Ceramic Flooring option taken from webpage.

[8] Option taken from: https://www.carpetright.co.uk/info-centre/blog/professional-carpet-vinyl-laminate-flooring-fitters/

[9] Option taken from: http://www.homebase.co.uk/en/static/your-guide-to-buying-floor-and-wall-tiles

Hardwood flooring examples

Below is an option[10] of some hardwood flooring at the lower end of the price spectrum at £29.99 (35.51 euros) per square meter.

Figure 45.Hardwood Flooring option taken from webpage.

Price of floor installation

There are certain costs that must be taken into account and stated for the purpose of the project. As well as material costs, labour costs must be accounted for. This means the price of the material will be added onto the costs of the labour, and then a total will be available.

Labour costs – the labour costs have been calculated at 4.6 euros per square meter of flooring installed.

Choosing the best option

As stated previously, choosing a floor material is dependent on the application of a room. There are certain practical issues that can dictate what material is used. Likewise, the aesthetic properties of a room can dictate the option chosen.

Large classroom

For the large classroom, the chosen material will be hardwood. Hardwood is excellent for this type of application. It is very durable, resistant to water damage and is aesthetically pleasing. This material will be perfectly suited to the design of the room as well as the purpose.

The type of hardwood that will be used is made by 'wickes' and costs 35.51 euros per square meter. This is the first option (below) presented and will be used because the material is high

[10] Option taken from: http://www.wickes.co.uk/Products/Flooring/Solid-Wood-Flooring/c/1000889

quality and the price is very reasonable. Laminated flooring would also be acceptable but the hardwood will last longer and require lower maintenance.

The large classroom is 18.13 meters long and 6.5 meters wide meaning the floor space is 117.8 Meters squared.

The material cost will be 117.8 * 35.51 = 4184.67 euros

The labour cost will be 117.8 * 4.6 = 541.88 euros

The total cost of the large classroom flooring will be 4184.67 + 541.88 = 4726.55 euros.

Teamwork room

The team work room is a small area that is designed for groups to work on tasks collectively. This room will be used for discussion and creative thinking so the environment should reflect this purpose. Carpet will be used in this room as it is the best suited material, or it can be hardwood as the large classroom as well.

If the decision is carpet, the chosen one is from 'carpet right' and will cost 29.59 euros per square meter. This is a good choice as it is high quality carpet that is in compliance with safety regulations. There are many available colours and the cost is low for this type of material. The option chosen is the second option presented previously.

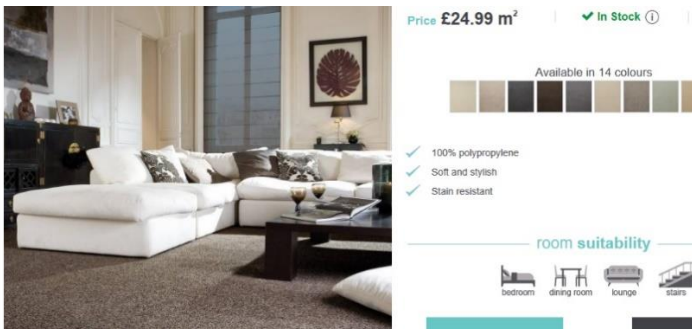


Figure 46.Teamwork room decision

The teamwork room is 8.81 meters long and 6.5 meters wide so the floor space is 57.3 meters squared.

This means the material will cost 29.59 * 57.3 = 1695.5 euros

The labour cost will be 4.6 * 57.3 = 263.58 euros

So, the overall flooring cost for the team room will come to a total of 1695.5 + 263.58 = 1959.08 euros.

Kitchen

When choosing a material that is suitable for a kitchen, as discussed previously a few factors must be considered. The kitchen material must be able to withstand food/liquid spillages

without being stained. The material must be easy to clean and fast to clean as well as having durable characteristics.

Therefore, best choice of material will be ceramic flooring as this type of flooring has all the correct characteristics for kitchen applications. The first option presented previously will be used as the kitchen floor material and is a product from 'wicks'. The price of this product is 10.60 euros.

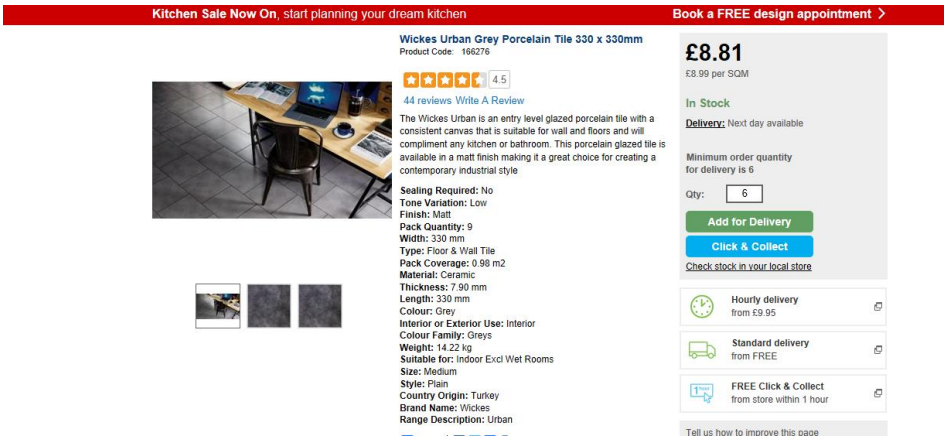


Figure 47.Ceramic Flooring decision

The area of the kitchen is 55.5 Meters squared so the overall material cost will be 10.60 * 55.5 = 588.30 euros.

The labour cost will be 55.5 * 4.6 = 255.30 euros.

The total cost of the kitchen flooring will be 588.30 + 255.30 = 843.60 euros.

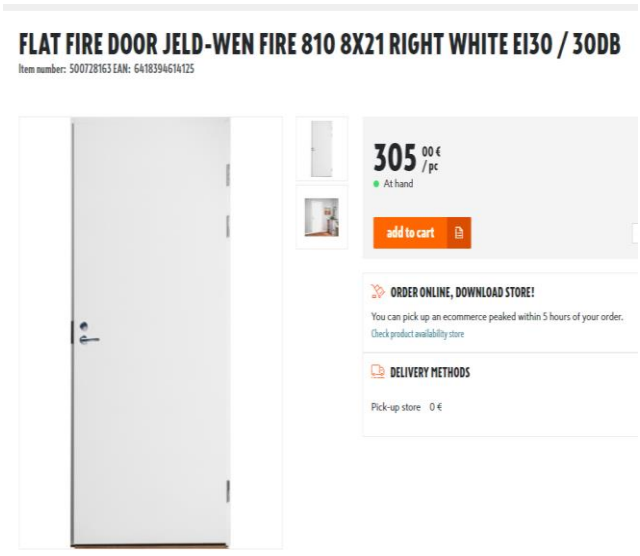
The total cost of the flooring will amount to 1959.08 + 4726.55 + 843.60 = 7529.23 euros.

3.4.3.2 Doors

As new walls are going to be built, the group need to add some doors. This door must respect the legislation, so includes disabled people, sound and fire. Taking this into account, the doors need to be at least 90cm wide and prevent fire and sound.

So according to this legislation, the door[11] below was chosen. The price is 305€ per door and comes from the same company as the walls.

[11] Door option taken from: http://www.jeld-wen.co.uk/inspiration/interior-doors/articles/fire-doors/



Information	Value
Packaging net weight	59 kg
Product packaging dimensions (depth, width, height)	212.0 x 81.0 x 12.0 cm
available in custom built	No
The fire door EI30 / Rw 38d	Yes
includes glazing	No
includes door frame	Yes
includes handle	No
Includes a lock housing	Yes
double door	No
rebated	Yes
water resistant	No
The sound insulating Rw of 30 dB	Yes
Thickness (cm)	5
Color	White
Door model	Internal door
Handedness	Right
Type	smooth door

Figure 48. Jeld-Wen door photo and characteristics.

The set includes a 50 mm thick rebated fire and sound insulating door leaf, the lock body LC190, fire and sound concentrated *massiivipuukarmi* 42 x 92 mm, 3 *nostosaranaa* (110 x 30) as well as fire and sound concentrated lacquered oak threshold.

In total 3 doors are required and the door cost will be average 1000 € with the labour cost.

3.4.3.3 Sound dispersion

Sound, by definition, is air vibration and it can be defined by two important things: its frequency (Hz) and its volume (dB). The human voice during the delivery of a class or in a conversation is between 60 and 80 dB. So here is showed how decibels sound depending on the amount:

Table 16. Relation between dB and human hearing

0 dB	**Normal threshold of hearing, and below no sound is perceived by man**
0 to 10 dB	Acoustic room
20 to 25 dB	Birds, insect, recording studio
25 to 35 dB	Whisper
35 to 55 dB	Classroom
55 to 75 dB	Sound outside
75 to 90 dB	Shout
90 to 110 dB	Nightclub
110 dB and more	Rave-party

The first option

This image shows how the sound would be distributed if the classroom was designed in accordance to the first or second sketching option:

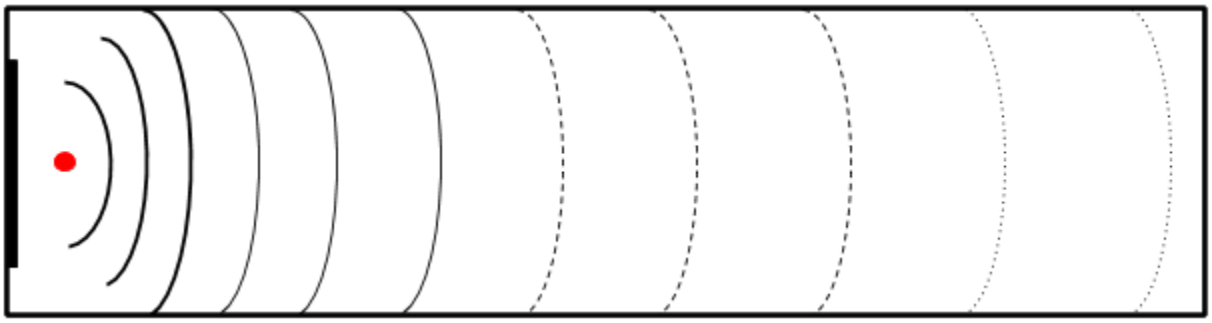
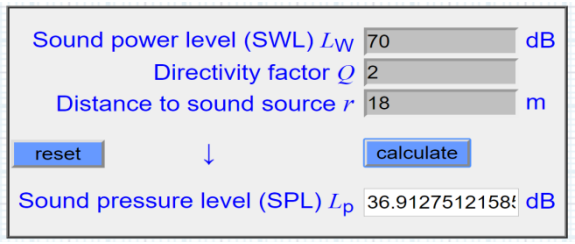


Figure 49. Sound dispersion in a horizontal room

The below image dislays the calculation of the decibels from where the red point is, which is the teacher talking from the front to the end of the class, at 18 meters:



So, if the teacher talks at 70 dB, a student seated at 18 meters in front of her would hear her talk with the same decibel level of whispering. That means that it's not a good option to build the class in this way.

The third option

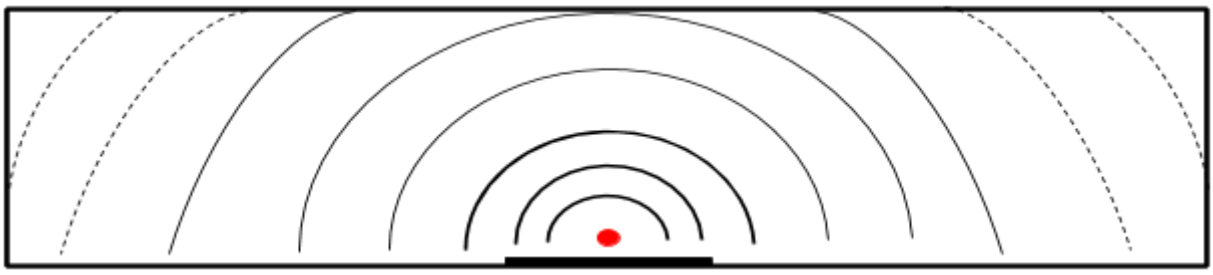
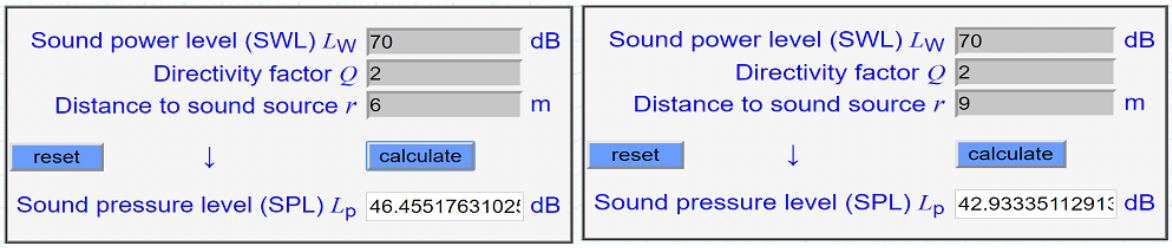


Figure 50. Sound dispersion in a vertical room



In this case, there is better sound at the back of the class because the length is reduced and as the propagation of sound goes around the space like a wave, it arrives to all the sides of the class.

During all this research the reverberation of sound has been neglected because if it's considered you need to multiply this sound by 2. So, the reverberation doesn't really increase the sound comfort. During normal speech the sound is around 60 dB, but becomes a whisper at around 35 dB so in the first option a microphone and speaker would have to be incorporated for the students at the back of the class.

Team work room:

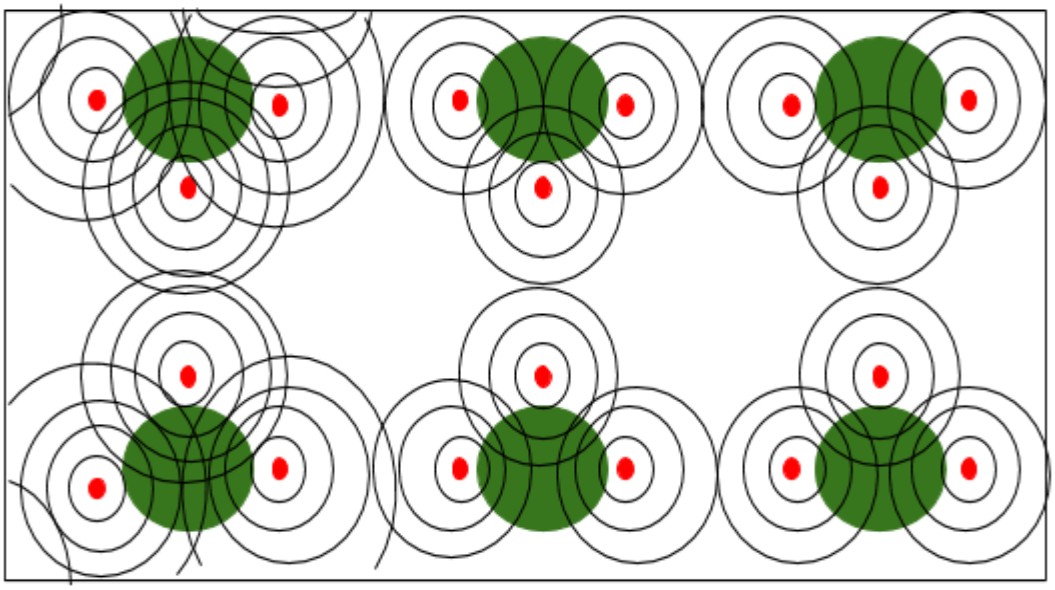


Figure 51. Sound dispersion in a teamwork room

As seen in this picture, if there are no separations between each team space, the sound can be overwhelming for the user and the space can become deafening because all the sounds will mix together and it's not the most efficient way to work in team. That's why it is important to add some removable walls inside the teamwork room.

3.4.4 Lighting and wiring

The group may need to consider the type of lighting used within W33 Building as the lighting should be designed to best suit the room. There are variables that need to be considered when designing a lighting system. Lighting systems can dramatically improve or negate to a room, so taking these variables into consideration will allow the group to create the optimal system.

3.4.4.1 Impact of lighting

Lighting can cause a significant impact to human sensory in both a positive and negative manner. In terms of positive effects, if lighting is installed correctly the room can be greatly enhanced. Perfectly applied lighting can increase user productivity as well as concentration. This is an obvious reason why lighting systems must be carefully designed.

On the flip side, when lighting is applied in an incorrect manner the room can be demised significantly. Lazy, careless lighting systems can lead to poor user concentration, strain to eyes and low visibility. Creating a lighting system that is optimal for the room's dimensions and design is a task that must be done carefully. When spending money on a room design, there must be some significant consideration to the lighting.

3.4.4.2 Design process

When designing lighting system, there is a process that can be followed to determine the most suitable lighting system.

The design process takes account of:

- The type of human activity that the lighting is required.
- The level of lighting that is required.
- The colour of the light relative to the color and materials utilized within the room. This can affect the views of certain objects within the room.
- How the light will be distributed within the premises.
- The effect of the lighting system on the users.

3.4.4.3 Lighting terms

Is useful to know which are the most important lighting terms because they are needed if a good lighting design is required. Is essential to know how light will behave depending on surfaces and colours:

Glare

Glare occurs when vision is either impaired or discomfort is experienced due to excessive brightness in certain parts of a person's field of vision compared to the brightness of their surroundings. There are two types of glare that need to be considered. The first type is 'disability glare' which is when discomfort or pain is experienced when a person is focusing

on a central object and the surrounding light is disproportionate to the light source of focus. When symptoms of glare aren't so severe but still cause irritancy, that would be categorized in the section of 'discomfort glare'. There are many causes of 'glare' such as lamps that don't have sheaths, screens that are too bright or even excessive natural light coming through a window. Glare causes discomfort and reduced concentration due to strained vision and ultimately distraction.

Reflectance

Reflectance is a measure of light or other radiation that comes in contact with a surface and is redirected. There are different types of reflectance that can be discussed. Reflectance can cause visual irritancy so will need to be addressed and counteracted to avoid this.

Specular reflectance

Specular reflection is when incoming light is reflected in a mirror type fashion from a surface. The incoming light bounces off the surface in a single outgoing direction. This type of reflection allows people to use light in a controlled manner. Accidental specular reflection is to be avoided as it can impair vision. This can happen when light bounces off glossy surfaces.

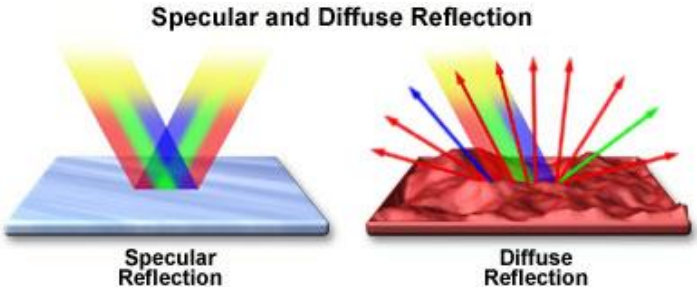


Figure 52. Specular and diffuse reflection example

Diffuse reflection

This is a type of reflection that is obtained from matt surfaces. Unlike spectacular reflection, diffuse reflection is when oncoming light comes in from a single direction, reflects off the matt surface then the outgoing light disperses from many different angles. Diffuse reflection abides by the laws of reflection but the different texture of the surface will cause a variation in the angle of the outgoing light.

Spread reflection

Spread reflection is a mixture of spectacular and diffuse reflection which comes from a mutual source. This type of reflection occurs when light is reflected from a rough surface such as metallic paint.

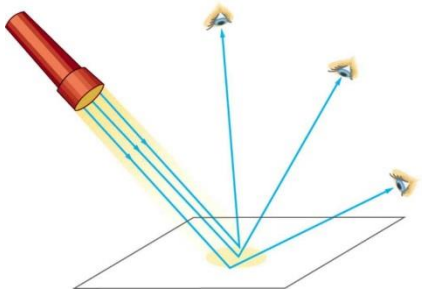


Figure 53. Spread reflection demonstration

3.4.4.4 Factors when creating a lighting design

The terms below describe reflective factors that need to be considered when choosing a surface material. These terms will become relevant later on in the design section of the report as they must be considered when discussing user comfort within a room.

Luminous flux

Luminous flux is referring to the quantity of light emitted in all directions per second and is measured in units of lumens. One lumen is a measure of luminous flux that is equal to 1 candela within one unit of a special angle. This could also be called one steradian.

Luminous intensity

This is a measure of the wavelength weighted power emitted by a light source in a certain direction per unit solid angle, based on the luminous function, a standardized model of sensitivity to the human eye. The SI unit of luminous intensity is the candela (cd), an SI base unit.

Illuminance

This is the quantity of luminous flux per unit area.

Luminance

This is the intensity of light emitted from any given direction from a surface per unit area.

Colour rendering

This is a measurable quantity of a light sources ability the reveal colours of an object in comparison to a natural light source.

Colour Temperature

This is basically a measure of light colours. There is a chart that can be used to see different spectrums of light colour. We can see in this scale the colour temperatures reflected on Kelvin:

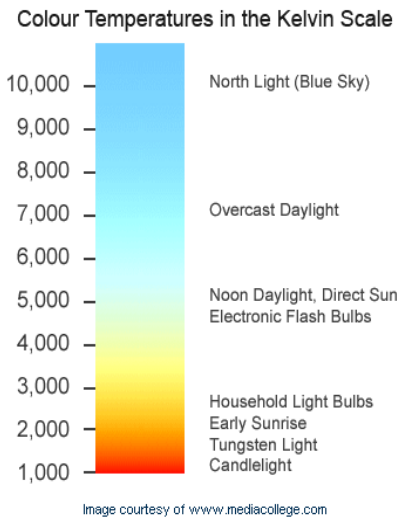


Figure 54. Colour temperatures in the Kelvin Scale

Lux

Lux is basically the amount of luminance within a given surface area, one lux is equal to one lumen per square meter. The level of Lux within a room will change depending on how much light is required. As different rooms have different uses, the level of lux can be dramatically diverse. If dangerous work is taking a place, a high quantity of lux will be required so that high visibility is present. On the other hand, if a room is supposed to be used for relaxing, the level of lux will be low.

The below table demonstrates how lux can differ depending on a room's application.

Table 17. Table showing different levels of lux required in different settings

Residential Property			
ROOM	LUX LEVEL*	RECOM-MENDED LIGHTS	RECOM-MENDED SPACING
Alfresco	70	D900 55°	2.5m
Bathroom - General	150	D900 55 °	1.5m
Bathroom - Vanity Basin	500	D900 45 °	1m
Bedroom - General	150	D900 55 °	2m
Bedroom - Dressing Area	300	D900 45 °	1.8m
Dining Room - General	100	D900 55 °	2m
Dining Room - Dining table	200	D900 55 °	2m
Hallways	40	D900 55 °	2-2.5m
Kitchen - General	300	D900 45 °	2m
Kitchen Bench - Task Area	600	D900 45 °	1m
Laundry	300	D1000 55 °	1.8m
Stairs - First Story Roof to Ground Floor	80	D900 45 °	1m
Stairs - Landing	80	D900 55 °	1m
Study - General	100	D900 55 °	2m
Study - Desk	320	D900 55 °	1.5m
Theatre Room	100	D900 55 °	2m

Commercial Property			
ROOM	LUX LEVEL*	RECOM-MENDED LIGHTS	RECOM-MENDED SPACING
Classrooms	240	D900 55°	2m
Electrical - Jewellery work	800	D1000 45°	0.75m
Entrance Halls - Foyers	160	D900 45°	2m**
General - Office General	100	D900 55°	2m
General - Office Desks	320	D900 55°	1.8m
Hallways	40	D900 55°	2-2.5m
High tolerance work stations	600	D1000 45°	1.8m
Hospital treatment rooms	400	D900 45°	1.5m
Laboratories	360	D1000 45°	1.8m
Stairs - First Story Roof to Ground Floor	80	D900 45°	1m
Stairs Landing	80	D900 55°	1m
Toilet Cubicles	40	D900 55°	2-2.5m

3.4.4.5 Requirements

Within the classrooms there are certain conditions that must be present for learning and teaching to take place at an optimal level. As mentioned previously, lighting can impact a room significantly so deciding on an acceptable level of lighting must be done.

The first thing to consider is the level of lux needed within the premises. After conducting research, it is apparent that 250 lux is the minimal acceptable level and 500 lux is considered optimum. Seen as the room is being designed for optimal function, 500 lux will be the required level.

Also, to determine the quantity of lumens required, the area of the room must be calculated. This can be done with a very simple equation:

$$Area = Lenght \cdot Width$$

After this calculation is done the number of Lumens (lm) required can be calculated using another very simple equation:

$$lm = Area \cdot Lux$$

Once the quantity of lumens is determined, the number of luminaires or lights can be calculated. They must be distributed in the correct manner to ensure the users have an even spread of light throughout the room.

As the largest room, will be used as a lecture room, it must have adequate lighting. For this to be achieved, the lux must be around 500 so calculations must be done to estimate if the rooms lighting will be sufficient.

First of all, the area must be calculated. The image below shows the main room along with basic dimensions.

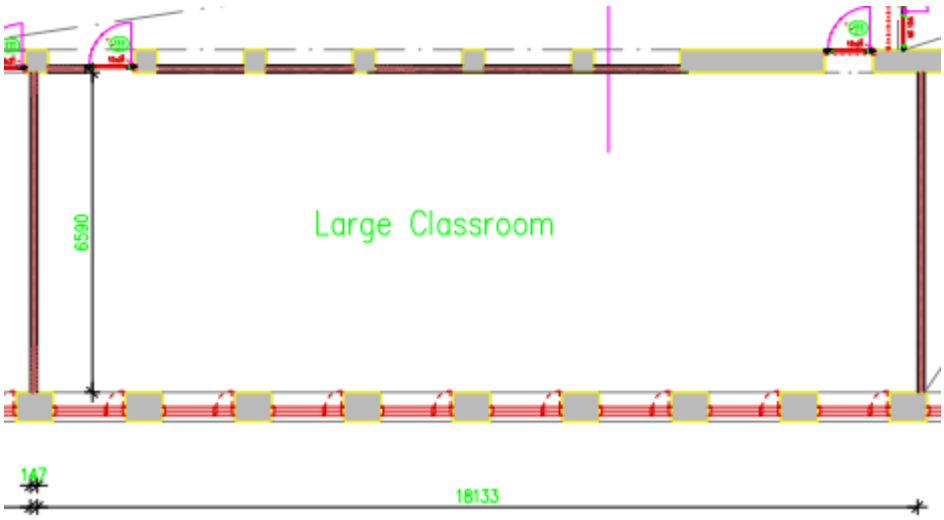


Figure 55. Large classroom measurements

Having the measures, next calculations are done:

Area = 18, 13 · 6, 59 = 119, 5 m^2

The number of required lumens = 119, 5 · 500 = 59738, 35 lm

Number of luminaires within the room = 12-10

lm/ number of luminaires= 59738.35/10 = 5973.8 lumens per luminaire.

So, each luminaire must produce equal or slightly more than 6000 lumens.

For the teamwork room:

TW room= 53 m2x 500 lux=26500 lm/ 4 bulbs= 6625 lm/bulb

Regarding the small cafeteria, the area for the eating part is 55 square meters and the kitchen is smaller, 48 square meters. If it's supposed that the lux for the kitchen is 500 lux and for the eating part is 300 lux:

Kitchen = 48m2 x 500 lux = 24000 lumens/ 4 bulbs= 6000 lm/bulb

Eating room = 55 m2 x 300 lux=16500 lumens/ 4 bulbs= 4.125 lm/bulb

3.4.4.6 Light selection

The below image shows a luminaire for the main room, teamwork room and the kitchen, that will provide a suitable quantity of lumens for the room. If these bulbs are installed the lux will be in access of 500 lux which will provide the room with optimal lighting in the tree of these cases.

Figure 56. Bulb decision

Table 18. Bulb specifications

Product Specifications - Quick Reference				
Input Voltage: Dimmable:	120-277 Volt AC NOT Dimmable		Dimensions: Bulb Base:	3.66" Diameter x 10.13" Long E26 Medium Base
LED Color:	5000 Kelvin		Replaces:	Up To 250W MH or HPS
Initial Lumens: Lumens per Watt:	6,500 Lumens 116 Lumens/Watt		Beam Angle: Rated Locations:	360 Degrees, Omnidirectional Dry or Damp

The specification shows that the selected bulb will produce 5000 K (Kelvins) so this is another reason why this bulb was selected. This number will provide the correct colour for a learning environment. The image below will shows a scale of different lighting colours depending on the number of Kelvins.

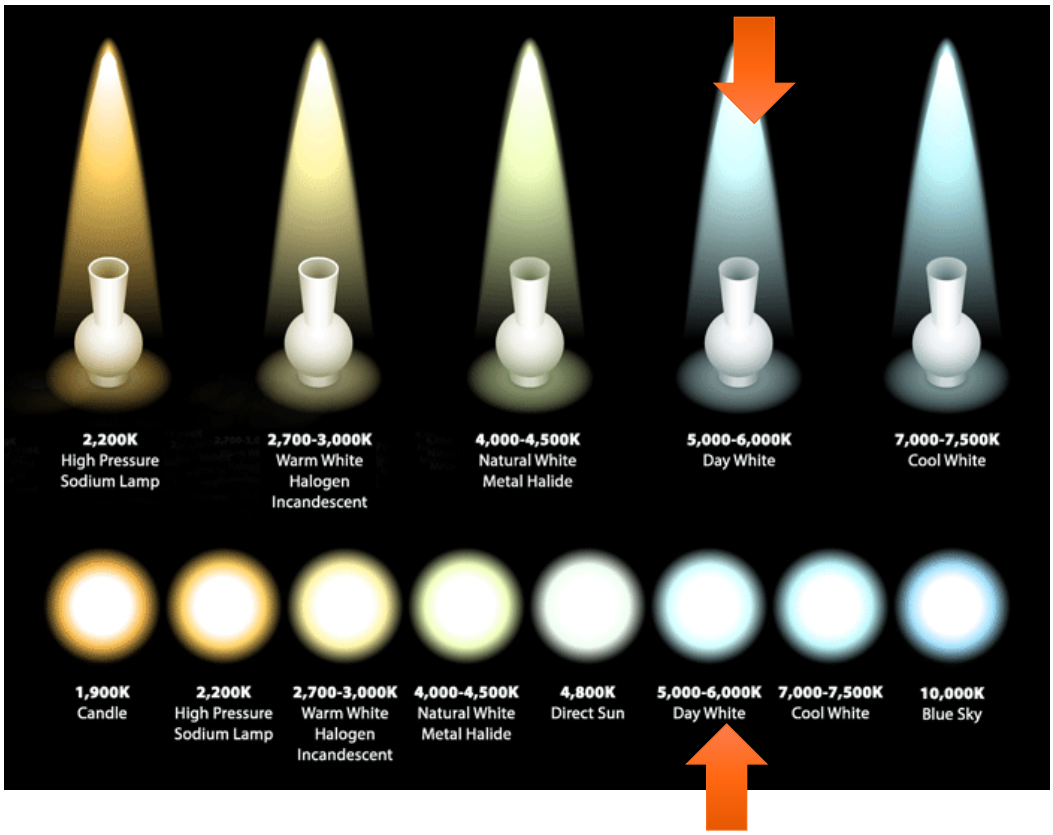


Figure57. The figure shows the skill of different lighting temperatures

It's marked with orange arrows the kind of colour temperature that we would have inside the room. This temperature is the best one to have inside a studying room as it's quite light and it allows concentration.

The team thought that would be a good idea to reuse the lamps remaining nowadays in the w33 cafeteria for the new cafeteria as the light temperature is quite appropriate.

3.4.4.7 Price of lighting

When purchasing more than 7 bulbs, the individual price per luminaire becomes $79.77, so 20 bulbs will cost $1595.4 which is the same as 1483.72€.

The running costs of these lights will need to also be taken into consideration. There is a basic formula to determine the kW hours used:

$$kWh = \frac{Device\ Wattage \cdot Hours\ used}{100} \cdot number\ of\ lights$$

As the room it's supposed to be lightened for 7 hours a day:

$$kWh = \frac{54\ Watt \cdot 7hours}{100} = 0.378\ kWh \cdot 20\ bulbs = 75.6\ kWh\ per\ day$$

Considering that the university is open from Monday to Friday (5 days per week):

Per week = 75.6kWh · 5 days= 378 kWh

Per year = 378kWh · 4 weeks· 12 months = 18144 kWh

The Image below is an extract of the Vaasa Elektriska web page. This shows the price per kWh in Vaasa, Vaasa, Finland:

Distribution charge	cent per kWh
1 Nov.–31 Mar. Mon–Sat between 7:00–22:00	4.86 cent per kWh **
other times	1.35 cent per kWh **

The prices include 24% VAT.

** In addition, a charge for electricity tax will be added to the distribution charge. From 1 Jan. 2015, electricity tax in tax category I = 2.253¢ per kWh + VAT 24% (= 2.79372¢ per kWh) and in tax category II = 0.703¢ per kWh + VAT 24% (= 0.87172¢ per kWh). Tax category II for electricity tax is intended for data centers and business premises where industrial production or professional greenhouse growing is practised.

Figure 58. Extract from the Vasa Elektriska homepage. Price of light per kWh

As seen, the price is 4.86 cent per kWh+ 2.27 cent (with taxes). Supposing that the price has not changed, it can be determined that the yearly cost for the electricity required for the lighting will be 0.0713€ * 18144 kWh = **1293,66 € per year**.

Distribution costs

When calculating the total electricity cost for a building, distribution costs must be taken into consideration. The price for the electricity per kW hour is not the only cost. The cost of distribution is significant and must be accounted for to provide an accurate cost total. Without considering the transmission costs, the figure presented will not be accurate or acceptable as a price indication.

The image below displays an extract from the 'Vaasa Elektriska' website[12] showing the transmission cost per kWh. This figure will be added to the final total.

Figure 59. Distribution charge from Vaasa Elektriska

So, this means that the transmission costs will be 0.0386€ * 18144 kWh = **700,35€ per year.**

Total electricity price

The price of buying 18144 kWh alone is **1293,66 € per year** and the cost of transmitting this amount of power is **700,35€ per year.** This means the total will be **1293,66 + 700,35** = **1994,01€**

3.4.5 Final selection

After exploring all the options presented, the team made their choice taking into consideration the costs, the legislation and the sound effect. Also, they have been considering the facilities and some decorative issues.

The final option about the teamwork room would be the one with the "Height adjustable table design". They made this choice because these tables allow to do different distributions and that can be a good idea if the class is needed for something else. Here we can see some other options about the distribution of these tables:

[12] Webpage: http://www.vaasansahko.fi/SV/Pages/Framsida.aspx

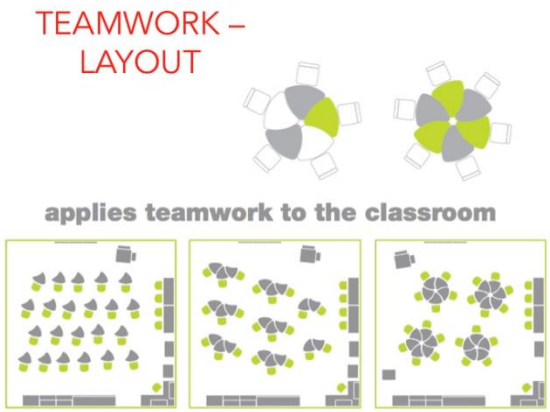


Figure60. Examples of the "Height Adjustable Table" distribution.

As it's been explained about sound dispersion, it's not feasible to do an extended classroom, so the design from sketch option 3 will be implemented. Even though this room can only fit 56 people (4 less than what was expected), it's a good option as the lecture complies with all the most recent regulations. This model is the chosen one, not only because of the sound dispersion and regulations but also because of the fact that in option 1 and 2, people standing at the back part of the classroom would not be able to see properly the board.

The cafeteria can be distributed in accordance with the previous sketch. It's a good option because it has the correct regulations and it can fit 32 people.

So the final result would be more or less like this:

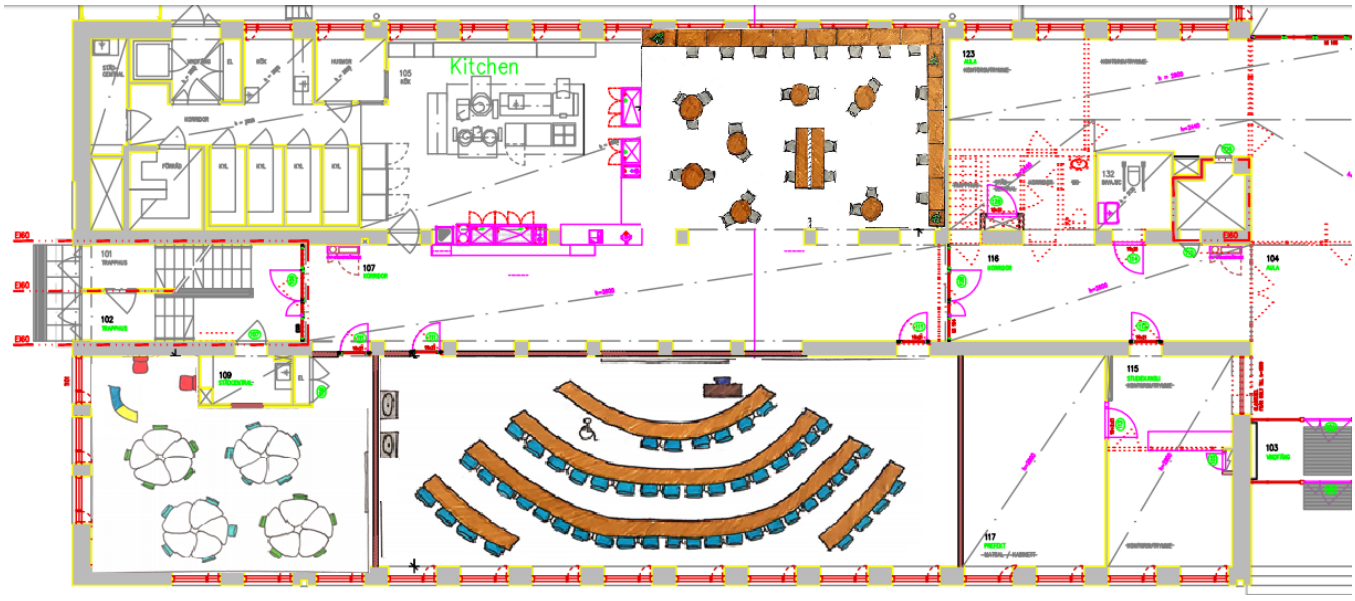


Figure 61. Final distribution mixing plans and sketches

Now, the team will use this sketch to build the 3D model.

3.5 3D Physical Model

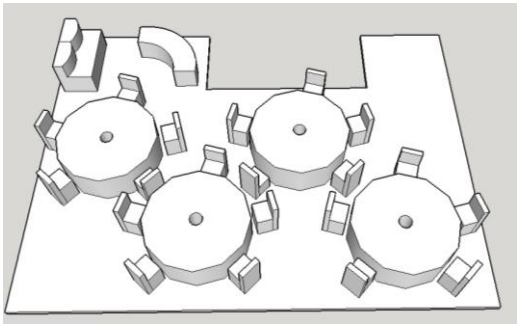
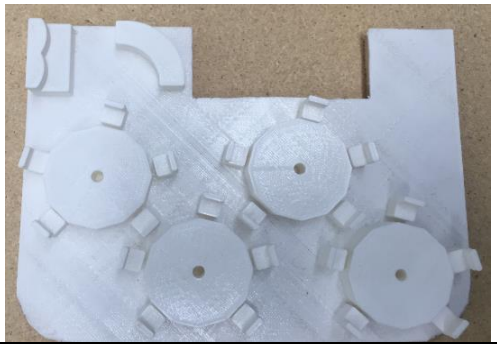
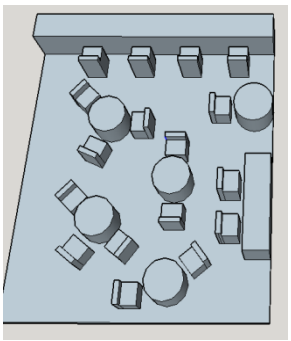
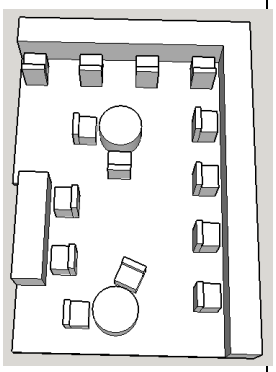
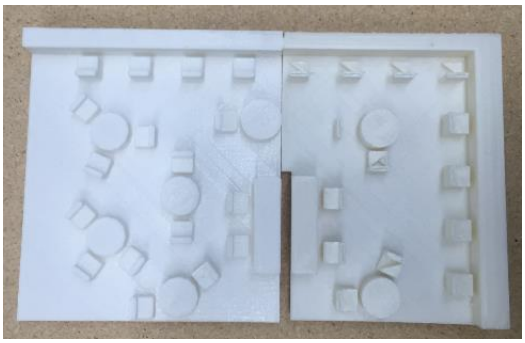
3.5.1 3D printing

As the most important part of the project is the result, the team wanted to implement the building structure with an idea of how the furniture could look like. First of all, the main purpose was to stick on the building's structure floor the sketches that were made before, but finally they chose the new technologies, the 3D printing.

The creation of a 3D printed object is achieved by using additive processes. In an additive process an object is created by laying down successive layers of material until the object is created. Each of these layers can be seen as a thinly sliced horizontal cross-section of the object that is wanted. In order to build these objects, first is needed to design a model with a 3D designing program, in this case SketchUp has been the chosen software to develop this task.

Once the team learned how to use it, they tried to reproduce (taking into consideration the regulations and measurements) the sketches in detail but, as the printers that they were allowed to use can't dive into details, they had to reconstruct the models into basic ones in order to print a non-detailed idea of how the room could look like.

Here we have an idea of how the basic reconstruction of the models and the result in 3D printing:

Virtual basic model	Result
Teamwork room 	
Cafeteria  	

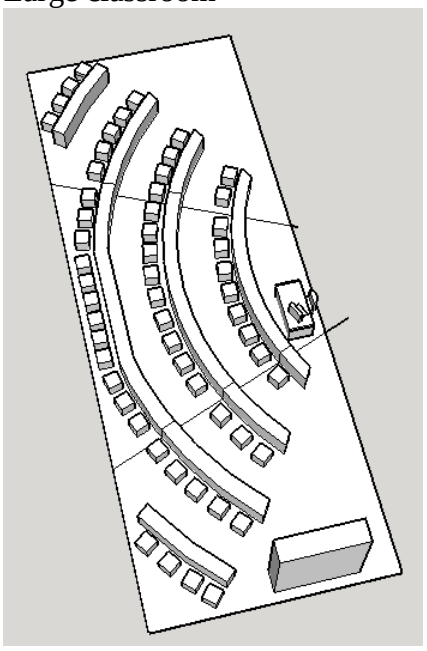
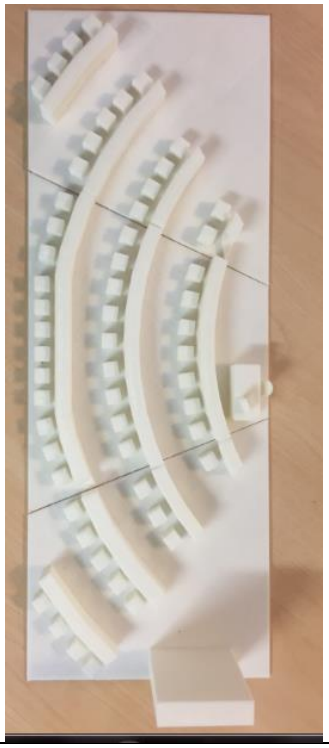
Large classroom 	

Table 1. Differences between virtual models and 3D printings

Some of the rooms had to be divided as they were too big for the printer's surface. For example, the cafeteria had to be divided into two pieces whereas the large classroom into three. It also needed to be divided because the more controlled you had the printing, the better the result would be. Sometimes, 3D printing can take a lot of hours so controlling the process becomes a hard task. If your pieces are separated into smaller ones, then it's easier to be taking care of the process in case that any failure could occur.

The lack of knowledge towards this technology has been a drawback in many moments, some of the rooms had to be printed more than four times, but finally the results came out. Another problem was the lack of filament. At the beginning, the group was using the *Wanhao* printer, which uses 2,85mm PLA filament, until it runned out of it (white colour), so then the main printer was the *Replicator (*1.75mm) which allowed the team to keep working in white colour as well as using different kind of plastic filaments, either ABS or PLA.

These two printers work in a different way. Each printer has its own software so the team had to deal with this situation. The advantage of the *Wanhao* printer in front of the *Replicator* is that its software automatically builds bridges for your pieces, meaning that when a surface does not have any support, this software builds it for you automatically

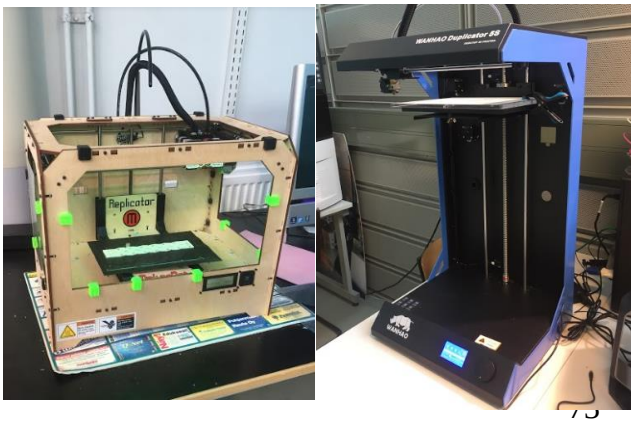


Photo 1. Left side, Replicator printer. Right side, Wanhao printer.

so that they don't need to be designed in advance. These bridges are easy to remove, that means that when the printing is finished they are effortless to take away and the piece looks just as the design made.

3.5.2 The structure

In this part of the project, the goal was to create a physical model that displays the design. The team thought about different options, but the best idea was to create a reproduction of the floor plan with 3D properties. It was created in a 1/50 scale so that the audience can visualize the different modifications that will be implemented within the w33 cafeteria.

The first task was to print the plan on A0 paper to achieve a scale described previously. (figure 62)

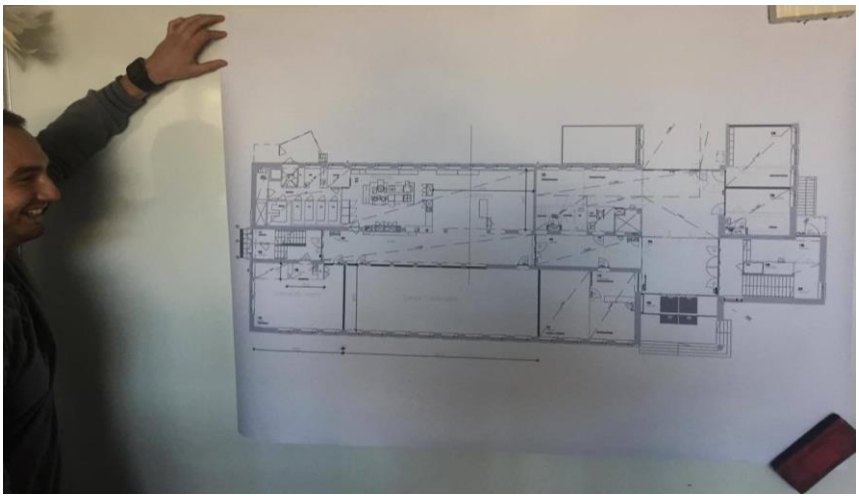


Figure 62. A0 Plan

All the stuff for the model was listed to know what needs to be bought and what can be found within the university. Referring to the plan, the different dimensions for the cardboard and wooden planks were defined for the different parts of the building.

Here is added the list of the materials used:

-Cardboard 5 mm depth

-Wood 12 mm depth

-Wooden planks 10x12 mm and 15x12 mm

-Wooden glue

-Pencil case

-Ruler

-Calliper

-White paint, paintbrush

Figure 63. Materials used for the structure

-Cutter

-Pair of scissors

-Clamp

-Rubber silicone

-File

Figure 64. Tools used for the structure

The first job was to cut a rectangle which will be the base of all the model. A reconstituted wooden board was used for that (figure 65).

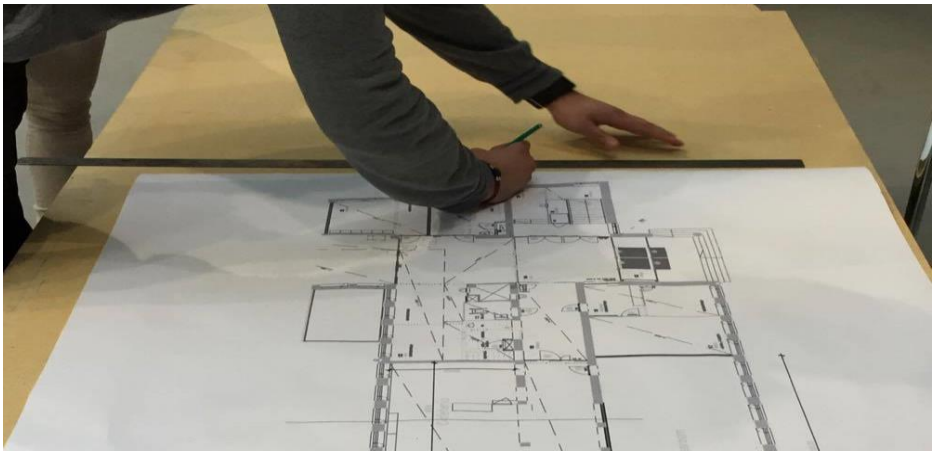


Figure 65. Cutting the base of the model.

After that, the plan was cut at the size of the building, in order to create the first floor due to the fact that the cafeteria is not at the level of the road. (Figure 66).

Figure 66. Cutting the plan of the model.

After the plan was cut, the cardboard was divided at the size required. Some plates were stacked to create the space between the ground floor and the first floor (figure 67).

Figure 67. Creation of the support for the plan.

Now the team began to create the exterior walls. The cardboard was cut to be the height of ground floor to the first floor but reduced the height between the first and the second floor.

After, windows, doors and architectural features were created. (Figure 68)

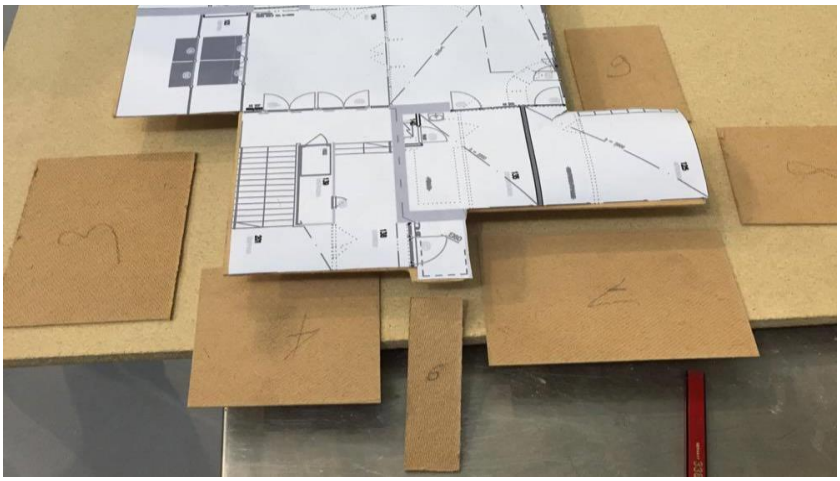


Figure 68. Base exterior walls

Finally the walls were thickened. (Figure 69)

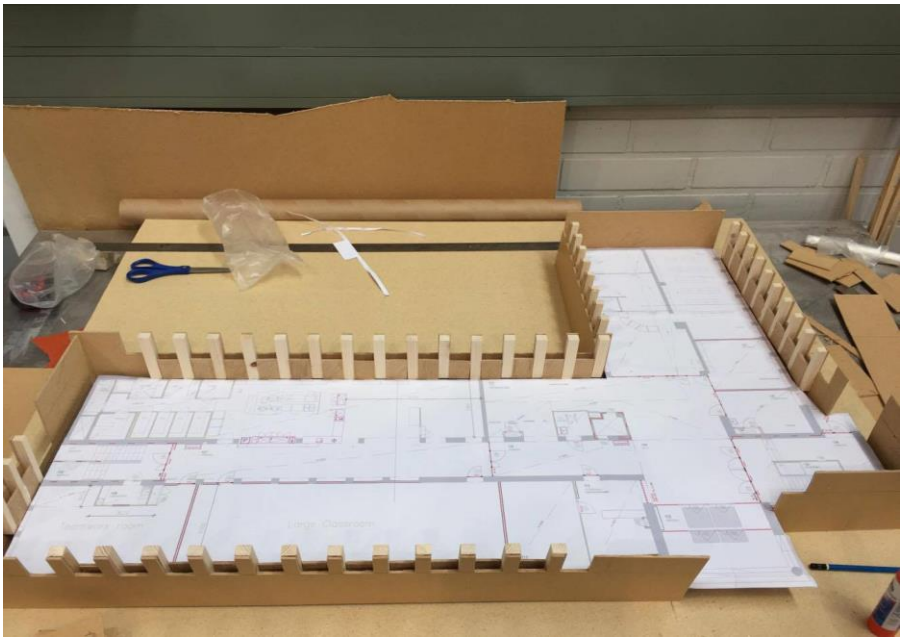


Figure 69. Thick walls.

The model continued to be build and a staircase was implemented within the design as shown below

Figure 70: Main staircase

Constructing the different rooms and pillars is the next step of the plan.

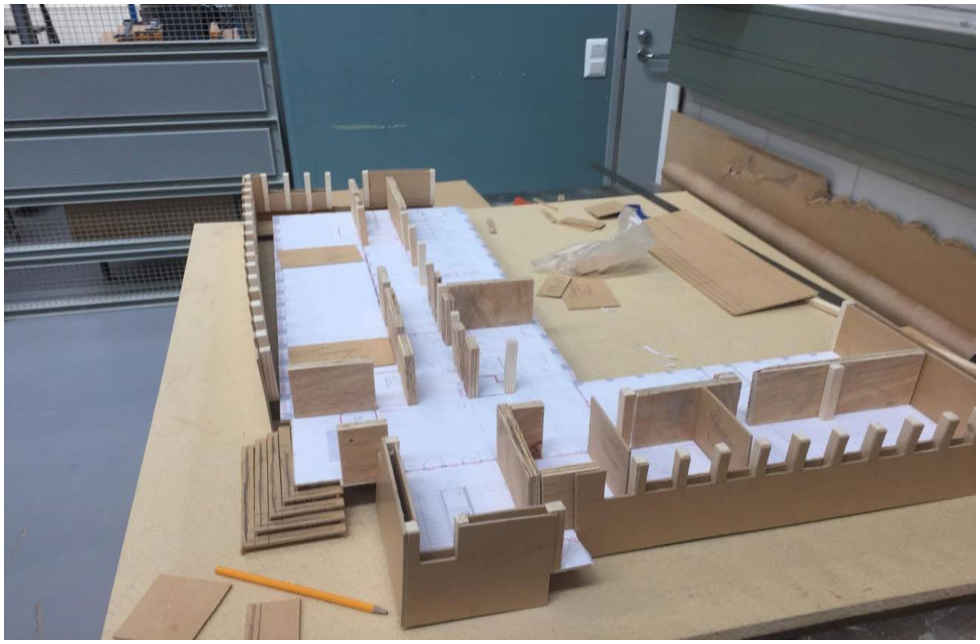


Figure 71: Room and walls created

Painting finishing of the Model

The final part of the model was the painting. All the walls and architectural features were painted in white giving the model a clean appearance. Only the base stayed with the original colour to create contrast.

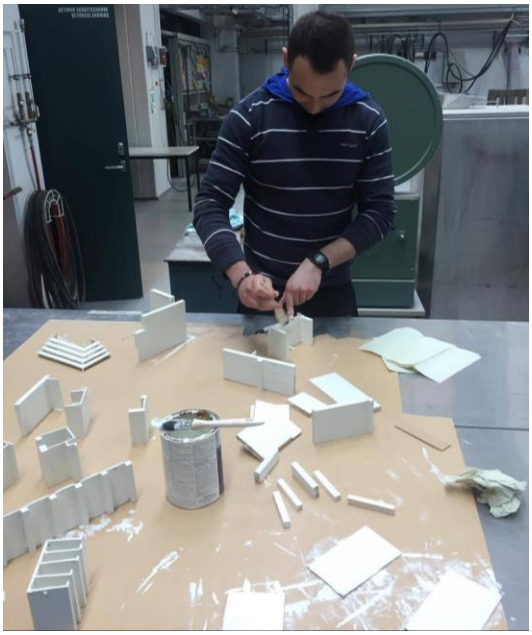


Figure 72: Painting all the walls

When all the different parts of the model were dry, they were stuck together. The team done some adjustments to be sure that the walls were sized appropriately.

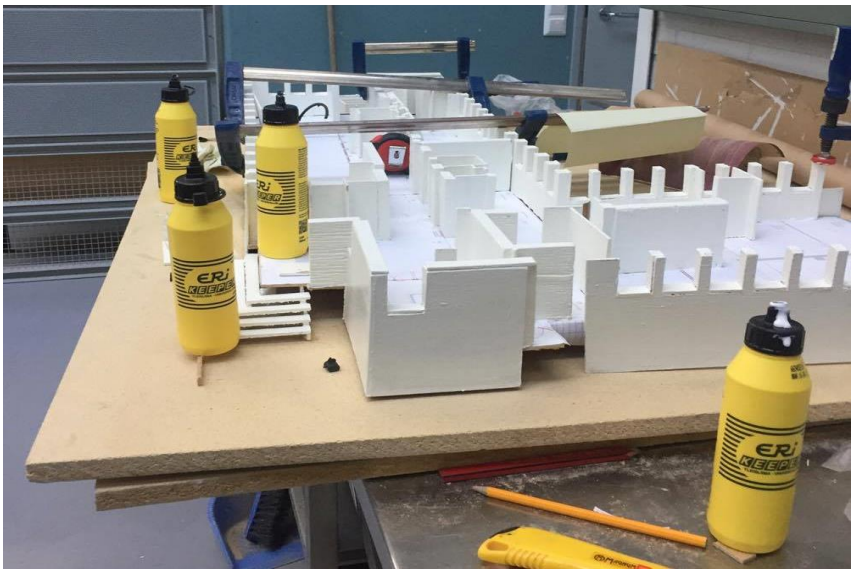


Figure 73: Sticking the model

Creation of the Logo in 3D

The project title will also be displayed on the 3D model. The team decided to reproduce the logo in 3D as this is the best option aesthetically. The material used was a brown wooden board and is 6 mm thick.

Figure 74. Physical logo

To complete the model, the 3D printed rooms were put in place. Some of the dimensions were slightly inaccurate so were cut to the appropriate size to ensure they will fit in the correct place. Finally, some wooden board was cut and stuck on the base of the 3D model.

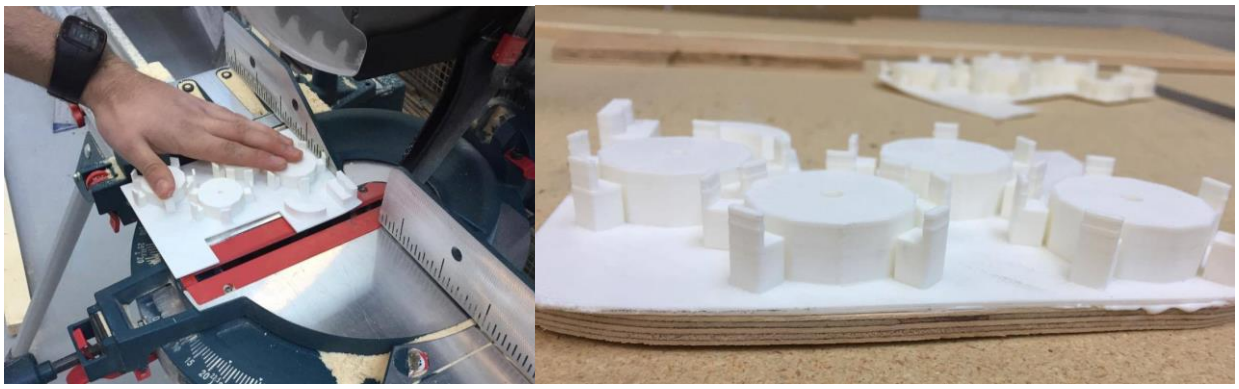


Figure 75. 3D printing improvements

And this is the result:

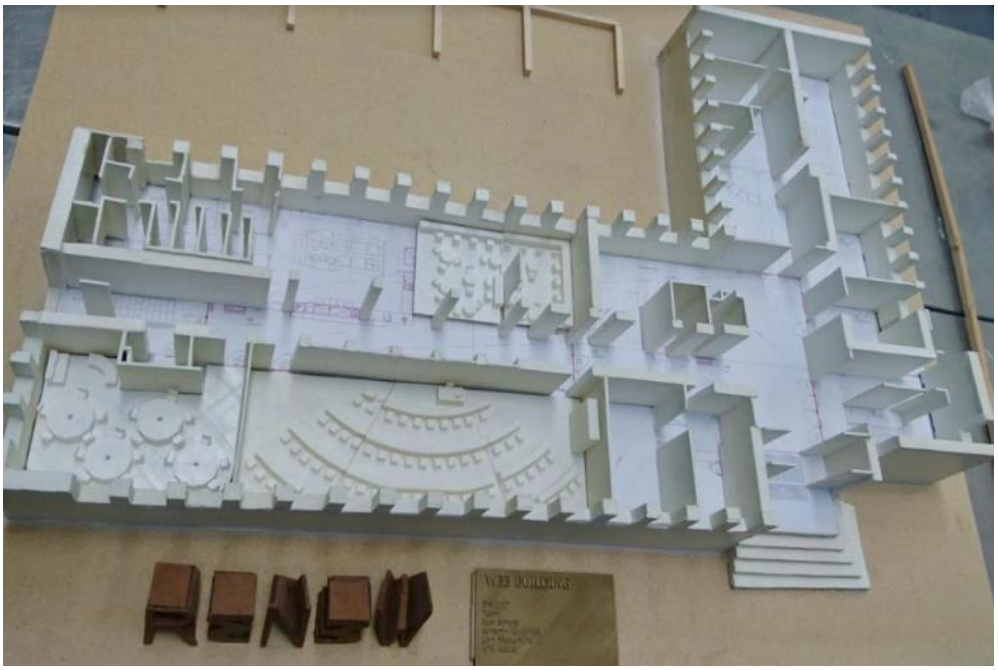


Figure 76. Final result of the physical model

3.6 Virtual model

After building the wood structure of the building and printing the 3D models, it was time to do the most realistic view of the results. Thanks to the SketchUp software, the team made a virtual 3D model, deepening in details and textures in order to take a view with the VR (Virtual Reality).

3.6.1 Design of the virtual model

The SketchUp model has been inspired in the previous sketches and in the researched furniture, even though some of them had been added from SketchUp downloads.

The first step to develop the model was exporting the AutoCAD file of the plan to the SketchUp model, in this way, there was a template to start building on. Having selected the parts that wanted to be constructed, it was time to extrude the model in order to convert it into a 3D model. Before doing this, some measurements were taken from the original building. It must be said that the whole floor of the building has been built, but as the project does not involve any other part outside the cafeteria, these are painted in white.

Once the main structure was built, it was time to deep into structural furniture, such as windows, stairs, columns and doors. It was difficult to find similar doors as the ones thought in the previous research, so the team decided to pick another one just to have an idea of the placement. Stairs, columns and windows are situated right in the same place where they are nowadays.

When finishing the structure, including the structural details, it was time to think about the walls paint and the floors. Taking into consideration the previous lightning explanation, both classrooms' walls needed to be painted in a light colour, such as white, light yellow, light blue… So the chose was light yellow, as it is not as strident as white but it was still light. Regarding to the floors, laminated wooden floor was placed around the space.

Placing the furniture was the next step. Some of the furniture of the virtual model was built by the team, but some other objects such as, chairs or plants (which need to be more detailed), were directly downloaded from the same software. This furniture has been situated taking into account the legislation and respecting the measures of the sketches. The decision of the furniture tried to be similar to the one thought when doing the research, but it was not an easy job to fins this exact furniture, so in some rooms the intention is to have an idea of how it could look like using other furniture.

Here, there are some pictures of the result:

Figure 77. Entrance of the buildin designed with SketchUp.

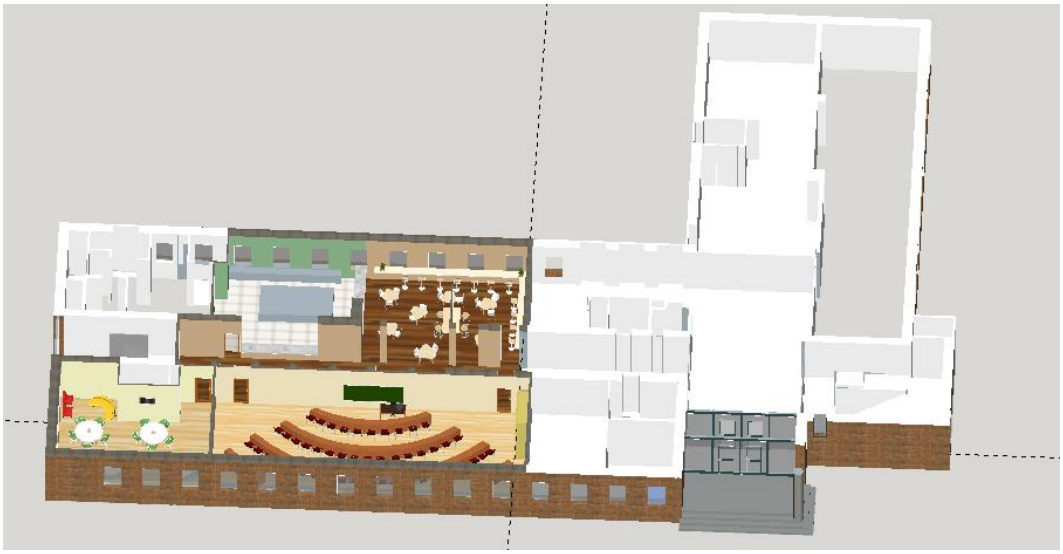


Figure 78. Building structure with SketchUp.

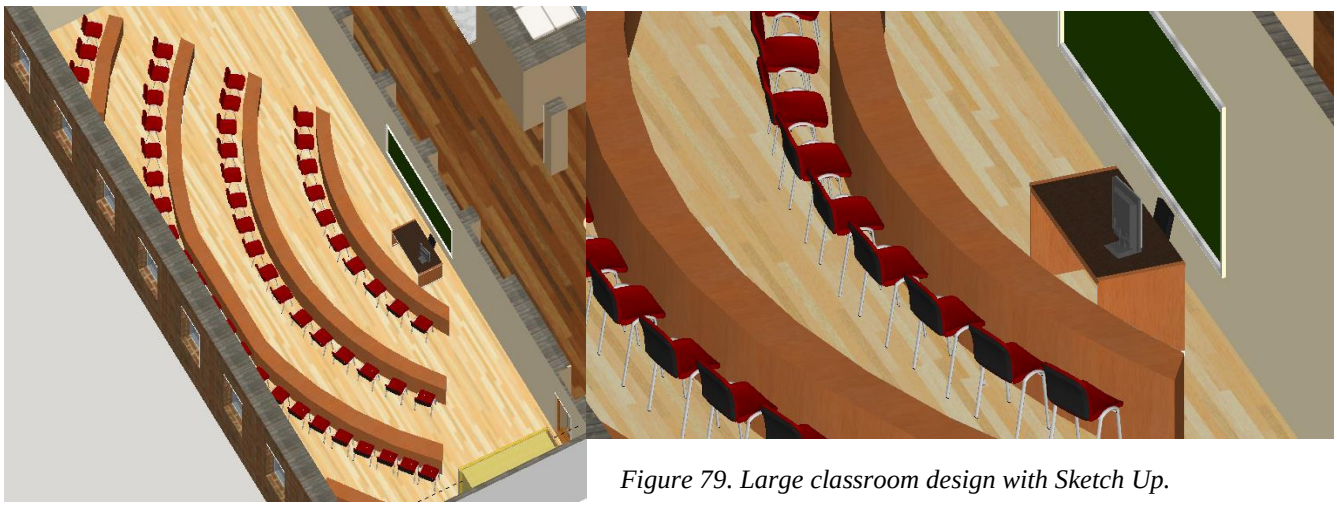


Figure 79. Large classroom design with Sketch Up.

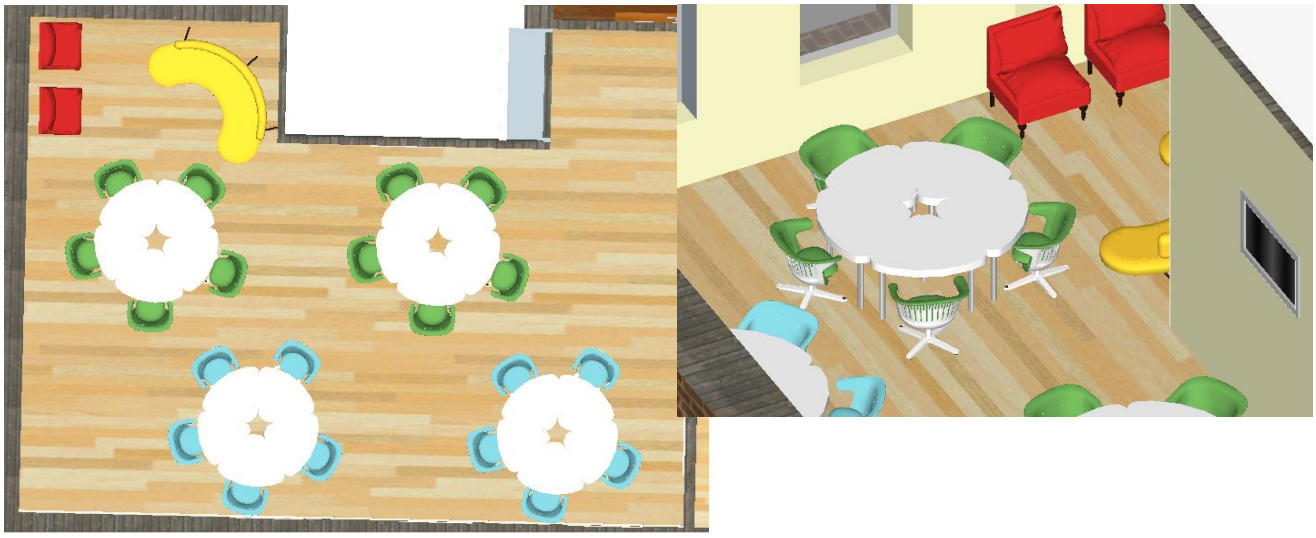


Figure 80. Teamwork classroom design with Sketch Up.

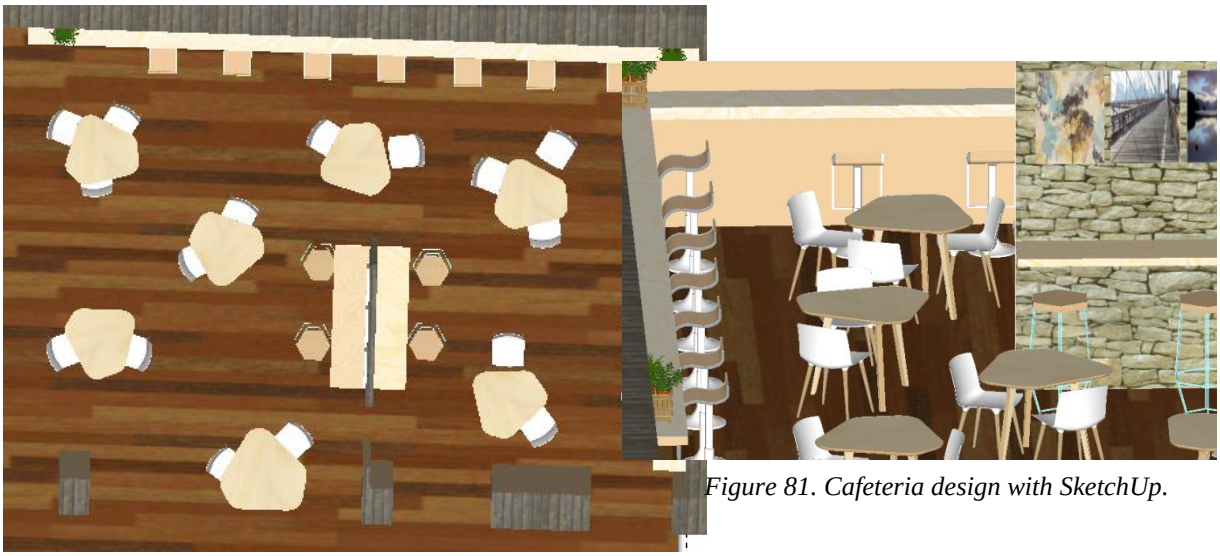


Figure 81. Cafeteria design with SketchUp.

3.6.2 Virtual Reality

Virtual Reality (VR) is the use of computer technology to create a simulated environment. Unlike traditional interfaces, VR places the user inside a virtual space. Instead of viewing a screen in front of them, users are immersed and able to interact with 3D worlds. By simulating as many senses as possible, such as vision, hearing, touch, even smell, the computer is transformed into a gatekeeper to this artificial world. The only limits to near-real VR experiences are the availability of content and cheap computing power. In this case, the university (Technobothnia) had the tools to try this technology so the team decided that they could expand the project a little bit more and go further.

In order to learn how this technology worked, some of the team members first experienced how it was to move inside an already designed house or a factory, in this way they could learn how the remotes worked. The trigger helps you to point and advance in the way that you want to go, and in the recording is showed as an orange dot. Once they practiced, they exported the SketchUp file into VR and they tried the technology with their model. The experience went really good so they finally decided that it could be a good tool to show people how could be to stay inside of the new space by their own.

After studying which way would be the better one to show the model, the team recorded this experience and here there are some results:

Figure 82. Large classroom VR screenshot.

Figure 83. Teamwork classroom VR screenshot.

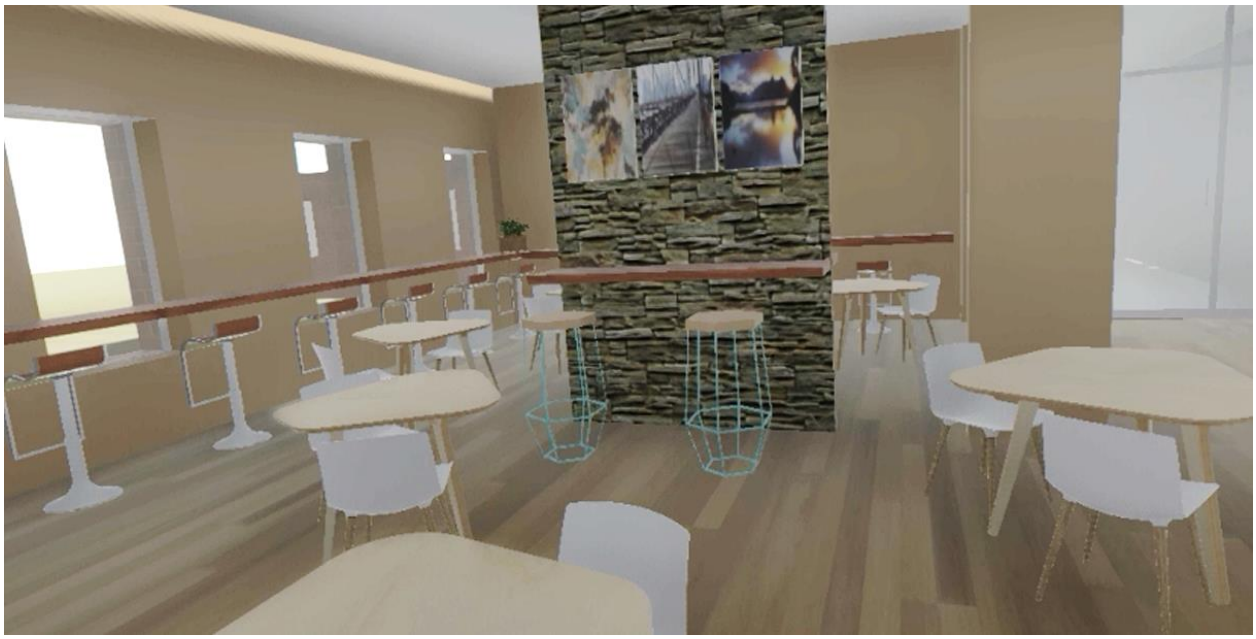


Figure 84. Cafeteria VR screenshot.

3.7 Budget

Here is showed a summary of the basic prices regarding the idea that the team had about this space. In this final budget, taxes are not taken into consideration so they are discounted. The final prices are without taxes then.

Issue	Item	Amount	Price €	Tax	Tax Origin	Total €
Teamwork room	"Height adjustable table" by Nansen Group	20	332.2	0.13	Canada	5780.28
	"Emerson student office chair" by Ave Six	20	75.5	0.1	USA	1359
	"Stockholm" by Ikea	2	369.4	0.24	Finland	561.488
	"k. lounge bench curve" by Knoll	2	715.7	0.1	USA	1288.26
	"Drop in tray system chalkboard" by USMakerboards	1	636.1	0.1	USA	572.49
						9561.518
Large classroom	"M60 swing away" by Sedia Systems+Container	52	625.55	0	Price w/ no tax	32528.6
		1	5000	0	Price w/ no tax	5000
	"Drop in tray system chalkboard" by USMakerboards	1	636.1	0.1	USA	572.49
						38101.09
Cafeteria	"TRGG710"	32	47	0.2	France	1203.2
	Tablette	19	9.5	0.2	France	144.4
	"Bar City"	7	59.9	0.2	France	335.44
						1683.04
Construction	Plaster walls	43.79	468.1434117	0.24	Finland	20500
	Door	3	305	0.24	Finland	1000
						21500
Lighting	Bulbs	20	73.47	0.2	UK	1175.52
						1469.4
Teamwork floor	Carpet	57.3	29,59 + 4,6	0.2	UK	1959.08
Classroom floor	Wickes Bordeaux Pine Wood Lacqueredflooring	117.8	35,51 + 4,6	0.2	UK	4726.55
Kitchen floor	Wickes urban gray porcelain	55.5	10,6 + 4,6	0.2	UK	843.6
						7529.23
			TOTAL			**79844.278**
Adding stuff	TV	?	**636.1**	0.24	Finland	
Whiteboard with casters	Double-sided flat 28843KPL transfer ink / ink 1515x1215 (1960) mm	?	**458**	0.24	Finland	
Plexiglass transparent board	Tableau rotatif laqué 120 x 150 cm avec axe horizontal	?	**935**	0.2	France	
overhead projector	Epson EB-1430Wi -lyhyen-throw interactive projector	?	**2619**	0.24	Finland	
interactive whiteboard	Tableau blanc interactif fixe tactile, 10 points de touch 206 x 124 cm	?	**699**	0.2	France	

This final budget is of **79.844,28€ without taxes,** but it's not including some other items as: projectors, televisions, ipads, sockets, flexi glass boards, lamps or wardrobes. Nevertheless, in this budget there is a proposition of some prices about these other items, but their cost has not been taken into consideration in the final budget as they are extra objects.

4. Conclusion

The group was initially assigned the task of renovating the W33 cafeteria but was given no further information. After the task was allocated, management was conducted to ensure all tasks are completed not only on time, but in an efficient, logical manner. The management process entailed many different things such as time statements that each individual in the group must fill out every day in order to track work that has taken place as well as how long each person has worked each given week. Also, potential risks were identified and evaluated based on which risk possess the biggest threat to the success of the project. Each risk was assigned a level of hazard and was sub sectioned using colour coding. Having weighed up the risks, with the use of planning the group made plans to minimize these risks. As well as planning to minimize the risks, the group also introduced a plan of action in case these risks were to occur. Priorities were also established to ensure the appropriate tasks were completed in the correct order; more important tasks were highlighted. Everyone took part in a Belbin test to establish the group roles. The Belbin test highlighted each individual's strengths as well as potential weaknesses.

After management was completed, the group could begin the main body of work. Initially research took place in the form of a survey; the feedback from the survey was intended to yield information that would give an indication of the type of work required. Options were presented within the survey that had been chosen upon by team members. These options ranged from a games room to sports facility, the idea was to present a few options and choose the one with the highest demand from staff/students. Results from this survey were collected and the most popular choices were established. The feedback was presented to the supervisor. The supervisor deemed the options inappropriate as they were geared towards what people want rather than what is needed, so the group was told to re-evaluate them.

The most needed facility within the university is a new classroom. This means that a new survey was created and classroom options were presented as well as the option of keeping a variation of the existing cafeteria. The results of the survey were gathered an analysed. After analysis, the decision to create a large classroom and a small teamwork room was clearly the best choice so that's what was selected. Also, due to popular demand the existing cafeteria will remain but will be downscaled.

The use of the room was decided so further research took place. There were many factors to consider when designing the new application of the room so these were addressed. These factors ranged from the interior design to the lighting design. The group began creating floor plans as well as researching legislation. Each individual member was assigned a certain task so began researching and documenting in order to complete the tasks. As the major tasks reached finalization, smaller tasks that have been neglected were then addressed.

As the major tasks are at the finalization stage or completed, the smaller tasks must be finished for the midterm report. The minor tasks were compiled in a list and distributed to individuals. Also work was compiled from the drive and arranged in the correct order.

Once these minor tasks were completed, the midterm report was ready and the group submitted the document to the supervisor. The group also created the midterm presentation using software called 'presi'. The presentation contained all the relevant information regarding the work that had been done so far. As well as the current status of the completed work, the presentation displayed the vision of the project allowing the audience to visualize the potential end result. All the key elements of the project were discussed including management, risks, limits, the vision/goal of the project and how the team will complete the task at hand.

After the midterm report/presentation, the team were faced with the task of putting all the planning/research into fruition. There were a few different tasks that needed to be addressed simultaneously so the manager was able to allocate the tasks to individuals in order to complete the work within the timeframe. The main tasks that were identified include the creation of the design prototype, creating the interior plans using 3D printing, creating a virtual version of the w33 building/interior, using virtual reality technology completing aspects of the interior design including walls, floors and completing research that had yet to be conducted. Each individual was aware of their task and work began.

Two members of the team were allocated the task of creating the physical prototype. They were able to access a facility that would provide all the necessary space and equipment to complete the task at hand. Once this area had been secured, the necessary materials were gathered and construction began. All the parts were measured to scale then cut, after this the team members were able to build the model successfully.

As the construction of the prototype was taking place, another team member was working in a different room simultaneously creating the 3D printed designs. Before work could begin, the allocated worker had to learn how to use 3D printing technology. This group member was able to use software to create a virtual version of the group's design that could be used for printing purposes. Once this had been completed, the 3D printing could begin. Each individual room had been virtually created in a simplified form in order to allow the 3D printer the ability to create the model accurately. The small classroom and the dining room were printed and ready to be incorporated within the physical prototype. However, the large classroom was not the correct scale for the 3d printer to create in one piece so it was split up into thirds; each of these thirds were added together to achieve the goal of creating a 3D version of the entire room. The large classroom was also incorporated within the prototype.

The next task was to create a virtual version of the design that could be seen using VR (virtual reality). The group member was able to create the virtual design using special software which allowed the design to be visually explored using the VR glasses. It was then possible to completely visualise the entire design, group members were able to walk around and explore the inside of the w33 building with all the renovations present. The entire building could be virtually 'toured'. Once this was possible, the group member was able to record the virtual tour in order to display the results in the final presentation.

The task of choosing the wall and floor materials was addressed also. Research was conducted including legislation, cost and analysis of different materials. The walls were researched and a solution was produced. The team member responsible for choosing the type of wall and

material conducted legislation research in order to ensure that all work that took place was in total compliance with regulations. The wall was then chosen respective to the legislation and could then be added into the report. Each room had different flooring requirements, so research took place to come up with the most appropriate solution. Once it had been the best materials for the individual applications had been established, cost analysis took place. The floors were chosen for each individual room as well as this; calculations were done to provide the cost of the materials and labour.

After this, all the costs from the entire design were calculated and added up to provide an overall total for the entire project.

At this point, the entire goal of the project had been fully achieved. The group has been able completely create a design that could be put into practical use. With the use of research, documentation, software, specialized equipment, teamwork and communication, the group were able to achieve the goal that had been allocated at the start of the project within the timeframe.

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Appendices

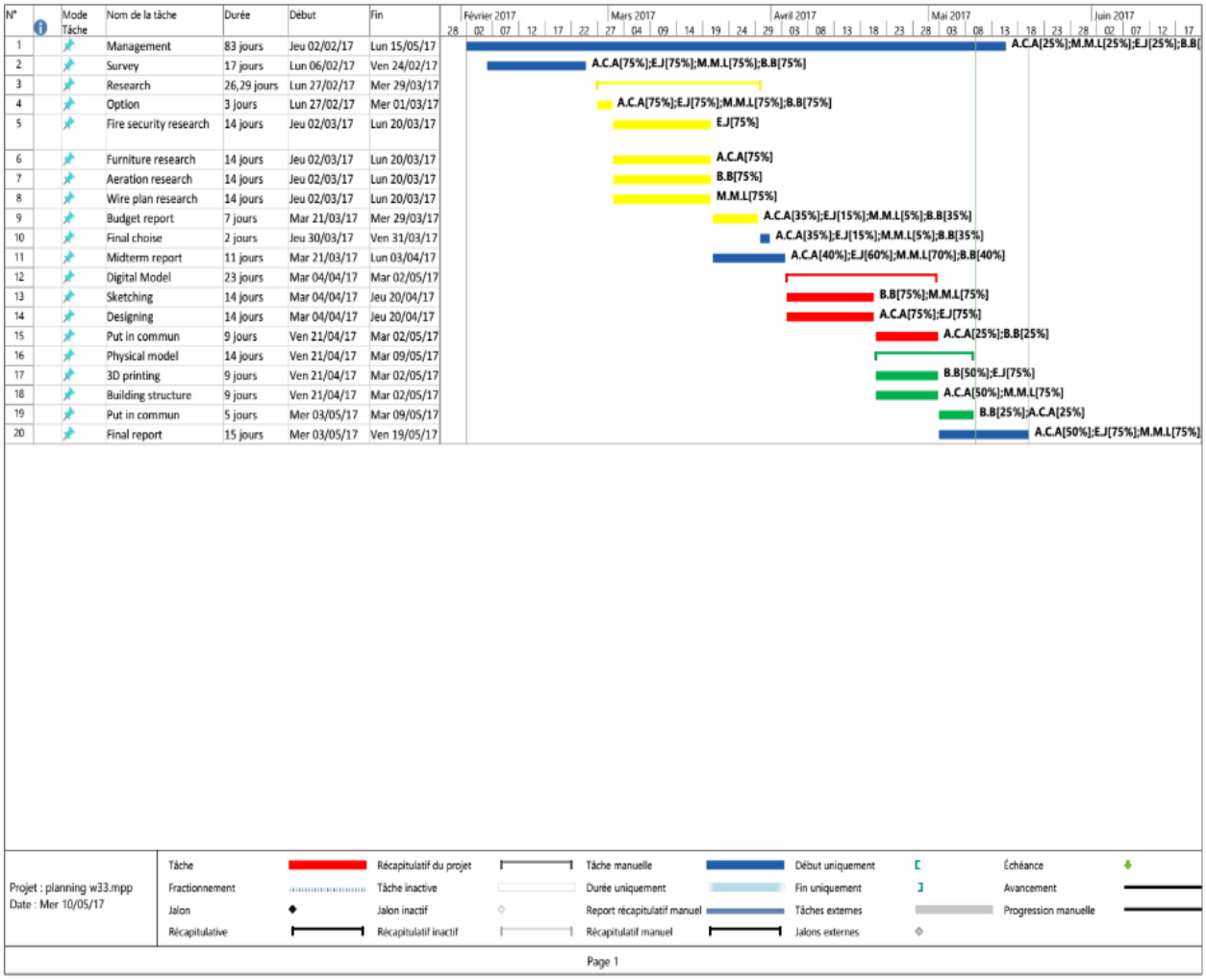
I. WBS

II. Responsibility matrix

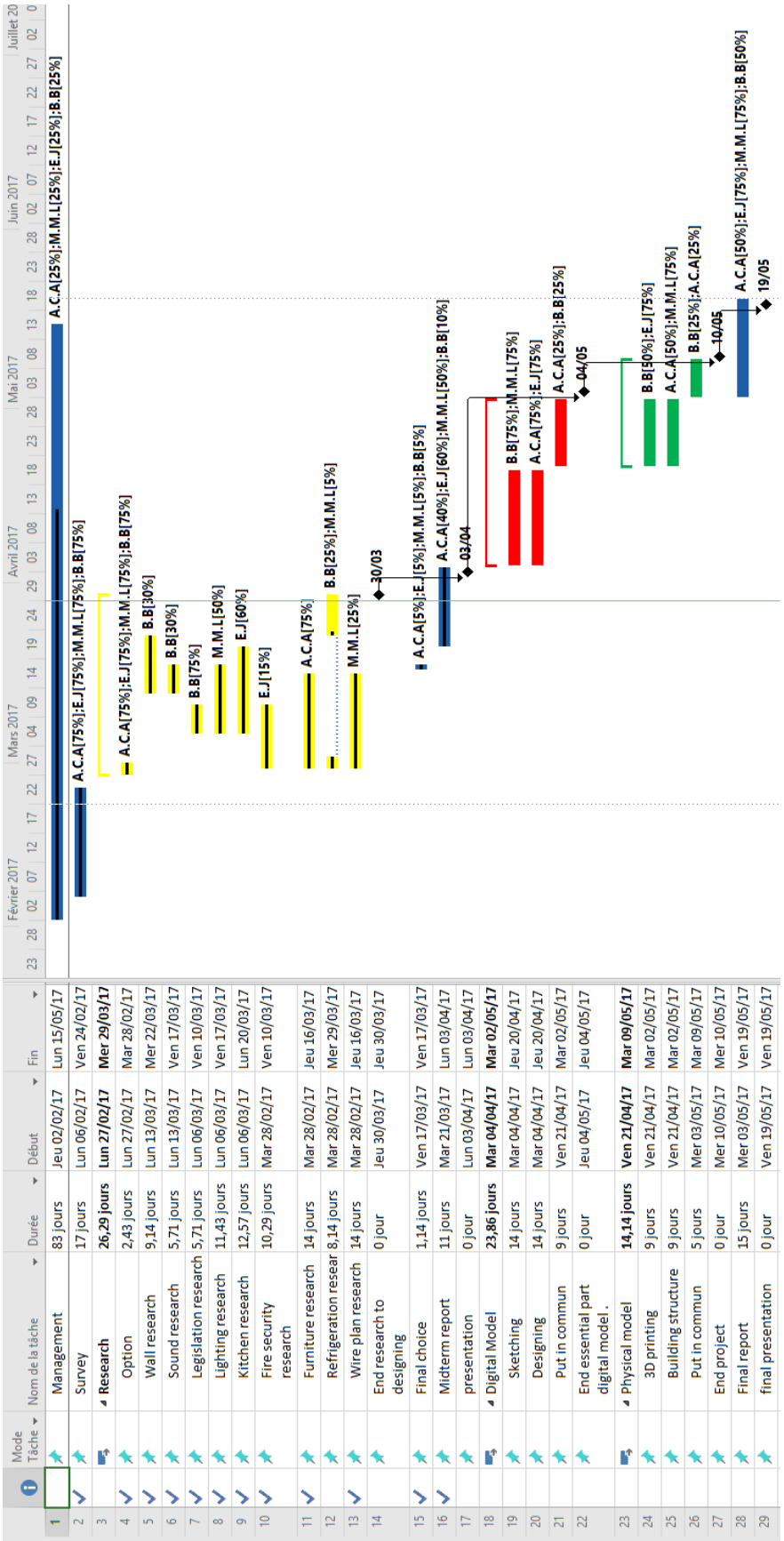
M	Manager
W	Worker

DELIVERABLE	SUBDELIVERABLE	TASK	BB	JE	LMM	AAC
Management						
	Scope	Define objective	w	w	M	w
		Define stakeholders	M	w	w	w
		Define deliverables	w	w	w	M
		Define milestones	M	w	w	w
		Define exclusions	w	M	w	w
		Define risks	w	w	w	M
	Requirements doc	Define technical requirments	w	w	M	w
	Planning docs	Make Gantt	M	w	w	w
		Distribute tasks	w	M	w	w
	Monitoring	Write weekly report	w	w	w	M
		Meet the tutor	w	w	M	w
Study report						
	Options	Brain storming	w	M	w	w
		Choose option	M	w	w	w
		Comparing costs	w	w	w	M
	Survey	Meet the staff	w	w	M	w
		Send survey	w	M	w	w
	Report	Fire security research	w	M	w	w
		Refrigeration plan	M	w	w	w
		Wiring plan and legislation	w	w	M	w
Digital model						
	3D model	Design	w	w	w	M
		Record virtual tour	w	w	w	M
	Plans	Sketching	M	w	w	w
		Measuring	w	M	w	w
	User/Designer manual	Add to project	w	w	M	w
Physical prototype						
	Structure	Build the structure	M		w	w
	Furniture	3D print	w	w	w	M
EPS Documents						
	Mid-term docs	Presentation	w	w	w	M
		Write report	w	w	M	w
	Final docs	Presentation	w	M	w	w
		Write report	w	w	w	M

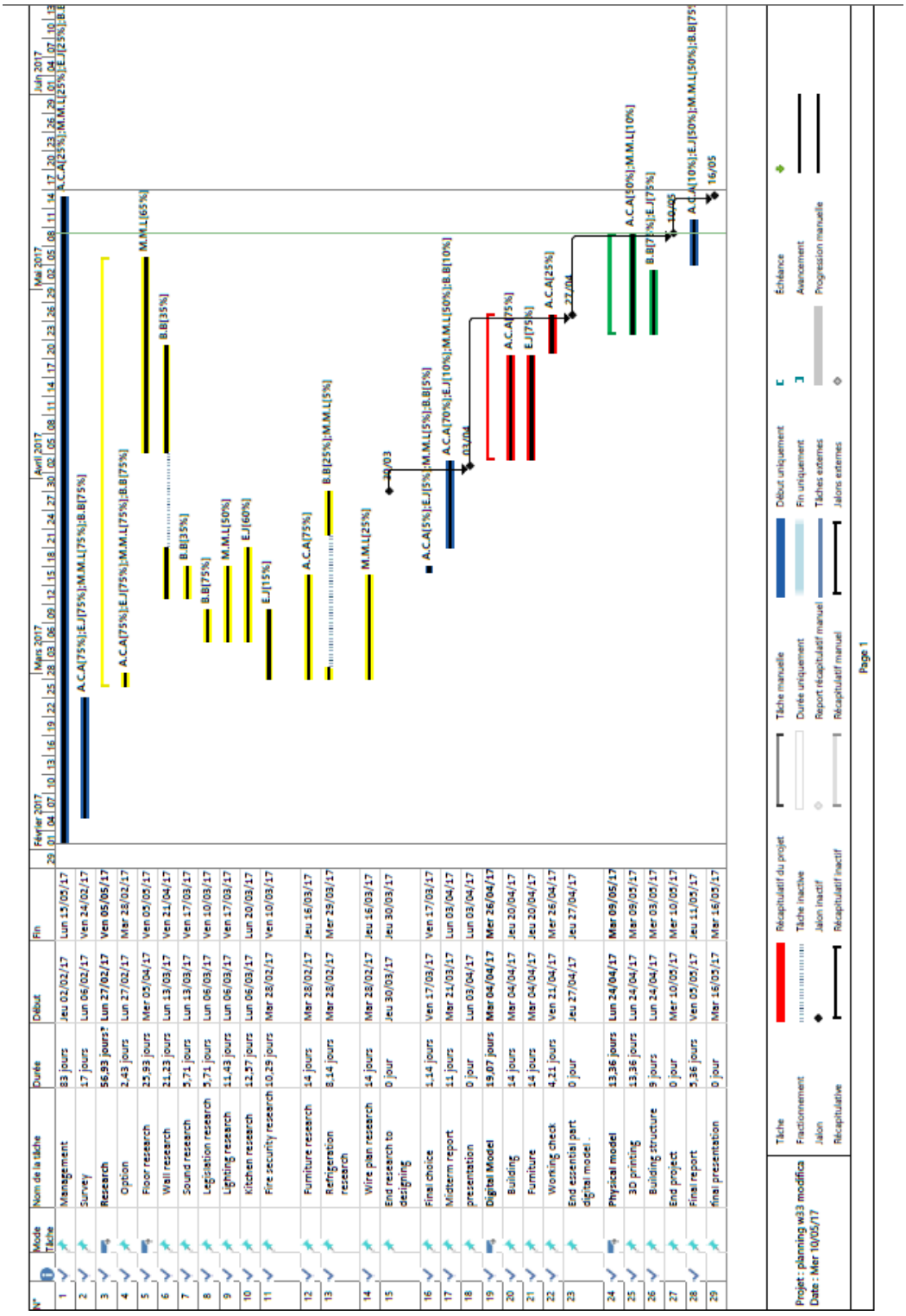
III. Time schedules (1,2 and 3)



N°	Mode Tâche	Nom de la tâche	Durée	Début	Fin
1		Management	83 jours	Jeu 02/02/17	Lun 15/05/17
2		Survey	17 jours	Lun 06/02/17	Ven 24/02/17
3		Research	26,29 jours	Lun 27/02/17	Mer 29/03/17
4		Option	3 jours	Lun 27/02/17	Mer 01/03/17
5		Fire security research	14 jours	Jeu 02/03/17	Lun 20/03/17
6		Furniture research	14 jours	Jeu 02/03/17	Lun 20/03/17
7		Aeration research	14 jours	Jeu 02/03/17	Lun 20/03/17
8		Wire plan research	14 jours	Jeu 02/03/17	Lun 20/03/17
9		Budget report	7 jours	Mar 21/03/17	Mer 29/03/17
10		Final choise	2 jours	Jeu 30/03/17	Ven 31/03/17
11		Midterm report	11 jours	Mar 21/03/17	Lun 03/04/17
12		Digital Model	23 jours	Mar 04/04/17	Mar 02/05/17
13		Sketching	14 jours	Mar 04/04/17	Jeu 20/04/17
14		Designing	14 jours	Mar 04/04/17	Jeu 20/04/17
15		Put in commun	9 jours	Ven 21/04/17	Mar 02/05/17
16		Physical model	14 jours	Ven 21/04/17	Mar 09/05/17
17		3D printing	9 jours	Ven 21/04/17	Mar 02/05/17
18		Building structure	9 jours	Ven 21/04/17	Mar 02/05/17
19		Put in commun	5 jours	Mer 03/05/17	Mar 09/05/17
20		Final report	15 jours	Mer 03/05/17	Ven 19/05/17



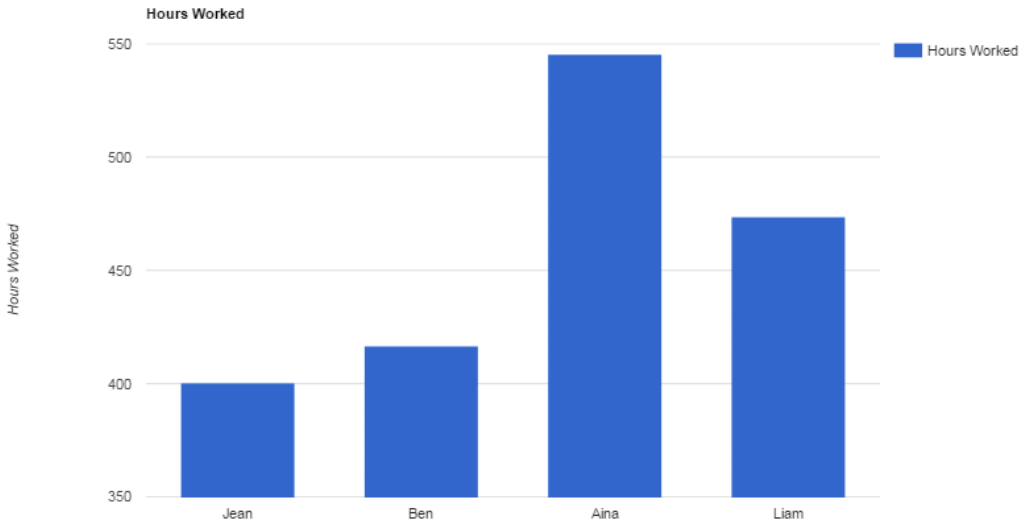
	Mode Tâche	Nom de la tâche	Durée	Début	Fin
1		Management	83 jours	Jeu 02/02/17	Lun 15/05/17
2		Survey	17 jours	Lun 06/02/17	Ven 24/02/17
3		**Research**	**26,29 jours**	**Lun 27/02/17**	**Mer 29/03/17**
4		Option	2,43 jours	Lun 27/02/17	Mar 28/02/17
5		Wall research	9,14 jours	Lun 13/03/17	Mer 22/03/17
6		Sound research	5,71 jours	Lun 13/03/17	Ven 17/03/17
7		Legislation research	5,71 jours	Lun 06/03/17	Ven 10/03/17
8		Lighting research	11,43 jours	Lun 06/03/17	Ven 17/03/17
9		Kitchen research	12,57 jours	Lun 06/03/17	Lun 20/03/17
10		Fire security research	10,29 jours	Mar 28/02/17	Ven 10/03/17
11		Furniture research	14 jours	Mar 28/02/17	Jeu 16/03/17
12		Refrigeration resear	8,14 jours	Mar 28/02/17	Mer 29/03/17
13		Wire plan research	14 jours	Mar 28/02/17	Jeu 16/03/17
14		End research to designing	0 jour	Jeu 30/03/17	Jeu 30/03/17
15		Final choice	1,14 jours	Ven 17/03/17	Ven 17/03/17
16		Midterm report	11 jours	Mar 21/03/17	Lun 03/04/17
17		presentation	0 jour	Lun 03/04/17	Lun 03/04/17
18		**Digital Model**	**23,86 jours**	**Mar 04/04/17**	**Mar 02/05/17**
19		Sketching	14 jours	Mar 04/04/17	Jeu 20/04/17
20		Designing	14 jours	Mar 04/04/17	Jeu 20/04/17
21		Put in commun	9 jours	Ven 21/04/17	Mar 02/05/17
22		End essential part digital model .	0 jour	Jeu 04/05/17	Jeu 04/05/17
23		**Physical model**	**14,14 jours**	**Ven 21/04/17**	**Mar 09/05/17**
24		3D printing	9 jours	Ven 21/04/17	Mar 02/05/17
25		Building structure	9 jours	Ven 21/04/17	Mar 02/05/17
26		Put in commun	5 jours	Mer 03/05/17	Mar 09/05/17
27		End project	0 jour	Mer 10/05/17	Mer 10/05/17
28		Final report	15 jours	Mer 03/05/17	Ven 19/05/17
29		final presentation	0 jour	Ven 19/05/17	Ven 19/05/17



N°	Mode de la tâche	Nom de la tâche	Durée	Début	Fin
1		Management	83 jours	Jeu 02/02/17	Lun 15/05/17
2		Survey	17 jours	Lun 06/02/17	Ven 24/02/17
3		Research	56,93 jours?	Lun 27/02/17	Ven 05/05/17
4		Option	2,43 jours	Lun 27/02/17	Mar 28/02/17
5		Floor research	25,93 jours	Mer 05/04/17	Ven 05/05/17
6		Wall research	21,23 jours	Lun 13/03/17	Ven 21/04/17
7		Sound research	5,71 jours	Lun 13/03/17	Ven 17/03/17
8		Legislation research	5,71 jours	Lun 06/03/17	Ven 10/03/17
9		Lighting research	11,43 jours	Lun 06/03/17	Ven 17/03/17
10		Kitchen research	12,57 jours	Lun 06/03/17	Lun 20/03/17
11		Fire security research	10,29 jours	Mar 28/02/17	Ven 10/03/17
12		Furniture research	14 jours	Mar 28/02/17	Jeu 16/03/17
13		Refrigeration research	8,14 jours	Mar 28/02/17	Mer 29/03/17
14		Wire plan research	14 jours	Mar 28/02/17	Jeu 16/03/17
15		End research to designing	0 jour	Jeu 30/03/17	Jeu 30/03/17
16		Final choice	1,14 jours	Ven 17/03/17	Ven 17/03/17
17		Midterm report	11 jours	Mer 21/03/17	Lun 03/04/17
18		presentation	0 jour	Lun 03/04/17	Lun 03/04/17
19		Digital Model	19,07 jours	Mar 04/04/17	Mer 26/04/17
20		Building	14 jours	Mar 04/04/17	Jeu 20/04/17
21		Furniture	14 jours	Mar 04/04/17	Jeu 20/04/17
22		Working check	4,21 jours	Ven 21/04/17	Mer 26/04/17
23		End essential part digital model.	0 jour	Jeu 27/04/17	Jeu 27/04/17
24		Physical model	13,36 jours	Lun 24/04/17	Mar 09/05/17
25		3D printing	13,36 jours	Lun 24/04/17	Mer 09/05/17
26		Building structure	9 jours	Lun 24/04/17	Mer 03/05/17
27		End project	0 jour	Mer 10/05/17	Mer 10/05/17
28		Final report	5,36 jours	Ven 05/05/17	Jeu 11/05/17
29		final presentation	0 jour	Mer 16/05/17	Mer 16/05/17

IV. Time statements

The tutor of the project has an excel file with all the time statements, as this file is huge it can't be represented properly so a brief resume of the total amount of hours is exposed. It must be said that these are the hours including lunch break:



	Jean	Ben	Aina	Liam
Hours Worked	400.25	416.75	545.25	473.65

V. Cost management

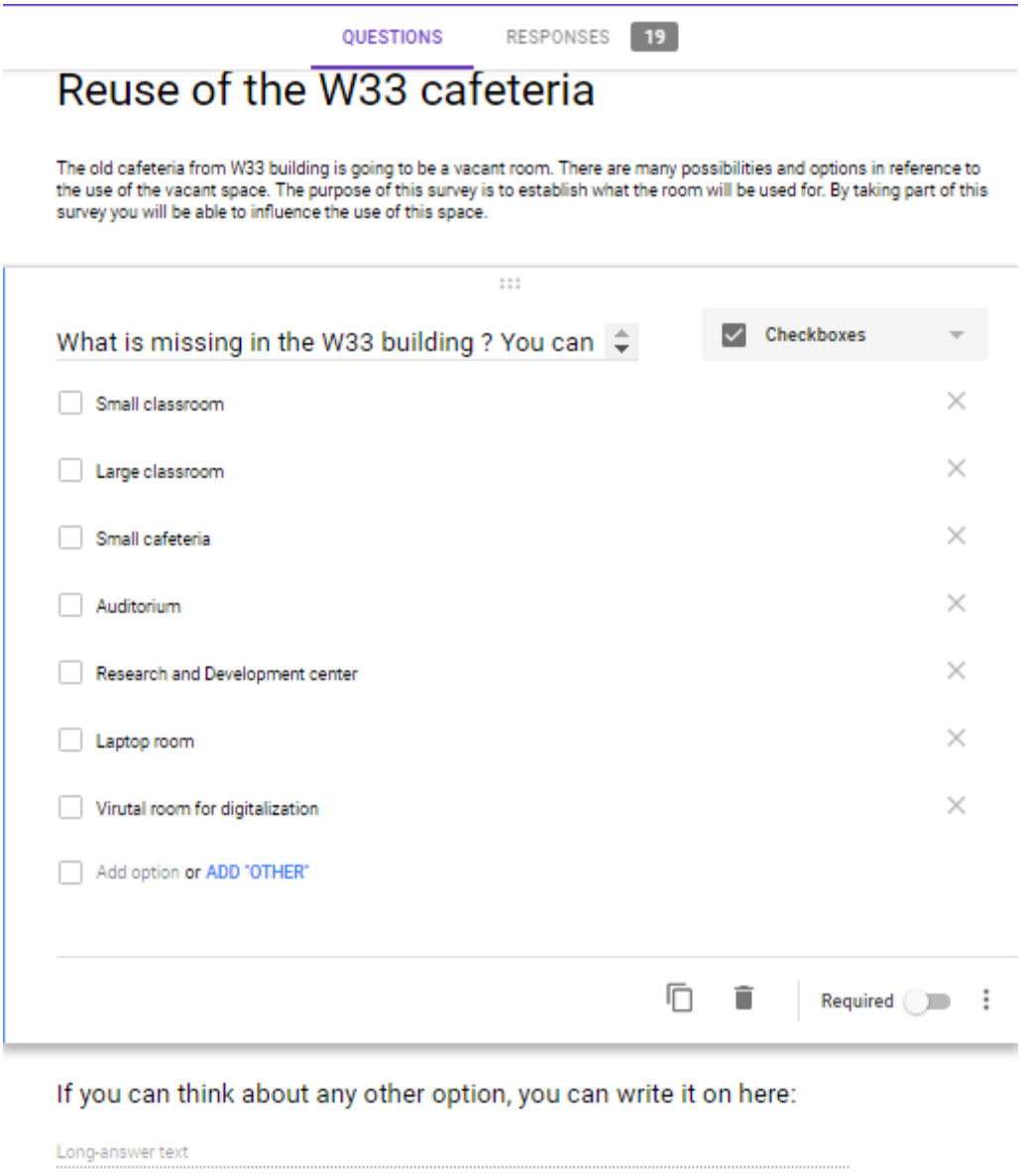
Total amount of weeks	18
Total amount of hours per member per week	28
Total of amount members	4
Total available hours for this project	2016

Price per hour per person	20 €
Total budget	35.286€

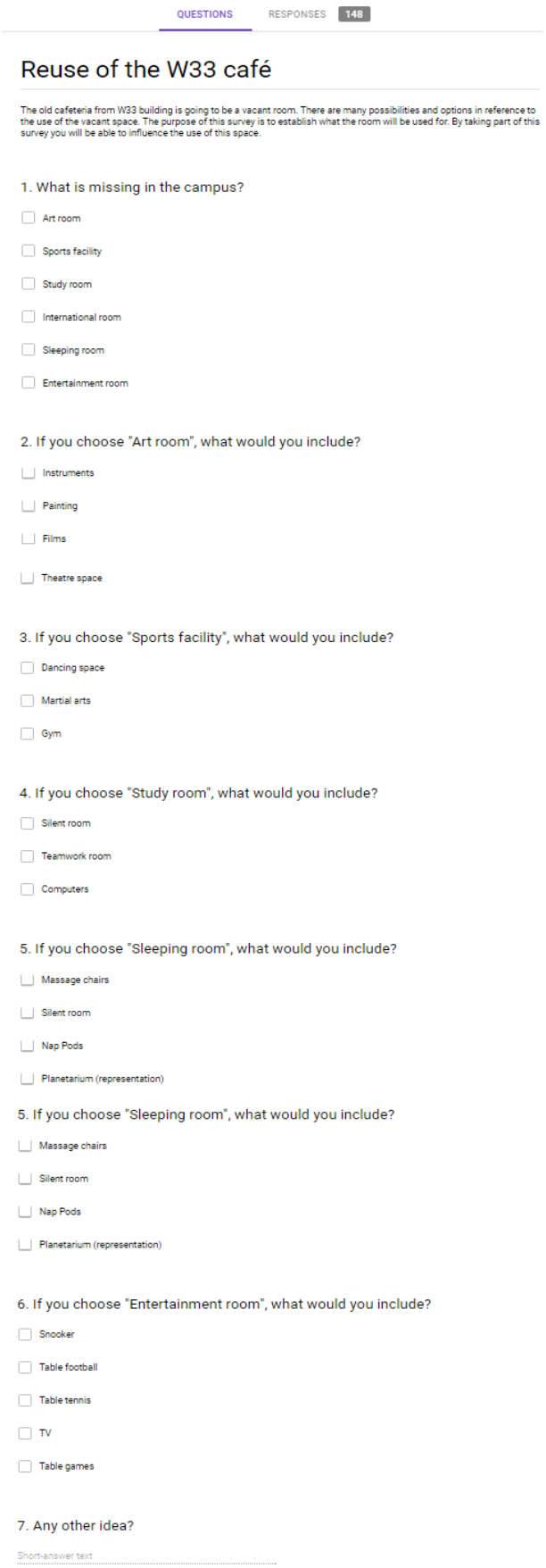
Tasks	Amount of working days available for the task	Average amount of hours per day per member spend on he task	Amount of members working on task	Total amount of hours spend on task	Cost of task (i)
Management	83	1	4	332	6 640 i
Survey	17	1	4	68	1 360 i
Research					
Option	2,5	6	4	60	1 200 i
Floor research	25,93	5	1	129,65	2 593 i
Wall research	9,14	6	1	54,84	1 097 i
Sound research	5,71	4	1	22,84	457 i
Lightning research	11,43	4	1	45,72	914 i
Refregiraton research	8,14	2	1	16,28	326 i
Legislation research	5,71	5	2	57,1	1 142 i
Kitchen resarch	12,75	5	1	63,75	1 275 i
Fire security research	10	5	2	100	2 000 i
Furniture research	14	5	2	140	2 800 i
Wire plan research	14	4	1	56	1 120 i
Final choice	1,14	2	4	9,12	182 i
Midterm report	11	5	4	220	4 400 i
Digital Model					
Sketching	5	3	1	15	300 i
Designing	5	3	1	15	300 i
Physical model					
3D printing	7	5	1	35	700 i
Building structure	7	6	2	84	1 680 i
Final report	10	6	4	240	4 800 i

VI. Surveys

Right survey



Basement survey



QUESTIONS RESPONSES 148

Reuse of the W33 café

The old cafeteria from W33 building is going to be a vacant room. There are many possibilities and options in reference to the use of the vacant space. The purpose of this survey is to establish what the room will be used for. By taking part of this survey you will be able to influence the use of this space.

1. What is missing in the campus?

- [ ] Art room
- [ ] Sports facility
- [ ] Study room
- [ ] International room
- [ ] Sleeping room
- [ ] Entertainment room

2. If you choose "Art room", what would you include?

- [ ] Instruments
- [ ] Painting
- [ ] Films
- [ ] Theatre space

3. If you choose "Sports facility", what would you include?

- [ ] Dancing space
- [ ] Martial arts
- [ ] Gym

4. If you choose "Study room", what would you include?

- [ ] Silent room
- [ ] Teamwork room
- [ ] Computers

5. If you choose "Sleeping room", what would you include?

- [ ] Massage chairs
- [ ] Silent room
- [ ] Nap Pods
- [ ] Planetarium (representation)

5. If you choose "Sleeping room", what would you include?

- [ ] Massage chairs
- [ ] Silent room
- [ ] Nap Pods
- [ ] Planetarium (representation)

6. If you choose "Entertainment room", what would you include?

- [ ] Snooker
- [ ] Table football
- [ ] Table tennis
- [ ] TV
- [ ] Table games

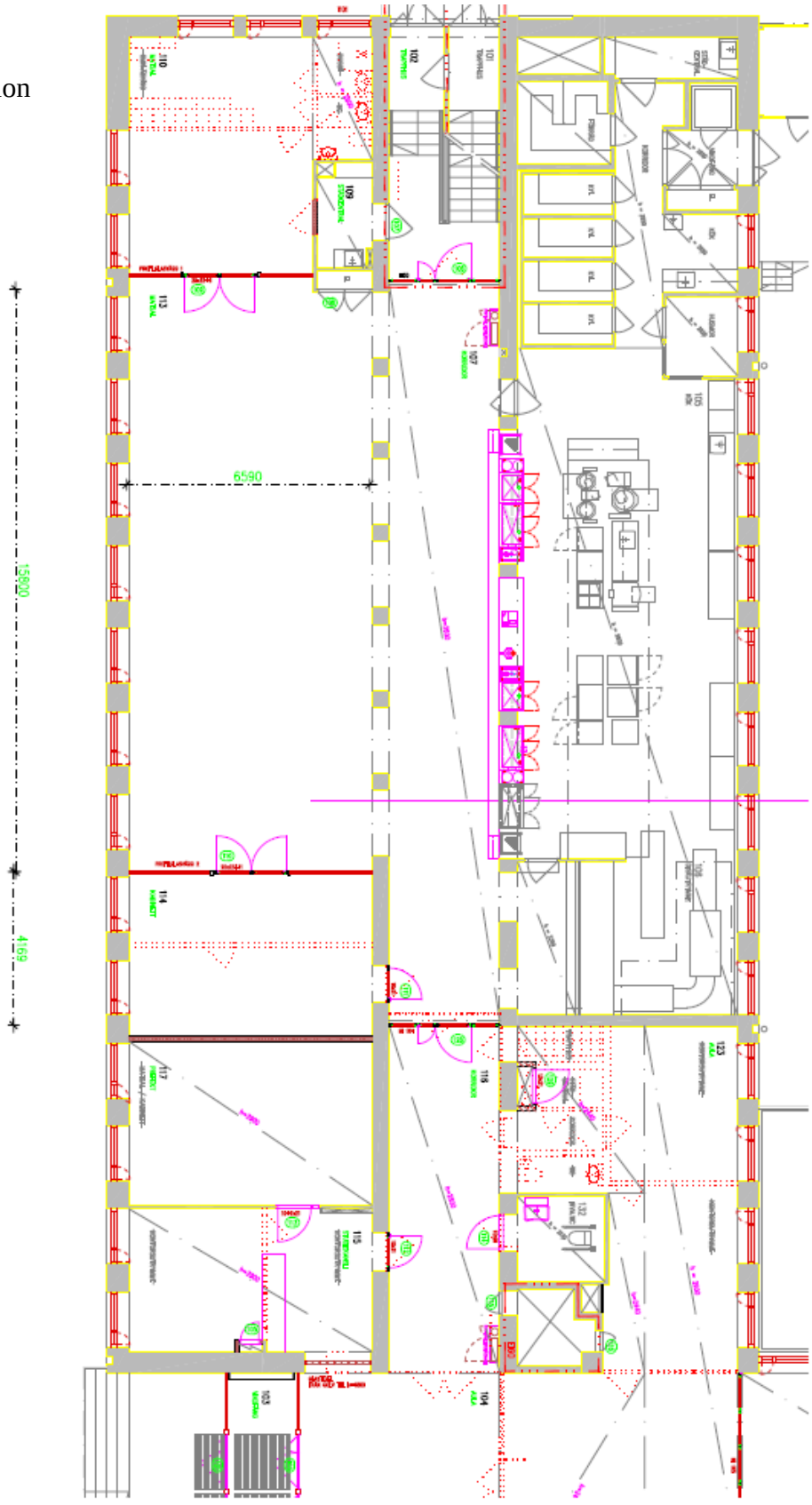
7. Any other idea?

Short-answer text

VII. Plans

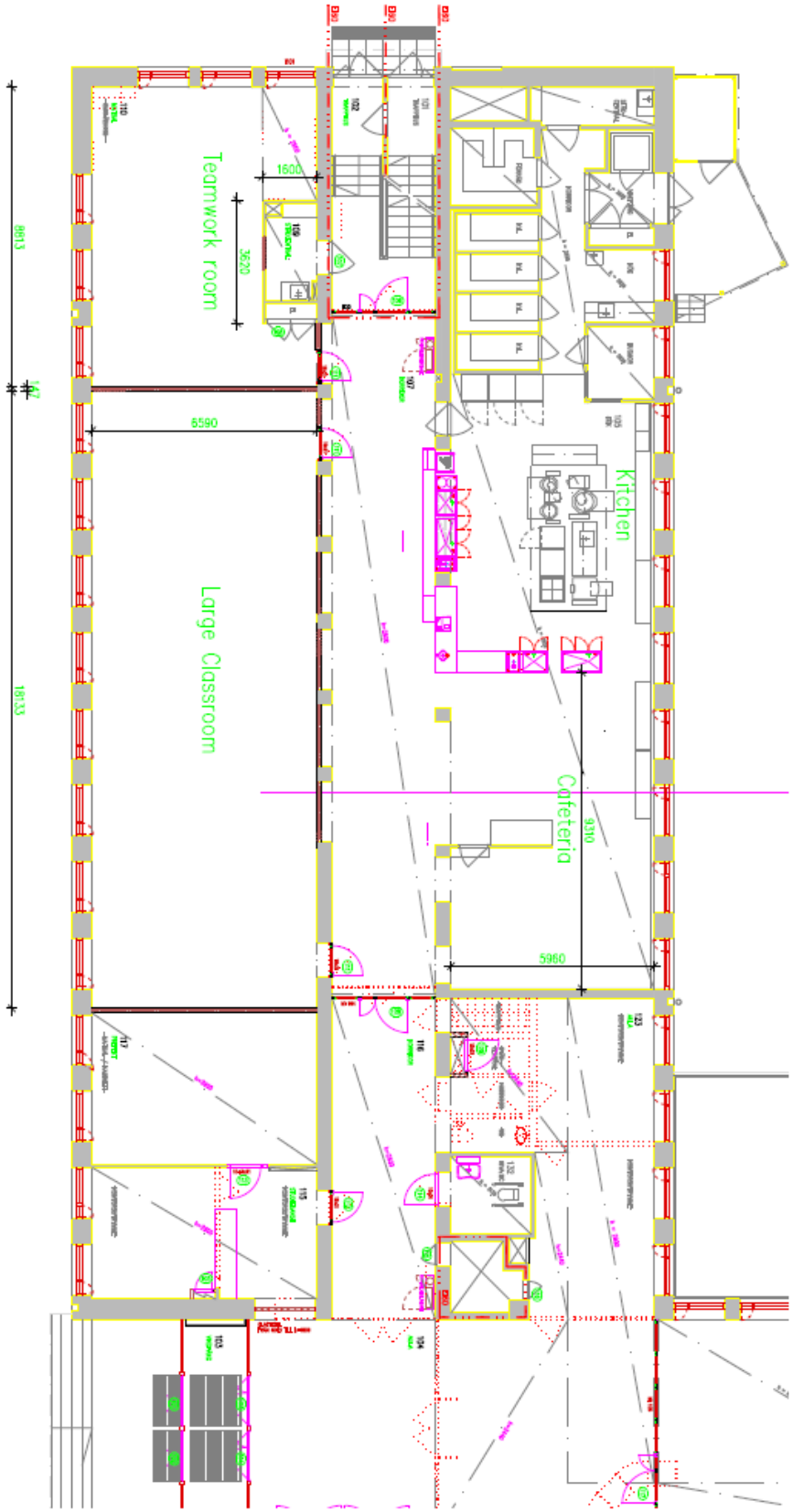
Nowadays distribution

Non scaled

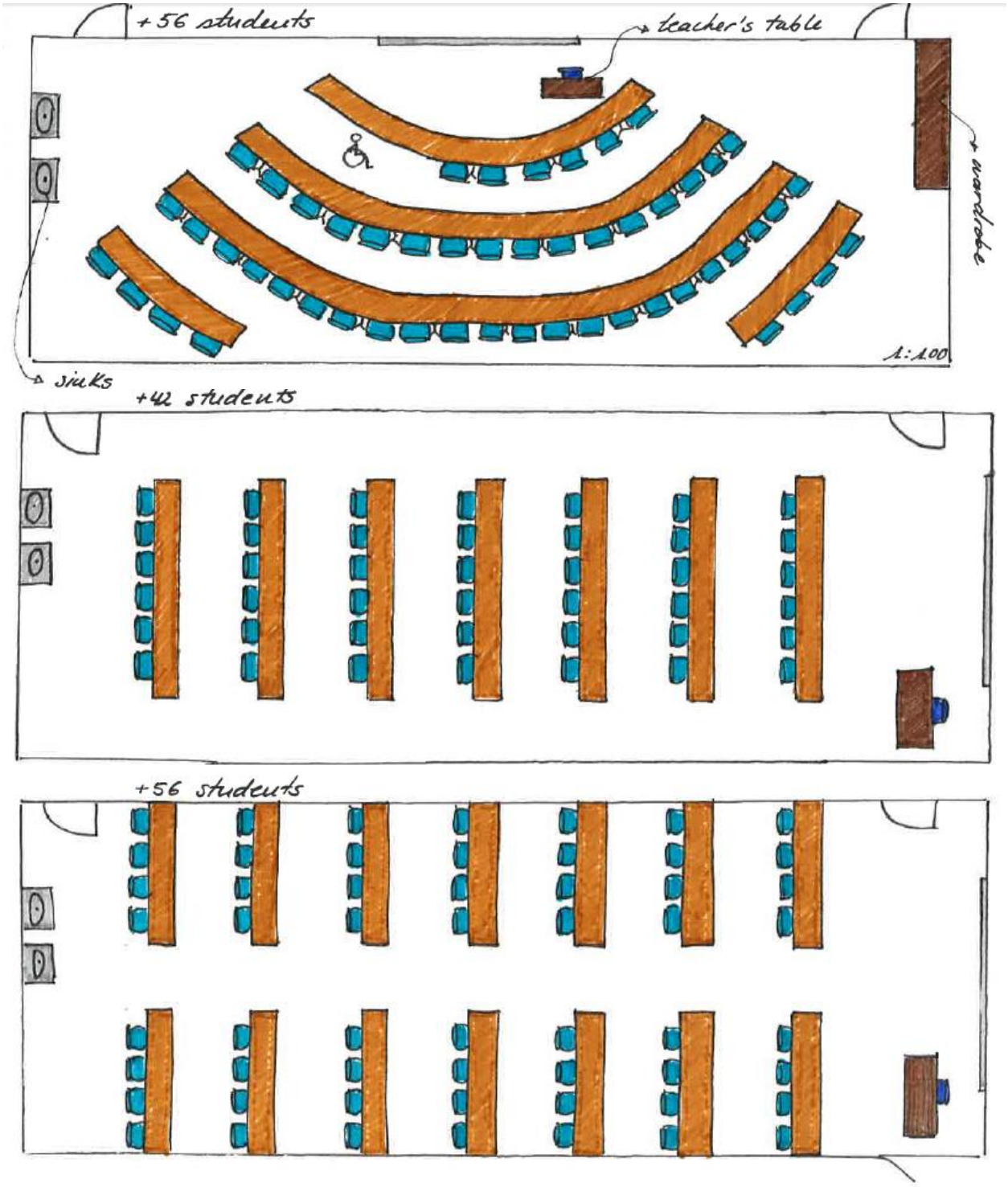


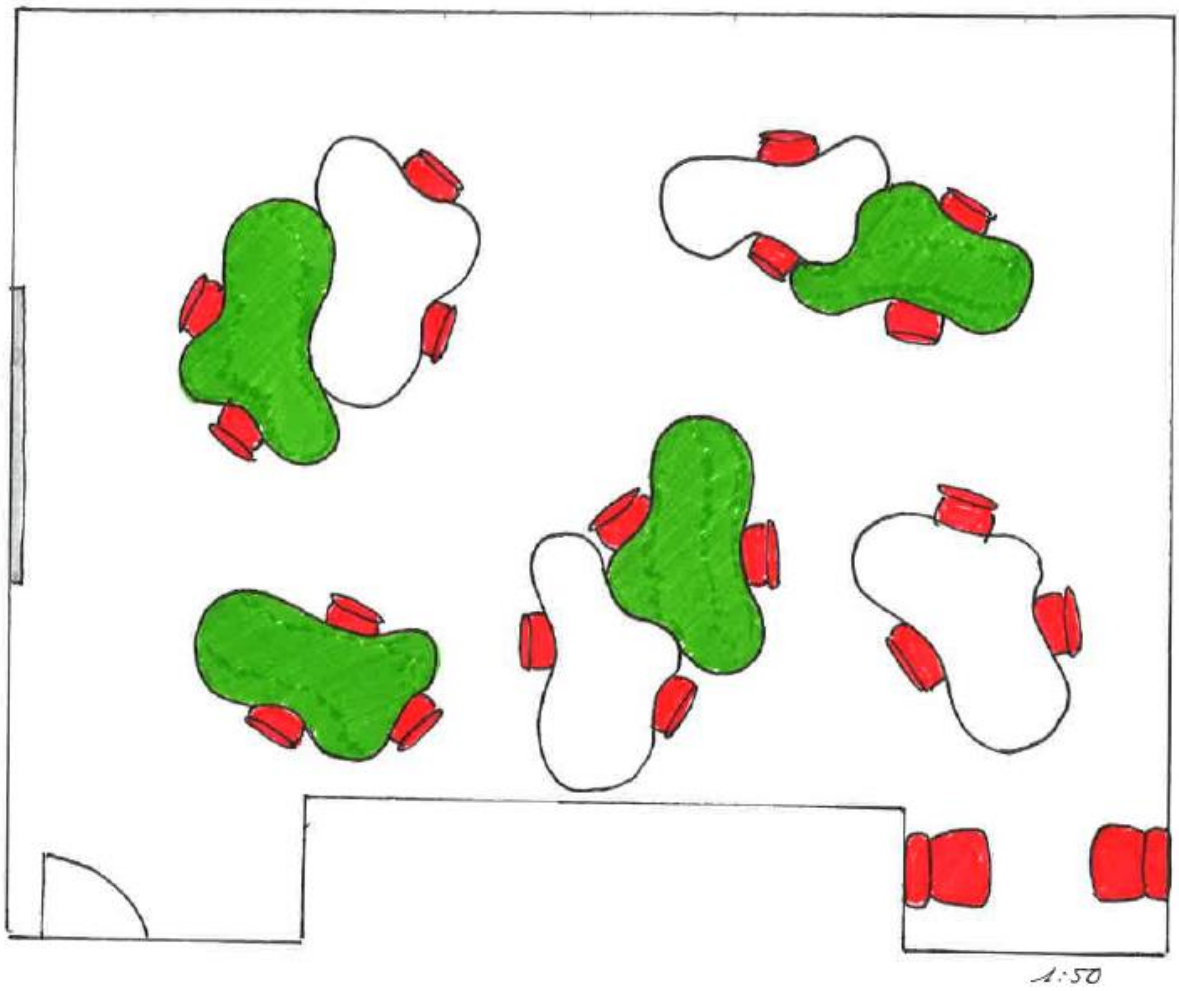
Project distribution

Non scaled



VIII. Room sketches

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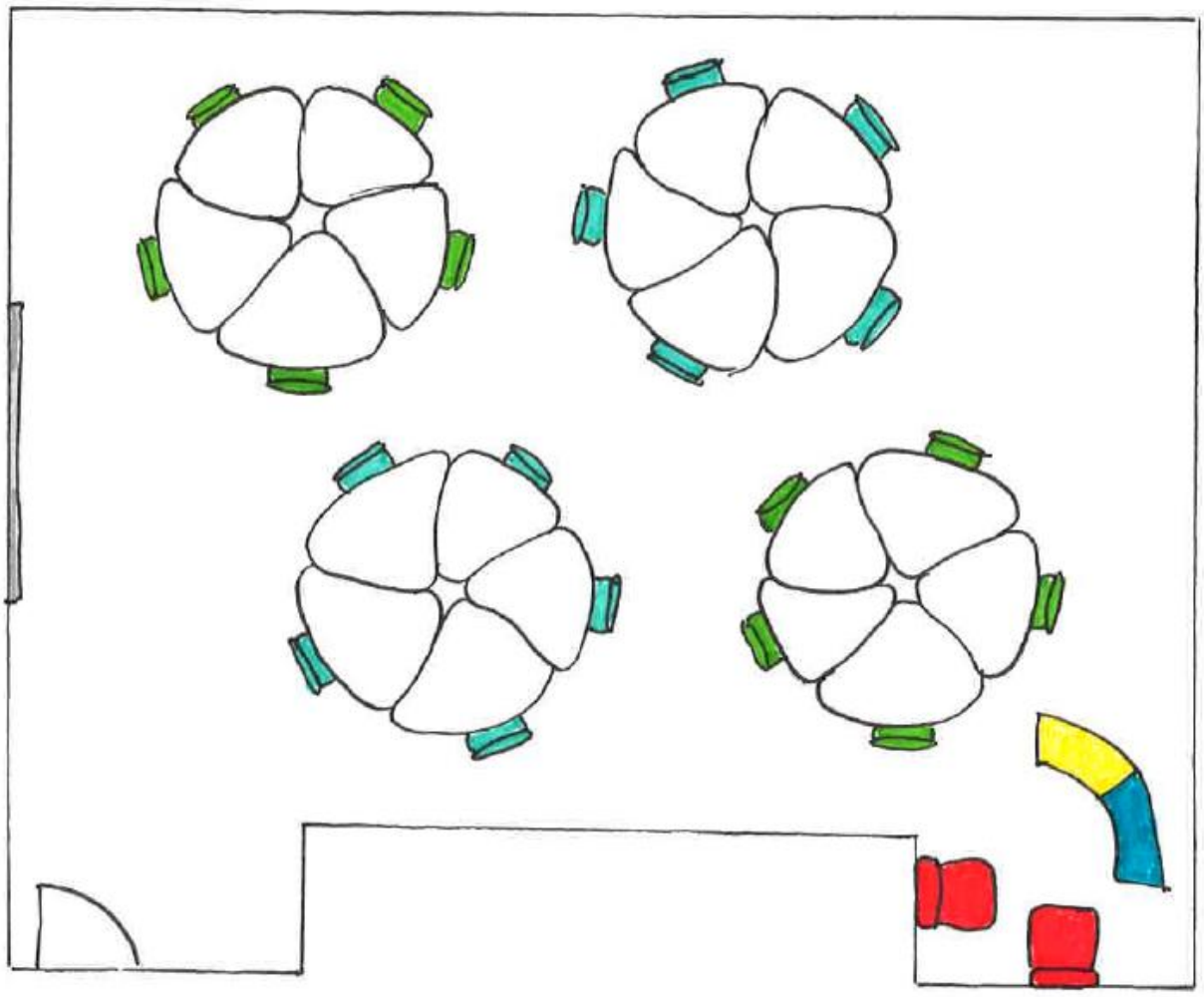

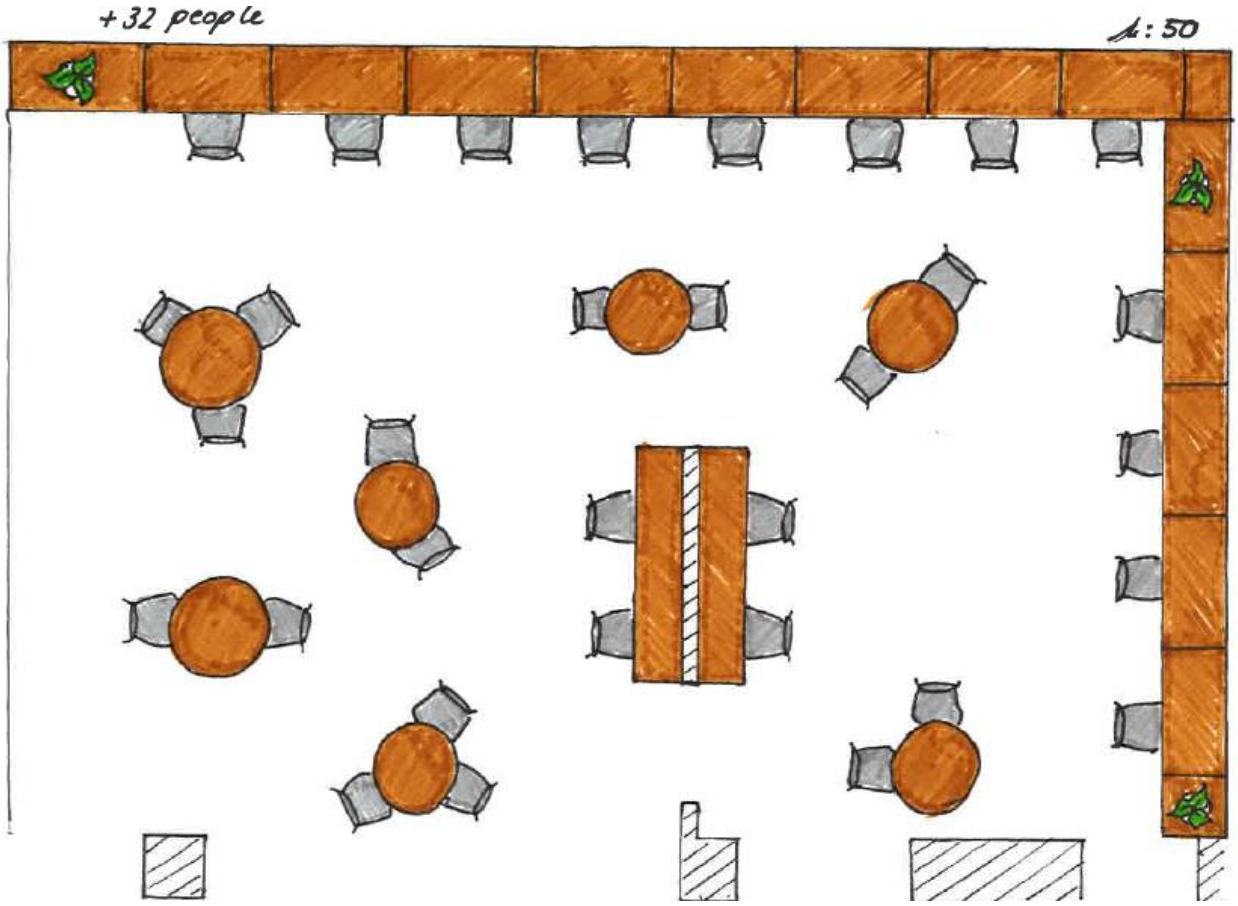
+32 people
1:50