EDITED BY NENONEN, KÄRNÄ, JUNNONEN, TÄHTINEN, SANDSTRÖM, AIRO, NIEMI

How to

CO-CREATE

campus ?

Suvi Nenonen, Sami Kärnä, Juha-Matti Junnonen, Sari Tähtinen, Niclas Sandström, Kaisa Airo, Olli Niemi (edit.)

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”Co-creation of new learning environments together with users is as important as the new solutions.

Foreword

"Learning Campus" invites its readers to campuses in Finland, where future learning environments have been studied and developed in 2011–2015. The multi-disciplinary group of researchers was gathered together by Olli Niemi from University Properties of Finland Ltd. The joint research has, in its extent and multi-disciplinarity, been a significant step in the development of the built environment. The articles collected in this book give an extra boost to Finland's status as a pioneer in education.

Our bilingual book presents a collection of research data and arguments for new solutions that are eagerly developed in our learning environments both in Finland and elsewhere. We hope that the chapters of "Learning Campus" will inspire and encourage readers to experiment, learn, and succeed.

The learning environments of the future are discussed from the points of view of campus co-operation, sustainable development, joint development, and multi-disciplinary learning. At the start of the research program, our dream was a collection of new space types. At the end of the program, we have noticed that equally important with new solutions is how they are realized together with users.

The development of new learning environments is a co-operation between multiple actors, multi-disciplinarily and with many voices. The diversity has been collected in this book. The authors include experts and specialists of the physical, virtual, and social space alike. The multi-disciplinary research has been a learning journey, in which the concepts, methods, and frameworks of different fields have inspired an enriching dialogue and co-operation.

During the research program, University Properties of Finland realized altogether 26 demonstration projects on their own campuses. The realization and evaluation of multi-space and multi-use learning, research, and working environments and joint planning was typical of the projects. In addition to this, the research program has invited other learning environment developers to join in. We thank all the authors, the editorial board, and the layout designer of the book as well as the Strategic Centre for Science, Technology and Innovation of built environment. It has been a delight to take this learning journey together and we eagerly look forward to future steps together.

Even though the Future Learning Environments work package as a part of the Indoor Environment Program ends, we believe that joint development and learning will continue. New learning, steering, studying, and working are scripted, page by page, in this book. We hope that these thoughts and ideas will be scripted and refined in our learning environments across the country.

Olli Niemi and Suvi Nenonen

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Value co-creation in university campuses

Eelis Rytkönen and Ville Korpinen

Today, working and learning happens in a variety of locations through a myriad of interfaces around the clock. As the means, times and places to execute actions are scattered based on individual daily routines, effective spatial facilitation of working and learning becomes increasingly complex. At the same time, university facility utilization rates are globally low, while maintenance costs remain high and the variety of end-user demands are becoming more heterogeneous.

Simultaneously, end-users themselves are becoming more and more active in creating, producing and managing novel spatial services for their own thematic communities. Multiple projects can be identified where end-users have taken over underutilized spaces and become facilitators in their own right. Compared to traditional bureaucratic campus management practices, these projects tend to be organically driven but in order to succeed, they require support from the university administration. The university administrators and campus managers can be argued to face a drastically different operational environment than the one they were operating in ten years ago.

This study aims at elaborating on guidelines for university administrators and campus managers to support these types of actions. The theme is approached from a business model perspective with a special focus on value creation for the university as an institution. In order to identify what kind of value these end-user driven projects aim to create, five cases from the Aalto University campus in Otaniemi, Espoo are analyzed based on interviews, workshops and complemented with archival data found on the web pages of the case projects.

The results imply that in order to support these kinds of developments, university campus managers should: focus on the changing needs of different users on campus; collaborate with both internal and external stakeholders of the campus community; identify new activities that enable effective learning and working processes; facilitate multi-usability of spaces; and increase synergies among the space users. In the future, managers will need to apply more holistic frameworks and tools in order to manage and facilitate value creation in the campus context.

Novel architectural solutions change campus design

Jenni Poutanen, Sanna Peltoniemi
& Noora Pihlajarinne

The change in the learning paradigm from transmission of information to an active learning model is evident in higher education, too. From solitary to group work, from virtual to learning by doing, all means and methods are possible. Like a lively city, so do our campus premises need to support a greater variety of spaces, as learning is becoming more and more diverse. How does architecture, in different scales and different solutions, enliven the existing university campus?

From holistic to small surgical operations, architectural solutions are presented on three different scales; campus, building, and group of space. Pervasive solutions, in which the whole layout is drastically changed, possess potential in changing essentially human interaction and how the building is used. However, these solutions are slow and expensive to execute. Then again, targeted learning space solutions, created, for example, in an area of formerly supporting spaces, are less expensive but have an impact only in the vicinity or for a certain group of users. The existing premises of campuses possess a huge potential to be turned into vivid urban centers that support learning and research of the future. Hence, the existing buildings can be seen as platforms for novel architectural solutions, and stages to present universities state-of-the-art education and research.

The outcomes of the research can be applied in different design stages and scales of campus environments. The article aims at evoking readers to ponder on novel and innovative solutions that could be used in campus development, and can be seen as a conversation opener for designers, campus developers and users. The visions presented in this article inspire readers to look upon campuses from a new perspective through innovative examples and spatial solutions.

Core Team: management of co-creation

Marko Keinänen

Regular formal project organizations can be rigid and produce constraints that make value adding co-operation concerning decision making and communication difficult or almost impossible. In modern projects, like campus development, efficient decision-making and communication between participating parties are in a crucial role. Therefore, a new kind of approach is needed. The research addressing inspiring Learning Environments is the part where the authors explore new organizational innovations that can facilitate cross-organizational and cross-disciplinary collaboration.

As the result of the outsourcing paradigm, construction companies are specialized around their core businesses. This has resulted in a considerable increase in the number of partners. The main business operations in this field are typically carried out as projects and therefore projects and their management play a crucial role. The core team concept is a new approach for the management of projects. We defined that the concept "core team" is the official or unofficial group that consists of two or more people who make decisions in the project. In our paper, we present a part of the results of our new study concerning knowledge of the core team concept among the Finnish building construction sector. Our main attention is concentrated on how a core team makes decisions and how the use of a core team affects the speed of decision making. We define the optimal team size and the concept's official character in an organization and investigate the effect of the use of a core team for the flow of information. The Data for the research was collected using a literature review and a survey that was sent to 682 selected professionals of the construction sector. The response rate of the survey was 20.5%.

In the traditional process of building, the parties change during the different stages of building. In a process of this kind, the understanding that has been jointly created is not able to "grow" during the process. The core team is responsible for decision-making during the whole customer process. Working this way, the jointly created new knowledge and understanding is preserved throughout the whole process. It is also crucial that all needed information must be available to those who make decisions. The core team can help in this by setting and integrating the different viewpoints of the stakeholders. Based on our research, in most cases the decisions of the core team are based on mutual understanding, the use of a core team accelerates decision-making and improves the flow of information. On the basis of our study, a core team is, in most of the cases, an official part of the organization and it consists of three to six people.

Efficient decision-making and communication between participating parties are crucial in construction projects. Core teams can support the decision-making and help the project to achieve its goals.

Mine, Ours, Yours – Lahti Campus Development

Satu Hyökki, Hannu Kaikonen and Suvi Nenonen

The article describes the process of LAMK Lahti University of Applied Sciences' future campus development from 2012 to the present date. The aim of the campus development is to employ a user-centric approach to create a pioneering, unifying, multidisciplinary and synergy-oriented spatial and functional entity by 2018, the Niemi Campus. For LAMK this means both a spatial and functional transformation from single faculty campuses to a centralized multidisciplinary and multiactor community. The transformation is first and foremost functional and cultural, even though the spatial solutions have an obvious effect to functionality. Considering the limits given by today's economical and operational conditions, the effective and responsible utilization of space is the guiding factor of the campus development. The campus concept is built on a strong user-centered basis with the largest volume campus user, Lahti University of Applied Sciences, point of view, but the starting point has been the co-operation of all campus users. By identifying the key-user groups, conducting user research and involving the users heavily in the conceptualization of the future campus, a campus solution that meets the end-user needs is created. From the research point of view, it was very important to do all of the material analysis in a continuous dialog with the users. Dialogical analysis of the user studies' results and joint future dialogue with the users formed the synthesis and the understanding and a description of the future learning environment. The development work was kept loyal to jointly created user information in all stages of the development. Campus theses drawn from the user information guide the campus development. The future LUAS Campus is formed from three intensively connected and function based locations devoted to learning, research and sharing. The solution offers a joint home base for all the faculties and multidisciplinary learning (Learning factory), research activities together with other universities and development organizations (Science Park) and, to the community, an open knowledge sharing platform (Sharing hub). The largest location, the learning factory, is currently in the main focus of development. Co-operation with the stakeholders was also important. In workshops, held in co-operation with the Helsinki University staff and students, visions of the spatial and functional dimensions of the future campus were created. Intense co-operation continues. We aim to develop a service called "campus". This campus development is an ongoing and never ending interaction with the users of the living Niemi Campus. We are happy to invite all to pimp the campus and its spatial and functional entity to meet their needs.

Library's transformation into **Learning Center**

Päivi Hietanen

The modernization of the Otaniemi Library designed by Alvar Aalto will begin in 2015. The strategic aim of the library is to transform itself into an inviting Learning Center. The planning started with a service design, the goal of which was to create for the library a new service concept and an environment to support it. Invited to participate in the development were a design agency, an architectural office and an interior designer.

The service design project, facilitated by Kuudes Kerros, established three service design teams that carried out extensive interviews of the university's students and staff. Based on the user needs collected through the interviews, six different user profiles were defined. The interviews were followed by a series of workshops, in which ideas about new services and environments supporting them were generated. After that, the best of the service ideas were selected and prototyped among the users. The co-design generated a new service concept and an ambitious service promise for the library: "Learning together will make us the best in the world".

In the beginning, the library project did not have a spatial program. The program came into being on the architects' desk after the design project had been completed. The architects converted the new service concept into a space design by grouping the services onto the different floors of the building and by designing the layout and furnishings to support the new functions. The chief architects for the programming were NRT Architects, whereas the visual identity for the library was the responsibility of JKMM Architects.

The concept of the new Learning Center was co-designed by three design agencies and the uses. This turned out to be a learning process for all. This kind of an approach requires that the project manager has the courage to question dominant design practices and is willing to manage a new kind of cooperation and multi-disciplinary team work.

In a building project, major decisions are made in the very early stages. Because the spaces are built to last for decades, it is advisable to put enough effort on redesigning activities and developing new concepts in the programming phase. On the other hand, without understanding the user needs, we cannot design spaces and services that work well. This realization is gradually entering the real estate sector.

Co-design provides the project team with a common language to deal with a complex entity. At its best, it also assures user engagement to design solutions so that there will be less changes in the following project phases. In fact, user-centered design offers a great chance for renewal in the real estate and construction sector and provides an opportunity to create better customer value.

Does Academic identity reflect the campus image?

Airo Kaisa, Rytkönen Eelis

User identity has a significant effect on how users experience a campus area and its buildings. Despite this, user identity does not necessarily meet the image of the organization. This article compares academic identity to the image of Aalto University and considers the relation between them.

The concepts of identity and image are easily confused. Identity often signifies a person's experienced perception of him/herself or a place. Image, on the other hand, signifies a desired or common conception of a person or a place. In other words, for example a place may have a bad image even though its users would experience it in a positive light. Respectively, a person's identity may be in conflict with his or her image. A person may feel that he/she is, say, shy, even though others consider him/her social.

This article compares the image of Aalto University to the academic identity of its users and considers the possible conflicts and similarities between them. The identity of the users was outlined by interviewing university staff and students. The Aalto University image was defined on the basis of the strategic policies of the university.

The Aalto University image is built around the concepts of openness, co-operation, and innovation. In practice, this means, for example, developing alternative learning environments, promoting grass root level projects, and more efficient use of space. However, these themes were not brought up in the responses of the university staff. The employees of the university formed their space identity more around the academic identity than specifically around the Aalto University image. The reason for this is, firstly, that users usually want spaces that they already are used to. There cannot be a complete "Aalto identity" if there is no history on which it is based. Secondly, it can be difficult for the users to see strategic policies in spaces that they use daily. Thus, the image and the identity do not always meet. On the one hand, the new Aalto University cannot yet have a firm identity, but it is constantly being built in the dialogue between the users. Therefore it is important to consider the strategic planning of spaces without forgetting the history and own identity of the users.

Learning sustainability in campus areas

Katri-Liisa Pulkkinen and Aija Staffans

Sustainability is one of the key challenges that future learning environments and campus development face. The everyday use of campus areas can be seen as an opportunity to do research and produce new knowledge on sustainability. Campuses could be developed in explorative ways, for example as living laboratories, which are an emerging way to do research and produce new knowledge. Living laboratories have learning on the course of change as their root configuration. In the field of sustainability, they could aim at reaching more sustainable technological solutions while developing more sustainable ways of living and a deeper understanding of interconnections of human and ecological systems. In this article we discuss some of the basic settings behind the need for these solutions and suggest processes to produce inspiring campus areas that advance sustainability. While the transition to sustainability is often seen as a top-down governing challenge, the processes suggested here are pioneering bottom-up ways to create change. Bottom-up action in innovation should be given recognition and nurturing, as the bottom-up initiatives often challenge systems that resist change. We also discuss how some of the current ways of producing campus areas are problematic for this need of new approaches. We use the Aalto University Otaniemi campus area as an example of a future sustainability learning environment.

Human & Green Workplace Design
In The University

Virpi Ruohomäki, Marjaana Lahtinen, Anssi Joutsiniemi, Miimu Airaksinen, Pekka Tuominen, Pirjo Kekäläinen and Janne Porkka

The objectives of the study were to develop a participatory design approach to promote energy efficiency targets and to support effective working and well-being of employees. The driving forces were sustainability and the workplace needs of university staff. University buildings need to be energy efficient, technologically up to date, meet the needs of the users and be healthy in terms of well-being of people. This research is based on multidisciplinary collaboration between work and organizational psychology, architecture, construction and energy engineering as well as practical viewpoints of health and safety at work.

The Human & Green action model was created in order to promote energy efficiency targets and to support effective working and well-being of users. The design process and its outcome can be improved by utilizing users' expertise and experiences of their work. Participatory design requires close cooperation between the users of the premises, the designers and other specialists. New participatory methods were developed and successfully applied in the university as a part of broad renovation. Participatory methods include interviews of managers and other key stakeholders, the Work Environment and Well-being Survey, the Visualization of the survey results in the building, the Participatory Workshops for the users and designers of the building as well as practical guidelines for implementing and using shared workspaces.

This study also included the use of new energy efficiency indicators, the purpose of which is to better take into account the interplay between efficient space use and energy efficiency. The proposed indicators are meant to complement the widely used specific energy consumption (kWh/m2).

The results contribute to future design of universities and campuses by integrating attempts towards user satisfaction and well-being as well as energy efficiency. The Human & Green action model and participatory methods can be applied both in universities and other contexts when creating sustainable working and learning environments for the future.

A digitally supported **collaboration and communication place**

Sari Tähtinen

Co-creation requires many participants to take part in the process. Having different actors with diverse backgrounds, views, and expectations, can make e.g. the planning process complicated and time consuming. Today, it is increasingly widely recognized that, no matter how difficult it may seem, the best outcomes are achieved when all the actors are able to take part in the planning process as early on as possible.

ABE offers a space and the technology for interactive human-centered co-creation of the built environment. The aim of ABE is to investigate new digitally supported and interactive planning and design methodology. Immersive modeling and simulation technologies, process modeling and data visualizations are developed to serve decision-making and present ideas, visions and plans. ABE caters to the needs of multidisciplinary teams and people with different backgrounds working towards a shared goal.

Instead of concentrating solely on outcomes, the underlying process is given an equal amount of attention. Providing the stakeholders with a detailed understanding of the process and its interconnections leads to greater opportunities to communicate and affect the project in correct time, which has the potential to make their participation more conscious and patient.

The ABE space, tools and processes can enhance multi-, inter- and transdisciplinary research by responding to four different challenges. 1) The communication challenge in connection with developing a common language among diverse users and experts – not only communication by words but also, and especially, communication with pictures and images. 2) The collaboration challenge in connection with trust building. This is facilitated with similar and democratic possibilities to visualize the processes and results and by offering a possibility to discuss and ask questions in a shared space and learning situation. 3) The interpretation challenge in internal learning within the group of participants and during the process: it is important to be interested in other people and their work, however unknown the topic or discipline is. 4) The dissemination challenge in providing possibilities for an external audience to learn more, too – not only discipline-based findings, but the findings that could not have been reached without collaboration between disciplines. It is important to visualize both the process and the outcome.

ABE is one means to increase the confidence in and competences for rich co-creation processes. It orients especially to work with different fields of perception – vision and sound included – and reminds us that image and word are interlinked.

Charrette supports facility development – Case Musica

Marja Naaranoja, Pekka Ketola and Olli Niemi

There is a clear need to improve the facility development process since too often a recently built or renovated facility does not fulfill the needs and it must be renovated. This chapter describes how during the briefing stage a Charrette helps to negotiate and plan spaces that support future strategies and needs. The research method is a case study.

A Charrette is a multi-day negotiation and planning process that harnesses different kinds of experts. A Charrette gives all affected parties the possibility to state their opinions about the plan and also to change the new plan. Careful selection of stakeholders and development at the site are important to a successful Charrette. The process varies from a three to a seven day event depending, for example, on the size of the project.

The case is Musica, a building at Jyväskylä University Campus where music is researched and learned. The aim of the Charrette was to plan a living room and learning/research spaces for the students. One of the goals was to bring music out for display in order to demonstrate what happens inside the rooms. There was a need to have both electronic and acoustic music, and to enable the listening of the music of the club also outside the building.

The case study illustrates how during the five day Charrette the new end-user goals are recognized and linked with the strategic principles of the facility company, and the needed planning documents are created.

Co-designing learning spaces: Why, with whom, and how?

Tiina Mäkelä, Anette Lundström and Inka Mikkonen

In this article we discuss why, with whom and how participatory co-design of learning spaces was implemented at the University of Jyväskylä Teacher Training School. First, participatory co-design (i.e., collaborative design) of learning spaces can support the understanding of users' precise needs and thus improve both the desirability and adequacy of the design from the user perspective. Second, participatory design is supportive to a democratic organizational culture. Third, increased ownership and dominance of co-designed solutions can lead to their more efficient use in teaching and learning and thereby support obtaining better learning outcomes. In the project described in this article, various internal (school administration, teachers, student teachers, and students) and external (researchers, constructor, designers, companies, etc.) stakeholders, all experts in their field, were brought together in order to co-design an inspiring technology-enhanced natural science learning space that allows diversified 21st century learning and, particularly, collaborative work. The initial results of our yet on-going impact evaluation indicate that involving various stakeholders, especially students, in the design has influenced positively 1) the design, 2) the organizational culture, and 3) the ways of teaching and learning. First, some of the indicators of the improved space design are relatively high average ratings in the student satisfaction survey and clearly increased use of the hallways during both classes and breaks. Second, in relation to impact on the organizational culture, it seems that participatory design and decision-making processes have led to less resistance to change. Moreover, as evidence of the increased participatory culture, we have witnessed how the co-design project has inspired other similar projects within the school such as redesigning the language studio, a project initiated by the language teachers. Third, the co-design project itself was seen as an opportunity to practice 21st century skills such as creativity, collaboration, and citizenship. The initial results from the video analysis and the student satisfaction survey indicate that the co-designed spaces inspire and support especially collaborative learning. We hope that the description of the phases and results of this project will support and inspire learning space co-design projects in the future.

Promoting **meaningful learning**

Kirsti Lonka, Lauri Vaara & Niclas Sandström

What are the possibilities and challenges for developing new kinds of learning spaces that promote meaningful learning and knowledge co-creation? Modern theories of learning should form the basis for integrating physical, virtual, social, mental and embedded learning environments. It is time for profound changes in designing schools and universities, due to the advancements in society, social media, knowledge practices, technologies and demands of the working life. The present paper introduces prospects for designing future learning environments especially in higher education.

How to co-learn on campus

Alpo Salmisto

This article examines two university-level courses in civil engineering education at Tampere University of Technology, which were conducted using knowledge creation and progressive inquiry based learning methods. The article summarizes the results of two peer-reviewed scientific articles. In the first case study, the application of progressive inquiry learning was tested on a Real Estate Business and Management course for Master's students. The main purpose of the research was to find new ways to improve students' learning outcomes and make learning more meaningful. A course plan based on progressive inquiry learning was developed first and then implemented in 2011. Subsequently, the course plan was improved based on student feedback to lend more support to progressive inquiry learning. A second course was conducted in 2012. Feedback was collected during the course and it was compared with the feedback of the previous years. According to the feedback, inquiry learning has facilitated the learning process of the students. Students considered as the best parts of the course the tasks and learning events based on progressive inquiry learning. The research demonstrated that the progressive inquiry learning method is a good way to improve higher engineering education courses. The results can also be used to develop other courses to improve learning outcomes as well as help students to find learning more meaningful. The second case study examines the application of knowledge creation learning for first-year university students on a Basics of Construction Management and Economics course. The objectives are to demonstrate the application of the course based on knowledge creation learning to mass teaching and to analyze whether knowledge creation learning improves student motivation and learning. The empirical data consist of the results of a student survey from two university-level courses. The first course, Basics of Construction Management and Economics, was developed on the basis of knowledge creation, and the second course, Building Project, was implemented using the case-based learning method. The results, based on student self-assessments, showed that case-based learning supported the learning process more effectively than the course based on knowledge creation. On the other hand, the results showed the relevance of applying knowledge creation based learning to the mass teaching of construction in higher education. The findings of this empirical study suggest that more attention should be focused on developing students' metacognitive skills in engineering education. The results of the case studies can be used in developing education in universities. New learning methods set new requirements also to learning environments. The future learning environments should be more suitable for the student-centric learning methods, which are based on students' active involvement in their own learning process.

What makes a Place? Claiming spaces for informal and social learning

Jenni Poutanen

How to redesign an under-used secondary space into a lively social and informal learning space? Here, three case studies are compared to shed light on what spatial elements create a Place for learning.
The scale of learning methods has widened, and the learning culture altogether has become more complex, variant and the choices free. Hence, the spectrum of spaces available should be modified. At many university premises, informal learning spaces are often limited to libraries and social interaction to cafés. However, secondary spaces, such as halls and corridors, which are located in popular areas on campuses, have great potential as redesigned into novel social and informal learning spaces. Learning spaces located in circulation spaces reach students from all faculties, which also intensifies the use of the spaces as those compose typically up to 22% of the total floor area of Finnish university buildings. Campus-wide Wi-Fi and the culture of Bring Your Own Device (BYOD) enable all secondary spaces for informal and social activities.

Our case studies have been refurbished in existing places. The three cases differ in design and development manners: two novel learning spaces created in a lobby, a renovation of a campus café, and co-created learning spaces in an academic library. The cases have revealed that students see university as their "workplace" and wish for spaces for "work". Studying among other people in an active place is also shown popular, but students expect places suitable for studying and concentrating.

All of these case developments seem to be successful in either attracting people or increasing the popularity of the space. On the whole, the different development and execution manners do not seem to play a part on how well the places are adopted even though one is a temporary and inexpensive development.

The cases offer practical implications and elements on how to create new learning spaces successfully. The location is most likely to affect the popularity of the spaces. These realized cases suggest that relatively small, acupuncture-like changes to existing spaces can create a relatively big impact. One definition common for all three developments is the "pleasant" qualities and updated image acknowledged by the users.

Students like to study among colleagues. Even noisy places possess potential if a pleasant acoustical environment is created with the help of carpeting and architectonic interior elements. A hint of privacy should be guaranteed even in an active place. Furniture plays a big role; ergonomics suitable for work, the look and the movability affect how the spaces are used. The absolute minimum requirement for any space nowadays is the availability of power plugs. The use of colors has been appreciated greatly, too, and the access to natural light and views have a significance as well. These kinds of small surgical developments can be adjusted according to the place and requirements. With the help of furniture and architectonic elements the atmosphere is adjusted to a learning place.

Pihazzo – multiuse of campus cafeterias and restaurants

Satu Kankaala, Jan-Erik Gussander, Suvi Nenonen

Increasing cooperation is a part of the everyday life of a university. A natural meeting place on campuses is around food and coffee. The multiusability of cafeterias and restaurants is a challenge that was responded to, as a result of a development project, with the Pihazzo concept. A Pihazzo is a place where a traditional restaurant opens up to a multiuse meeting and working environment. With the help of usability walkthroughs and workshops, a manual was composed, which combines four viewpoints that are important for the usability and planning of restaurant, dining and cafeteria spaces: the viewpoints of the customer, the range of services, the spaces, and the design. The boundary conditions of usability and planning are sustainable development and social responsibility as well as accessibility. The Pihazzo concept is tested and developed further within the space and service offering of the campus restaurants of Aalto University.

1 Campus as a **communal platform**

This section discusses campus as a communal platform: What challenges are there for campus management and what should be taken into account? The challenges for the team of builders of a communal campus are considered in Marko Keinänen's article, after which service design as a tool for campus development is presented.

Value co-creation in university campuses

Eelis Rytkönen & Ville Korpinen

Today, working and learning happens in a variety of locations through a myriad of interfaces around the clock. As the means, times and places to execute actions are scattered based on individual daily routines, effective spatial facilitation of working and learning becomes increasingly complex. At the same time, university facility utilization rates are globally low, while maintenance costs remain high and the variety of end user demands are becoming more heterogeneous.

Simultaneously, end users themselves are becoming more and more active in creating, producing and managing novel spatial services for their own thematic communities. Multiple projects can be identified where end users have taken over underutilized spaces and become facilitators in their own right. Compared to traditional bureaucratic campus management practices, these projects tend to be organically driven but, in order to succeed, they require support from the university administration. The university administrators and campus managers can be argued to face a drastically different operational environment than the one they were operating in ten years ago.

This study aims to elaborate on guidelines for university administrators and campus managers to support these types of actions. The theme is approached from a business model perspective with a special focus on value creation for the university as an institution. In order to identify what kind of value these end user driven projects aim to create, five cases from the Aalto University campus in Otaniemi, Espoo are analyzed based on interviews and workshops, and complemented with archival data found on the web pages of the case projects.

The results imply that in order to support these kinds of developments, university campus managers should: focus on the changing needs of different users on campus; collaborate with both internal and external stakeholders of the campus community; identify new activities that enable effective learning and working processes; facilitate multi-usability of spaces; and increase synergies among space users. In the future, managers will need to apply more holistic frameworks and tools in order to manage and facilitate value creation in the campus context.

What is the main job of a campus manager from an end user point-of-view?

As the tasks of a university are dictated by legislation with regard to education, research and social impact, it can be stated that also the framework within which a campus manager conducts his/her job is defined from a normative point of view. Whether or not a campus manager is successful at his/her job can be approached by how well the built environment facilitates the value creation processes of the university. In this sense university facilities managers need to constantly bear in mind that facilities as such do not create value by themselves from an end user perspective. End users create value through their respective value creating processes where facilities act as value creation enabling resources. In order to better facilitate these processes facilities mangers need to create a deep understanding of various end user jobs and of the processes through which they try to get these jobs done.

What do we actually mean when we are talking about the university? Do we focus our attention on the various end user groups such as bachelor, graduate and post-graduate students, the teaching staff, the administrative staff, etc. or are we looking at the university as an institution that as such has certain targets that it needs to reach with regard to i.e. the number of graduated students per year? Of course all the various groups are parts that together make up the institution and as such the posed question might seem trivial but in an increasingly more dynamic environment it is not. If the institution point of view is accepted it will drive the development from the top down, i.e. how can various space solutions facilitate faster graduation times and higher quality research? If we approach the question from an end user perspective, the development process will inherently become more bottom up oriented, i.e. how can various space solutions facilitate better interdisciplinary co-operation amongst students and thus help create a more open university culture that in the future will further the level of interdisciplinary research efforts?

As we begin to understand the new ways of learning, the mounting evidence is forcing us to rethink the traditional methods of university teaching. Vast lecture halls are becoming obsolete as MOOCs (Massive Open Online Courses) are starting to offer essential-

ly the same level of engagement at the comfort of your own home. The leading universities have started opening their courses to the public via various virtual learning spaces such as www.edX.org. If the learning spaces of the future are not going to be lecture halls and traditional classrooms then what are they going to be?

Abraham Lincoln stated that the best way to predict your future is to create it. In the context of future university campuses one might say that the best way to predict your future is to co-create it with your end users. To reach this goal, campus managers need to accept and embrace a different way of facilitating the university's needs as an institution by turning their focus towards the various end user groups.

What are the end user's works and needs?

General business management literature has become flooded with advice that is telling managers to listen to their customers, be sympathetic towards their end users and become problem solvers for their clients. The problem is that we are not yet so familiar with the various tools we need to use in order to gather and generate useful customer insight that we can utilize while developing our offering.

One way to better understand end user needs is to approach the subject from a jobs-to-be-done perspective. By simplifying the use of products or services we can say that users "hire" a product or a service to do a certain "job" for them. Harvard Business School Professor Theodore Levitt said in the 1970's that people don't want a quarter inch drill but rather a quarter inch hole. Therefore the job-to-be-done of a drill is to make a hole in the wall and the drill was "hired" to do that job. By focusing on the "job" instead of the service or product that the person "hired" we effectually broaden our perspective. Instead of selling him the drill could we have started to rent out drills and other equipment for enthusiastic DIYers? When gathering information on possible end user needs, we are likely to get very different answers if we ask for an opinion of the best classroom that one has ever been in as opposed to asking which products or services one has recently "hired" to help in learning. By looking at the answers to these questions one might assume that the latter one produces more insights on how to facilitate learning processes.

End users can and should not be expected to be experts in the field of designing built environment solutions. But they can and should be expected to be experts in their own respective jobs-to-be-done needs and the solutions that they are currently hiring for their learning related "jobs". This is why it's crucial to focus on the "job" and not cling on too tightly to the product or service point of view.

The heterogeneous nature of end users on campus

As the possibilities of executing tasks have multiplied through technological advantages, end users are becoming increasingly heterogeneous in their space consumption habits because of both disciplinary and individual needs. From the disciplinary perspective, universities tend to house multiple disciplines that are traditionally siloed in their own administrative units and thus usually have their own allocated spaces. Different disciplines require different sorts of spaces by nature: a business student could basically complete his/her degree without any allocated premises with just access to resource clouds, whereas it would not be purposeful to have a chemistry degree without any laboratory courses. On the other hand, presentation skills are useful for students of both degrees. At the same time, some studies propose that the utilization rates of university spaces are around 30% (Neary et al. 2010; University Herald 2013; Harrison and Hutton 2014), which reflects possibilities of cutting spatial costs and allocating the same amount of money to the core tasks of the university: research, teaching and societal impact. For example, both degrees may have some basic courses that may be housed in common facilities while more specific facilities such as laboratories could potentially be altered to house multiple activities of a variety of disciplines. Another option would be to collaborate outside the university with industry actors and to share these costly specific spaces with private sector companies or other external institutions with the same needs.

From the individual demands perspective, the working, stu-

dying, learning, teaching and socializing habits of an end user group vary significantly even under the same disciplines. Some students "hire" the campus facilities just to meet friends, some to find interesting information in the resource clouds of the university, some to use free Wi-Fi, some to print gig tickets, some to take a nap on a sofa, some to utilize the licenses of expensive computer programs either for studying or entertainment purposes or both. Some choose to do all their studying in a library, some choose to utilize the forge works spaces for crafting Christmas presents, some prefer studying in small groups in a group work space or cafeteria on campus while some prefer studying from their home and on the side while working in the industry. Some only come to the campus when they have a course where presence is mandatory. And some do all of these. Some just want to get the degree as quickly as possible and study efficiently in solitude while some are looking for socializing possibilities, friends, events, and discussions on campus. The difficult question to be posed for the campus managers is which tasks universities are willing to support followed by a question of how to attract people to the campus. Or do students even need to be attracted to the campus if they do not come there naturally?

Some researchers demand only a laptop and access to the academic publications, some need a sterile laboratory where to do tests, and some absolutely want their own table in their own office room because they are not able to concentrate otherwise. Some have meetings, some teach, some travel to conferences, seminars and some just write on the road. Some work from public spaces, some spend most of their time in the office and some do all of their work from a home office. And again, some of the researchers do all of this. In addition to these core end user groups, the administration, the academic partners, public partners, business partners, delegations and visitors also have their own demands and habits to execute their jobs-to-be-done.

The variety of possibilities to execute activities and the heterogeneity of the end user groups and end users have understandably made it more complex for campus managers to develop, design, maintain and facilitate a purposeful number of right kinds of spaces for multiple activities in university campuses. By trying to support only individual demands, purposeful campus environments are difficult to create because of the low utilization rates and bureaucratic administrative structures – everything can not be offered with limited resources. Rather, filtering the real needs of end users, creating a holistic vision and typology of end user groups and identifying potential synergies among the groups is the key to a successful space allocation and a lively university campus. The challenge is to offer an adequate number of different sorts of possibilities in wise locations – the role of the campus managers seem to be expanding from bureaucratically managing, monitoring, guarding and maintaining a real estate mass towards also identifying potential end user driven projects and collaborating with potential operators who would be able to facilitate actions of communities inside the buildings. These sorts of facilitative actions on the operational level are difficult to manage based on traditional bureaucratic business models. Campus managers do have time limitations and need to focus on their existing tasks but what they can do is support the new types of end user focused facilitative actions or even encourage the proactive members of the university community to create their own spaces.

Tools to help out in a complex environment

To find a balance in this complex actor network and action environment, we need tools that cover both sides of the equation: the end user demands and the resources with which the demands are fulfilled. A business model approach seems to offer possibilities for exploring this field. General characteristics of a business model as a concept include: it is a unit of analysis between business strategies and operations, it does not only describe what businesses do, but how they do it, it describes a firm-centric yet boundary-spanning activity system, and it describes both value creation and value capture (Zott, Amit and Massa 2011). The Business Model Canvas (Osterwalder et al. 2010), which is a business model tool designed for practitioners, has been studied as a potential framework (Rytkönen and Nenonen 2013; Rytkönen 2014) to help in organizing actions in university campuses. Accordingly, its most potential use is in early stage concept creation and it also functions as a tool for collecting ideation results and communicating ideas visually.

What information does the BMC provide and how to use it?

In a nutshell, The Business Model Canvas is a tool with which a business model can be visualized and communicated. It bases on four themes: Offering, Customers, Resources and Financials. These themes are divided into nine building blocks and set on a pre-structured canvas: Value propositions; Customers, Channels and Customer relationships; Key resources, Key activities and Key Partners; Revenue Streams and Cost structure. Based on these building blocks, by utilizing post-its, a group of people can discuss, test, plan and develop business models for their businesses. For further information on Business Model Canvas, visit businessmodelgeneration.com or read Osterwalder's dissertation (2004) or the book Business Model Canvas (Osterwalder et. al. 2010).

By comparing the Business Model Canvas approach with an integrated model developed for the needs of university campus management (Den Heijer 2011), the most useful features of the Business Model Canvas were identified as: (a) inclusion of an end user centric approach to developing a campus; (b) integration of social and virtual space dimensions to the campus strategy; (c) creation of a fluent service platform; (d) piloting and testing new campus concepts (Rytkönen and Nenonen 2013). Moreover, initial results of a multiple case study based on seven business model workshops that outlined five recent development cases on a university campus (Rytkönen 2014) indicate that multiple alternative business models have evolved in the university campus context and that the essence of these spaces is that they are facilitated as systemic entities on three abstraction levels: social community facilitation, physical space facilitation, and virtual network facilitation.

These three levels together form the place and facilitate the potential value creation of a facility for some of the end users – none of them can function separately. From the space operator point of view, the social layer was seen as the most important one of all the studied cases. Earlier, university campus managers seemed to have mainly focused their actions on the physical facilitation and technical details leaving the social and virtual aspects with minor attention. It was also evident that the business models constantly change over time which requires dynamics from administrative principles, systems and managerial actions.

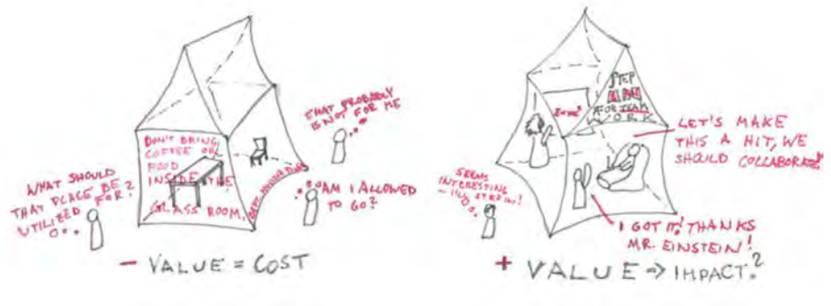

Figure 1. Does a space create value or accumulate costs for the university?

Case study examples

In a multiple case study (Rytkönen 2014), the following five cases were chosen to understand how these intrinsic cases differ from one another and from traditional campus developments:

The five case examples (Rytkönen 2014) are all operated by different autonomous space operators that are not professional facilities services providers but have initiated the projects as normal space users. Through an identified thematic or action-based need, they have started to develop spaces in their own right and to facilitate social activities inside the spaces.

The results indicated that university facilities should be regarded as vehicles for value creation rather than valuable physical assets as such. The physical assets do have monetary value for the owner (i.e. Real estate company) but for the client (i.e. University) the physical asset is rather a cost, for the customer (i.e. University unit) it is rather a vehicle for keeping the end user happy, and for the end user (i.e. Student) it is rather a vehicle hired for a job-to-be-done. And as the value of the end users for the university is generated through the mental and physical work they execute, those actions are the most crucial ones to be supported if the aim of the campus is to support the core actions. Ultimately, it is the actions inside the facilities that count and that can create the value of the facilities for the university. If no actions take place inside the facilities, the facilities generate only costs in the forms of rents, development and maintenance fees, which cut the budgets from the core actions of the university. If we recall the quarter inch hole example from the beginning of this text the analogy holds true in this case as well. The drill itself as a tool creates no value for the end user but rather is a resource in the users own value creation processes. As such the built environment at the university campus creates no value in itself for the end user groups but acts as a crucial resource in their own value creation processes i.e. studying, learning, teaching, networking, etc.

In the initial data collected from the five cases, the nine building blocks were described by 244 words or phrases, only 11 of which were common to all. Based on a within case analysis, the abstraction levels varied significantly from describing concrete elements such as "kitchen", "ear phones" and "free Wi-Fi" to more abstract elements such as "discourse", "global connection" and "atmosphere". These elements

Figure 2. Case study examples

were not comparable. Through complementing the initial workshop data with archival data and conducting a between case analysis, a pattern in the descriptions was identified – each Offering element had a tendency of falling under either a technical ability (physical), a social activity (social) or a network related proposition (virtual). It was also identified that each case has a specific focus in comparison to the other cases. Finally, the data was complemented by interviews and the themes were narrowed to the four business model components (Offering, Customers, Resources, and Financials). In a cross-case analysis, 37 common elements were found on these three abstraction levels and the focus area of each case in the campus ecosystem became clearer.

When looking through the lenses of the four business model cornerstones, the common offerings of the studied cases consisted of: Collaborative learning on the social level; event and learning spaces, testbed, kitchen, hot desk and Wi-Fi on the physical level; and encounters, community and buzz on the virtual level. Accordingly, the common customers were students on the social level; students, researchers, university, visitors and events on the physical level; and university, schools and business partners on the virtual level. The common elements are listed in Table 1.

According to the results, the different cases seem to be highlighting different core tasks of the university and are primarily subjected to specific, thematic end user groups even though they are open to all the end users of the campus to some extent. Each case aims to create synergies through fostering interdisciplinary encounters in a thematic (urban innovation, digital manufacturing, product design) or activity-focused (learning, entrepreneurship) environment. The focus areas of the projects are illustrated in Figure 1.

Common elements	Social (Community facilitation)	Physical (Space facilitation)	Virtual (Network facilitation)
Offering	Collaborative learning	Event&learning spaces, testbed, kitchen, hot desk, Wi-Fi	Encounters, community, buzz
Customers	Students	Students, researchers, university, visitors, events	University, schools, business partners
Resources	Users/community	Spaces, janitors and partners	Academic, business, funding and learning space partners, staff, events
Financials	Staff	Rent&maintenance, Furniture&equipment, Development, Staff	Staff

Table 1 Common elements of studied cases

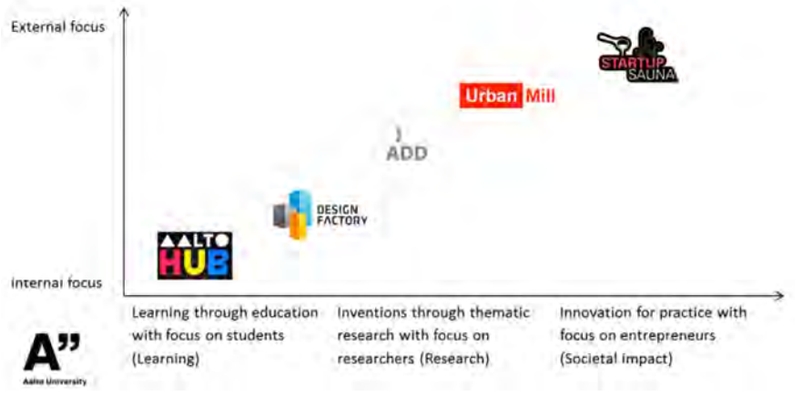

Figure 3. The core functions of the case examples.

Constrains

Even though the resulting application of the Business Model Canvas is a usable tool for conceptualizing, visualizing, discussing and collecting qualitative information about cases, it does have certain drawbacks. First, it must be highlighted that the different elements could not be unambiguously allocated to only one of the mentioned layers but some exist on all these layers, whereas some elements change in their roles when crossing from one layer to another. Second, the Business Model Canvas should not be used alone but it requires quantitative data to support its principles – the real challenge is in measuring the success of a business model from an end user perspective and linking it with the missions of the university. How to balance between individual needs and institutional aims? Third, the comparability of business models is difficult – our proposal is that no model itself is better than another but multiple models are needed in order to support the complex tasks of universities in a complex actor environment.

Conclusion

To conclude, it seems the university campus managers are facing a drastic expansion in the nature of their work. In addition to their important routine tasks without which the buildings would fall apart little by little, they need to understand and support both social and virtual facilitation of a myriad of end users. In order to respond to these evolving practices they need to: focus on the changing needs of different users on campus; collaborate with both internal and external stakeholders of the campus community; identify new activities that enable effective learning and working processes; facilitate multi-usability of spaces; and increase synergies among the space users.

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Novel architectural solutions change campus design

Jenni Poutanen, Sanna Peltoniemi
& Noora Pihlajarinne

How does architecture, on different scales and through different solutions, enliven the existing university campus? Space and the environment have an impact on human behavior; facilities can foster learning, interaction, and creativity. The layouts of existing, modernist campus premises are inadequate in supporting current changes in pedagogics and user requirements. Facilities should offer affordances for novel learning, including social and informal aspects. Social space is constructed in physical environments. Novel architectural concepts on how to enhance the spatial structure of campuses are introduced, along with principles of how to create spaces that support learning and creativity. From holistic to small surgical operations, architectural solutions are presented on three different scales: campus, building and group of space. Pervasive solutions, in which the whole layout is drastically changed, have potential in changing human interaction and how a building is used essentially. However, these solutions are slow and expensive to execute. Then again targeted learning space solutions, created for example in an area of formerly supporting spaces, are less expensive, but have an impact only in the vicinity or for a certain group of users. Three different architectural viewpoints create a holistic interpretation of future learning environment architecture.

Urban campus supports various learning methods

How does the campus of the future look like? What kind of architectural solutions could turn modernist campuses into lively learning centers of the future? In order to answer these questions, one must first understand the concept of campus and its origin. By drawing inspiration from the original principles of campus design solutions and combining them with the new upcoming learning methods, campuses could evolve into lively urban centers that support various learning methods. The article looks far ahead to the future and illustrates novel architectural solutions that evoke readers to reflect on their own campus of dreams and to co-create.

What is campus?

Campus as a word is familiar to everyone. It can refer to the premises of a university or other institution, for example a hospital. The concept of a campus entered Finland at the end of the 1950's from the United States, where campuses were – and still are – isolated entities outside the city. The word campus originally means a field outside the town, and in that light the city center campus is a contradiction in terms. In the United States campuses outside the city are, in fact, like small cities, which form their own entities with urban activities, such as housing, services and free-time entertainment.

In the middle of the 20th century the objective of campus planning in Finland was to develop an urban university center with various functions, including housing. The starting point was in creating an interdisciplinary and lively social milieu, which is in use 24 hours per day, and where student housing is located among the facilities of the university. Hence, the campus area would be lively around the clock, and the use of the facilities would be effective.

However, the original plans and their objectives have not realized in full scale. On the contrary to the United States, campuses in Finland are rather small and services are limited, including mainly restaurants and cafeterias. In addition, housing is not as significant a part of the Finnish campuses as it is in the United States.

Campus as a city

Nowadays, cities have grown and surrounded campuses that once were isolated units in the field. In other words, the campuses, which were designed to form their own entities, are now in close interaction with the city.

Campuses have two alternatives of how to interact with the city. The first option is to blend in with the city and to expand the functions and facilities of the university outside the borders of the campus. The campus will turn into a city center university. This approach will connect the campus as an essential part of the urban environment and provide several possibilities for cooperation with different companies and other actors active in the city. However, this approach could also mean a loss of the identity of the campus.

The original principles of the design solutions of campuses defend the viewpoint of an urban campus. Hence, a second possibility could be that urban activities are brought to campuses. Campuses could be preserved as their own entities and real campuses by the original definition. All campuses reflect the era they were built in and this history can be seen as a part of the identity of the campuses. By bringing urban activities to their premises, campuses could strengthen their identity but still develop the spaces towards a more urban environment.

Campus as a new urban center consists of diverse spaces and supports various functions. This, in turn, supports the on-going changes in learning methods and a new demand on diverse learning spaces.

This paper presents the results of three studies from different viewpoints merged together and forms a holistic picture of campus development in the architectural point of view. These viewpoints draw inspiration from urban studies and research on creativity together with the constructivist learning paradigm.

New learning is creative

The change in the learning paradigm from transmission of information into an active learning model is evident in higher education too. From solitary to group work, from virtual to learning by doing, all means and methods are possible. Like a lively city, our campus premises, too, need to support a greater variety of spaces as learning is becoming more and more diverse. However, most of the current campus environments still reflect the transmission, as up to 65% of the main function spaces are occupied by rooms with formal, scheduled functions, such as lectures and seminars. The transmission is reflected in the layout of a classroom; the arrangement of rows of seats and tables indicates the person in front to speak and others to listen. Moreover, at worst, the inflexible layout inhibits the use of novel teaching methods and may hold up adopting novel pedagogies.

The research in pedagogics indicates that learning is most effective when the learner seeks and finds answers, rather than passive transmission of knowledge. In other words, learning can be seen as creative. Just as a scientist, the learner follows a pattern of making a discovery; even though the discovery has been already invented, it is new for the learner. Our question is: what would be the kind of learning environment that could support this perspective of new learning?

Our research has recognized a vision of five principles to guide the design of learning environments that could support creative learning. The first principle, Openness and Diversity, aims at making the university a melting pot of a variety of people from different professional and cultural backgrounds, from inside the campus as well as from business fields. The second principle, Coherent Grouping, aims, then, at driving the right people together. The environment could speed up serendipitous encounters between people whose ideas can be beneficial to each other. This could be achieved by arranging workspaces differently, or by creating totally new space functions that automatically cluster the people that are interested in same subjects.

The third principle, Inspiration, refers to the fundamental basis of the whole student-oriented, creative learning: motivation. Especially motivation that is inborn; a drive to engage in learning because it is interesting, enjoyable or positively challenging. For that reason, physical learning environments should be designed so that they support the inborn motivation of students and raise interest towards the subjects to be learned. Ironically, the current campus interiors seem to aim at quite the opposite: learning is practiced behind closed doors as to ensure that the knowledge will not escape outside the classrooms to accidentally motivate or evoke interest in anybody. Hence, we need a total turnover; an inspirational learning environment should allow and spur the free flow of knowledge. Users should be exposed to the richness of exciting learning subjects, new ideas and perspectives. Teaching spaces should allow spontaneous come-and-goes, and the work of talented peer students and professionals should be exposed to others to allow inspiration to arise.

As creative work and learning come in many forms, the learning environment needs a sufficient Work Space Variance, which is the name of the fourth principle. Creative working could be supported by providing spaces for both cooperation and solitary toil, not forgetting places that allow pure resting as a counterbalance for intensive work. The last principle, Means of Realization, reminds of the importance of spaces where the learned things can actually be done: tested, observed and developed further.

Architecture is a powerful tool in directing user behavior: who meets with whom, how often and in what circumstances. It also controls the amount of environmental stimulus; for example by opening or closing spaces or by exposing and hiding functions we can adjust what the users perceive in their immediate environment.

Architectural solutions

So what would then be the methods towards the revolution of learning spaces? The change in current campus environments can be executed on several scales and from several perspectives, which may blend or be combined. We offer architectural viewpoints on three different scales – campus, building and space – and ponder on radical to small acupuncture-like changes.

How to urbanize a campus?

Each campus is unique and there are no all-inclusive solutions on how to urbanize or enhance the urbanity within a campus. However, by emphasizing specific urban qualities in the campus environment, and supporting these qualities by architectural and administrative solutions, a campus may develop into an urban environment.

First, and the most important of these urban qualities, is the identity of a place. Identity can be enhanced, for example, by strengthening the characteristic features of a place. A strong identity increases the attractiveness of a place, and generates a unique atmosphere in the campus. For example in the case of Tampere University of Technology, the characteristic feature of the campus is the close connection to Hermia Science Park. This connection could be strengthen by creating a physical connection between the university and the Science Park. (See Fig. 1)

Spatial hierarchy creates a sense of orientation even in an unfamiliar place. Distinguishable landmarks and sights are points of interest in an urban environment. Also modernist campuses could enhance their spatial hierarchy by developing sort of "landmarks" or "sights" – and who knows, maybe campuses could become popular tourist attractions in the future. In addition, orientation in the building scale is important. Corridors could reflect the functions along it, and help to navigate within a building. (see Fig. 2)

Figure 1. Imaginative physical connection between Hermia and TUT.

A dense built environment creates an urban atmosphere, and the spaces between buildings can be seen as interesting venues. Dense housing in a campus area increases the number of users in the premises, and, furthermore, the demand on services. Naturally, density often appears as high buildings. Hence, housing in a campus area could be located for example on top of existing buildings. This, in turn, may enhance the urban atmosphere within a campus. In addition, along the people and services, the premises are used more effectively. (Fig. 3)

Variety and mixed primary uses attract different people to campus premises in different times of the day. This increases the usage of the spaces, and creates its own part of the urban atmosphere of the campus. The mixed primary uses in a campus could be, for example, commercial business. (Fig. 4)

User-driven modifications are considered a sign of a free and innovative environment; the interdisciplinary and cozy atmosphere of a place encourages creativity and the exchange of ideas. For example, students could occupy under-used corridors or classrooms, and turn them into open access living rooms. (Fig. 5)

Figure 2. Orientation can be enhanced by identity markers.

Figure 3
Housing located on top of campus buildings.

Figure 4
Mixed uses on campus

Figure 5
User-driven modifications

Radical change: Building as an empty canvas

Changing the layout of an old university environment in a large scale, e.g of a whole building, enables massive changes in the whole working and learning culture. A campus building with lower architectural value here demonstrates a comprehensive solution and can be seen as an empty canvas for radical redesign and change in layout. This option obviously requires the biggest investments, but results in most extensive outcomes, too. An overall makeover gives free hands to sculpture the distribution of functions, it enables us to rethink the operational entities of a building.

Rethinking operational entities means rethinking the synergy benefits that different functions can have on each other. By an overall change, we can readjust the parts of the community that interact with each other. For example, instead of forming an operational entity out of the members of the same faculty, we could form it out of the people with same interests. All the workspaces of researchers could be combined. The benefits would be in the peer-to-peer community; Being in the same situation, but having different traditions and ways of acting, the researchers would be able to offer each other significant new approaches and fresh points of view, which is not necessarily possible within a faculty or department. This kind of a rearrangement would not only ease practical matters, but also bring a significant increase in the innovation activity of the campus. (see Fig. 6)

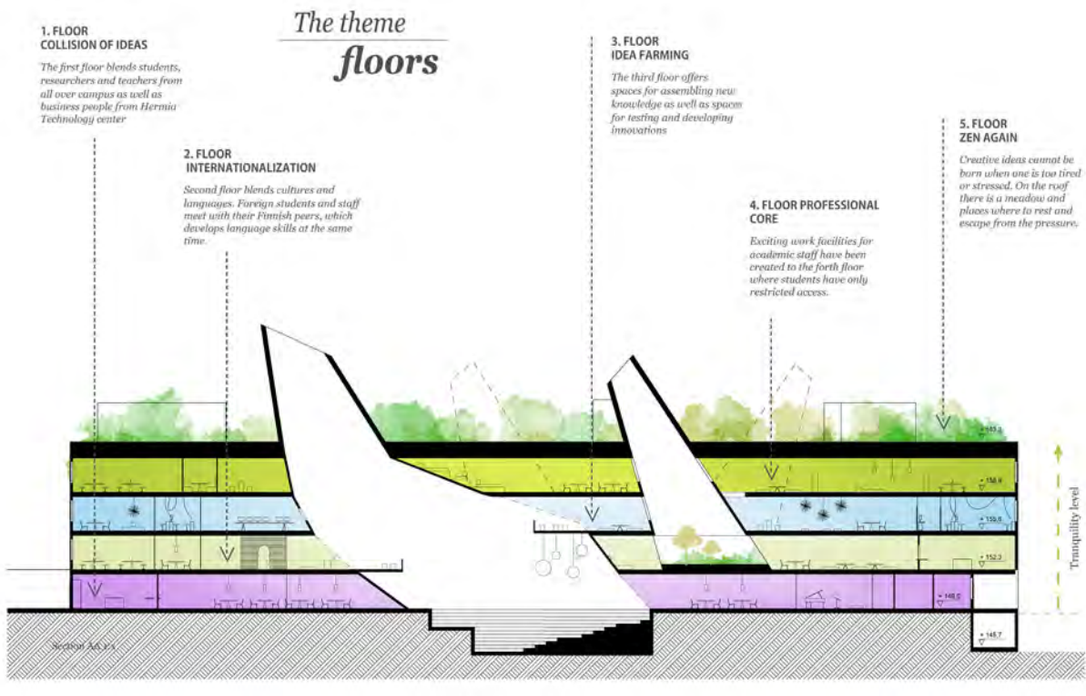

Figure 6. An example of rearranging functions in floors according to themes, previously arranged according to faculties

Not only rethinking the relation of operational entities, the complete change gives us the possibility to rethink the layout and proportions of spaces in relation to each other. The sizes of the spaces could be adjusted freely according to the use. Creating an open (loose enough) connecting space between the functions allows flexibility, as spaces can extend to the shared area. Also new linkages between spaces and uses could be opened. For example rearranging class-rooms between laboratories could help the interaction of research and teaching. Then again connecting e.g. spaces for the demonstration of phenomena or guided group work with a traditional lecture hall would open alternative uses for the lecture hall. In other words, allowing functions to overlap optimizes also the usage of spaces. (see Fig. 7)

Dreaming scenarios for types of spaces

In the previous chapters, we have looked at learning space dreams in the context of existing premises. This chapter introduces scenarios for several non-place related space types that could be implemented in different learning environments.

The typology of learning spaces is typically divided according to formality; informal learning – formal teaching, and according to sociality; social – individual. In architecture, other typical divisions are e.g. according to privacy: public – semi-public – semi-private – private, or according to primary – secondary functions. Of course, the management of spaces affects the accessibility too, e.g. whether the use of a space requires reservation. However, from a purely theoretical point of view of architecture, the previous divisions could be blended. The current typology of learning spaces seems limited, too. Altogether, the variety within spaces and between spaces often seems to be inadequate.

At least four categories can be separated for theoretical scenarios: firstly, transformations made within a certain existing space type, secondly, how the spaces are situated in relation to each other, thirdly, how the space changes according to the functions (i.e. Adjustability, Convertibility, Flexibility, Adaptability) and, lastly, novel types of learning spaces.

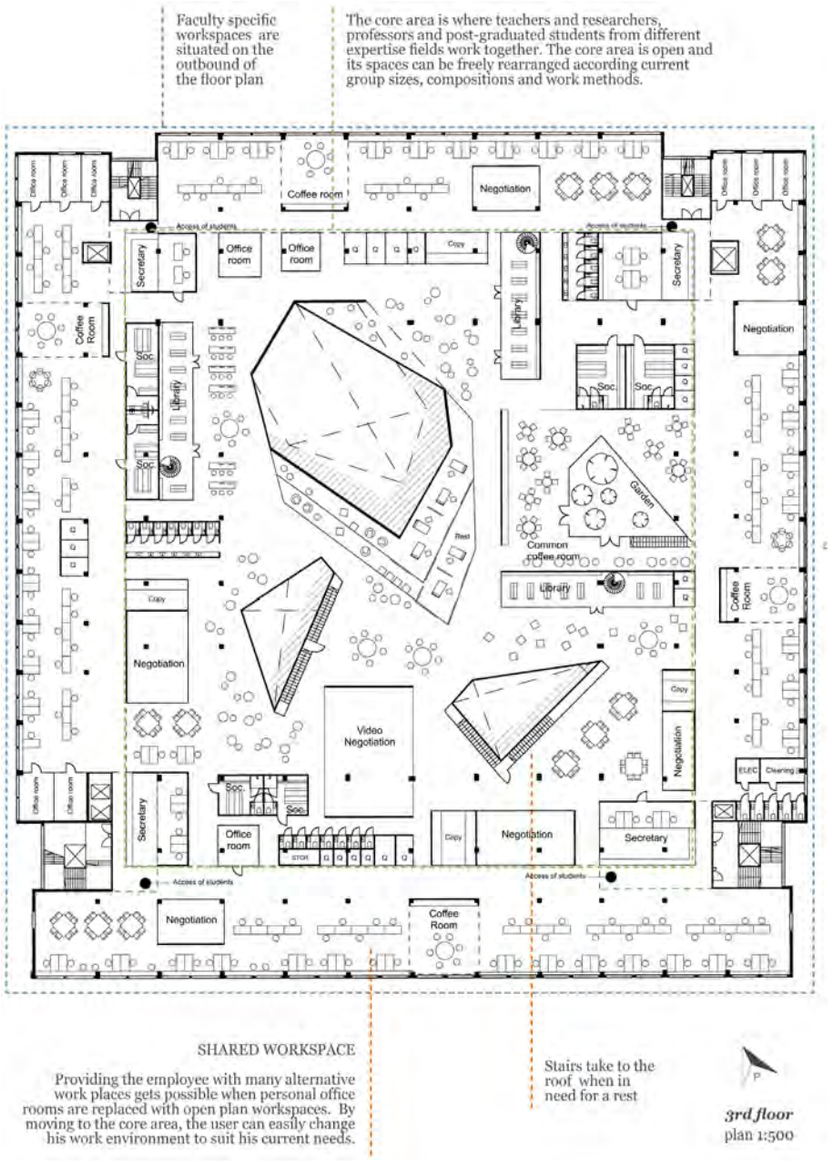

Figure 7. Idea Farming based layout of shared workspaces

The functions are blending; for example academic libraries are moving towards social learning spaces. The bipolar definition between formal and informal is becoming blurry. A space could allow for multiple simultaneous activities whether formal or informal. With the right design, formal activity can happen in an informal space and vice versa. People who utilize the space should define the way of use, instead of the space itself. In many cases, the space with furniture is the definition of use, at least restricting usability.

The redesign of a traditional lecture hall into an active lecture hall, which supports various simultaneous activities, works as an example of changes made within the space type. The typical rigid layout of a lecture hall with fixed seating and rows of tables allows only teacher-student communication, but hinders possibilities for group discussions that may be the heart of an active mass lecture. Then again, if a lecture hall is changed into a "vineyard" of platforms which allow free-standing furniture, not only active mass lectures, but also many other layouts and functions are possible. (see Fig. 8)

The second scenario, the relation of spaces to each other, we discussed earlier. Here we want to emphasize the possibility of how surprising combinations of spaces can open new possibilities, e.g. enhance interaction amongst functions, and also increase the functionality of spaces. (see Fig. 9)

The third scenario is about how the space adjusts according to the functions. Flexibility and multi-functionality are concepts often used in this context, but we find Adjustability, Adaptability and Convertibility as important aspects, too.

Flexibility is seen as something achieved by a geometrically clear space with free-standing furniture. The user-adjustments and the

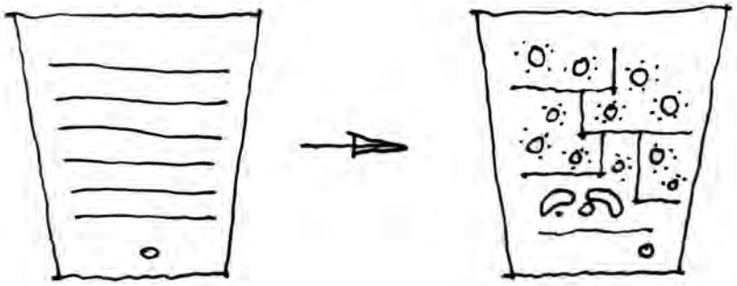

Figure 8. Lecture halls can be changed into active multi-functional spaces

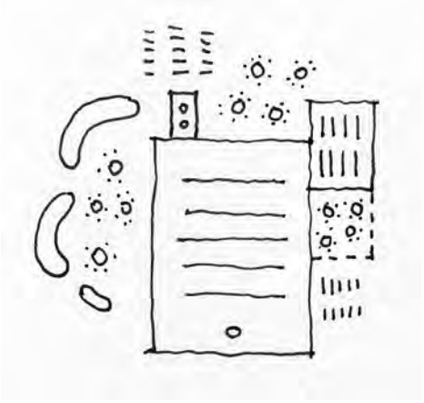

Figure 9. Adjusting the size of the spaces according to the use

flexibility could be taken further with Adjustability and Adaptability. Spaces, spatial elements and/or furniture integrated with ICT could recognize the user and adapt according to user/s. The space could be controlled with one's own mobile device through an application that communicates with the space. A user could pre-set ambiences for different learning situations. The adjustments could be made to lighting, temperature, color, music, and the transparency of a glass room.

Convertible spaces, then again, allow users to change the space/s according to the current function by moving not only furniture, but also spatial elements. Hence, different settings could be created in the same location. (see Fig. 10) Together with the previous aspects, multi-locational learning spaces could add to the spectrum of spaces.

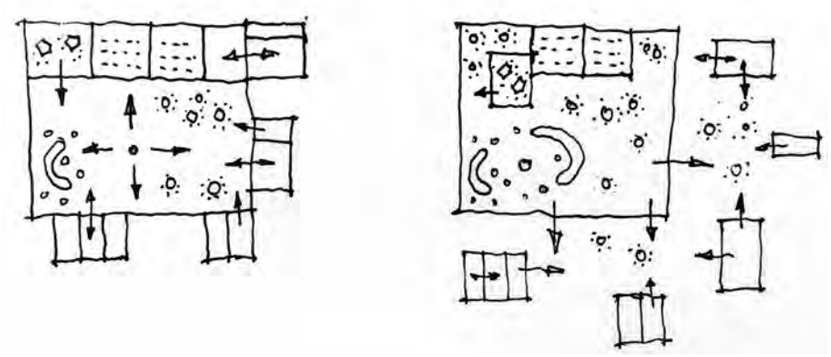

Figure 10 .A space can be converted and adjusted according to functions.

With integrated technology on campus, learning spaces could be developed into a network of places and be connected together.

Novel types of learning spaces can be seen as a mixture of the previous, in which functions and layouts are blended. We here introduce a "cross" model (see Fig. 11), which houses different sub-spaces but can be combined and controlled from one point if necessary. The space can be divided into smaller rooms allowing separate and even semi-private functions, or combined into one big lecture hall with lecturer in the middle. With different kind of furniture in the sub-spaces, different functions are allowed simultaneously without disturbing other functions.

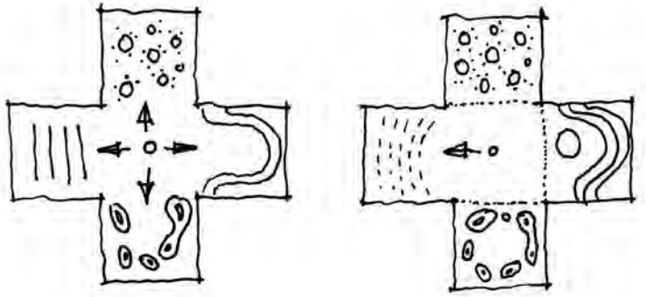

Figure 11. The Cross model allows different functions simultaneously, too.

Conclusion

The existing premises of campuses possess a huge potential to be turned into lively urban centers that support learning and research of the future. Hence, the existing buildings can be seen as platforms for novel architectural solutions, and stages for presenting the universities' state-of-the-art education and research.
Radical, extensive changes would most likely create the biggest impact on behavior and functionality. However, not all changes need to be massive and expensive. Like acupuncture, which releases energy by the point of a needle, so could the campus spatial structure be energized through small changes, which have a bigger impact than their size.
Our case studies are positive examples of how supporting functions areas have been developed into informal and social (learning) spaces. The case studies are introduced later in this book. Nevertheless, the completed examples add to the spectrum of spaces and reflect the ideas presented here.

Like acupuncture, which releases energy on points of the needle, ***so could campus spatial structure be energized through small changes which have bigger impact than their size***

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Core Team: management of co-creation

Marko Keinänen

Traditional options for organizing projects are well known covering solutions from pure project organizations up to functional organizations via variations of matrix organizations. Besides of this capable and clever project management professionals are continuously establishing informal structures and linkages to facilitate necessary cooperation between people and project partners. Particularly modern projects, like in campus development, with their turbulent and dynamic nature have apparent needs that are beyond the solutions provided by traditional options. The making of the right decisions requires an understanding in several different fields. Also the cooperation between the separate parties must be seamless for the success of the project in the best possible way. We have recognized the appearance and significance of core teams in case projects. Study behind our research from the building construction sector. We argue that a core team can be a significant factor regarding efficient decision making and communication.

Introduction

Plain formal project organizations can be rigid and produce constraints that make difficult or almost impossible value-adding co-operation concerning decision making and communication. A new kind of approach is needed particularly modern projects, like campus development, where efficient decision making and communication between participating parties are in a crucial role.

We defined that the concept core team is the group which consists of two or more people. It is the official or unofficial group who make decision in the project. In this chapter, we present the results of our new study concerning knowledge of the concept core team among the Finnish building construction sector. We define optimal team size and concept's official character in an organization. In addition to these organizational matters, our main attentions concentrated on it how the core team made decisions and how the use of the core team affects the speed of decision making. The available amount of the information affects the successful decisions essentially. In our study, we also investigated the effect of the use of the core team for the flow of the information.

Research behind our study

The research addressing inspiring learning environments is the part where the authors are exploring new organizational innovations that can facilitate cross-organizational and cross-disciplinary collaboration. Main business maneuvers in this field are typically carried out as projects and therefore projects and their management play a crucial role. Nowadays, as results of the outsourcing paradigm, companies are specialized around their core businesses. This has resulted in a considerable increase of number of partners also in building construction and renovation projects. Such projects are typical instruments for improving existing learning environments or creating new ones in university campuses.

The Data for the research was collected using literature review and survey. The purpose was collect knowledge concerning core team from construction sector. The survey was sent to 682 selected professionals of construction sector. All the selected respondents were on manager or director level position in their companies. Response rate was 20.5%.

Campus development projects

Campus development project can be seen as a special construction projects. Even campus development has its special characteristics; its processes are based on the construction industry. The construction industry is a project-based industry and it has its traditional ways of structuring projects. Key partners and their leading experts such as architects, project managers, client's consultants and chief engineers have well-established roles, relating mandates, tasks, contractual obligations and payments. Decisions are typically decentralized with each actor responsible for his own tasks.

Campus development and its project are gradually transforming from resource orientation towards service orientation where benefits and life-cycle of the built property is put first. This means also extensive involvement of end-users such as citizens, tenants or, like in our case, students. Campus development projects are therefore increasingly playgrounds of individuals and groups representing their interests and desires. Furthermore, campus development project need to have capacity and skills to anticipate and understand end-user experiences for meeting fully their needs.

> **Core team consists from three to six people**

The concept core team and its emergence

Managers and other project experts tend to use the term core team to mean a special small group of project executives or project experts with a specific mandate. For example, this special mandate can include co-ordination of key partners or preparation of proposal for strategic decision making. In our study, the concept core team means the group which consists of two or more people. It is the official or unofficial group who make decision in the project.

Despite of being intuitive ad-hoc solutions one should acknowledge them. Emergence of such practical and practice based examples have real needs behind them. Otherwise they would not exist at all. In addition to these practical examples, core team has been mentioned in the project management literature, although only seldom, as a central unit of a project organization (e.g. by Cobb, 2012; Hartman, 2000; Haugen et al 2010; Robles, 2009; Wysocki, 2009).

Conscious of the fact that the core team is only seldom found in the literature, we expected that the core team would be nearly an unknown concept within the building trade. Our surprise we found that 50 % of the respondents have been working with the concept core team.

Formal or informal cooperation

Besides a formal hierarchy in organizations it is also needed to recognize an informal hierarchy. People can be in a social relationship via official rule systems but this is not necessary the case. Sometimes people generate a relationship via unofficial mechanisms. High expectations of top quality results, for example, can be caused the forming of the unofficial team next to an official organization (Kähkönen et al., 2013). In general, informal project organizations have been seen as chances to achieve the value-adding collaboration between project partners. At present, many organizational solutions that are aimed to facilitate collaboration between project partners fall into the category of informal organizations. Sometimes project partnering solutions can be seen only as informal organizational arrangements
According to such an understanding teams can be form officially or unofficially. In our research we found that 64.8 % of those respondents who knew the concept core team reported that the core team is part of the official organization. Therefore only about one third of core teams have been operated unofficially in the organization.

Defining "optimal" team size

Team size affects team's processes, decision making and communication. The optimal size of teams is debated in many studies and varies depending on present task. One reason for such diversity in the recommendations is that different authors define "optimal" in a different way. Differing from the definitions of "efficiency" and "effectiveness" of inspections are used to highlight the benefits of the various team sizes. Even these studies have been made by measure optimum team size from little different starting points, settles the results quite near each other.

In 1981, Buck made a study where he indicated no difference in effectiveness between three, four or five person teams. According to Yetton and Bottger (1983), behavioral theory showed inspection performance for the team sizes of three to four and beyond for team members, there is no performance improvement. Four years later, in 1988, Bottger and Yetton published a paper concerning behavioral research where they found expert pairs perform as well as larger groups. In 1989, Bisant and Lyle found an improvement in individual productivity as a result of two-person inspection. Grady (1992) defined an optimum size of four to five people. In 1993, Gilb and Graham studied efficiency and effectiveness of different sizes of teams. In their study, they defined that efficiency was major issues per work-hour and effectiveness was the percentage of total majors founds in inspections. Gilb and Graham found that maximum efficiency was reached by the team size of two to three people and maximum effectiveness by four to five people. Weller (1993) defined effectiveness as the defects found by inspection. He found that four person teams were twice as effective

and more than twice efficient (it is unclear, how Weller defined efficiency) as three person teams. Strauss and Ebeneau (1994) reported that in the inspection team should be at least three members. According to them, the maximum size of inspection team is seven people. Any more people would tend to reduce the efficiency and effectiveness of the process. In 1997, Porter (et al.) reported that inspections are usually carried out by the team of four to six members.

As mentioned earlier, the literature gives the conflicting accounts of how many members should be in optimal team. Therefore it is not conductive to make strong recommendation about the optimal team size. We can, however, estimate, based on most of the studies that the optimal group size settles between three to six people.

For the measuring optimum team size of core team, we ask from the professionals of a construction sector: "how many people belong to the optimal core team?" This question has the same kind of challenge than a try to join different research of optimum team size together: different authors define "optimal" in a different way. Nevertheless or just therefor the results look quite similar that earlier research. Chart 2 includes results from our research. On the left axis is mentioned a number of people in the team and on the horizontal axis is perceptual value from the answer alternatives. As we can see from the chart 2, most of the respondents reported that optimum number of people is five people in the team. Based on respondent's experiences, the next popular alternative was four people in the team. Answer alternatives three and six people in the team also differ from the rest of answers, being more popular than the rest of alternatives.

Even though in different research the optimal has been defined a different way that takes place in the real life too. Based on earlier research, even in these there are their challenges; it is justified to recommend that size of team should be between three to six people.

How to make decisions?

The decision-making is one of the key tasks of the core team. Right and timely decisions affect directly the final result of the project. In our research it was studied how the decisions are made in the core teams. The matter was clarified by multiple choice questions. Response options and their perceptual shares are shown in the chart 3.

In most of the core teams, the decisions were made with mutual understanding (84.5 %). This is more than four out of five from all answer alternatives. Decision of the expert has the second biggest share from answers. 8.5 % of core team made decisions by the expert's decision. By the leader's decision decisions were made in 7 % of core teams. It is considerable that there was not a single core team where

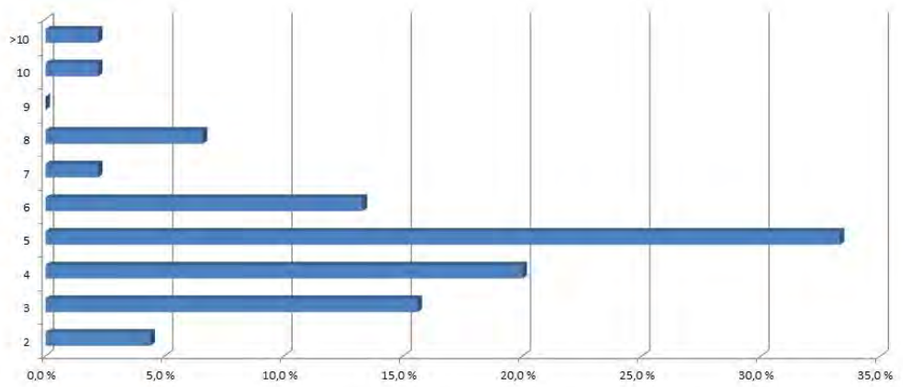

Chart 1. Optimal team size

the decisions were made by voting.

How the core team makes decisions is one thing. Another thing we were studied was how the use of the core team affects the speed of the decisions making. Did it accelerate or slow down decision making? All the answer alternatives and their perceptual shares can be seen of a chart 4.

From all the respondents 85 % answered that use of the core team accelerates decision-making. Even so that 56 % of the respondents see that the speed of the decision-making has increased significantly. 7% considered that the use of the core team did not have any affect and 8% answered that the use of the core team had slowed down decision-making a little. Based on this, to use the core team, one can reach the decisions faster.

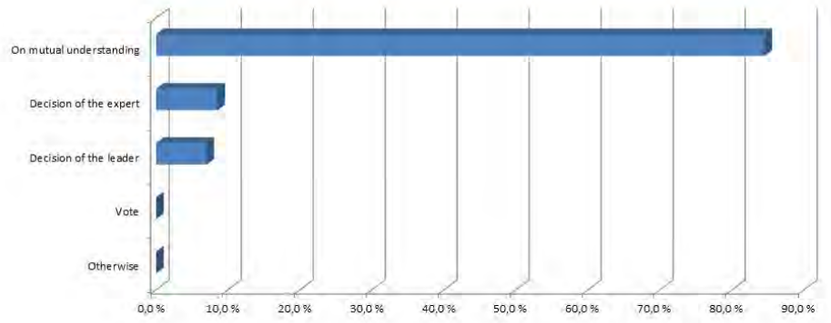

Chart 2. How decisions are made

Affect to flow of information

Available information affects the making of decisions and their accuracy in many respects. When more parties participate in the project, the decisions must be considered from the point of view of every party. The more information the parties get from one another the better chances of making good decisions they have. In our research, we study how the use of the core team effects on the flow of information. All the answer alternatives and their perceptual shares can be seen of a chart 5.

From all respondents 60 % answered that use of the core team improved the flow of information significantly. Totally 91 % of the respondents were that mind that uses of the core team improve the flow of information. No one of the respondents answered that the use of the core team would have weakened the flow of information. Only 9 % of the respondents reported that use of the core team has no affects to the flow of the information. Based on this research it seems the use of the core team supports the flow of the information strongly.

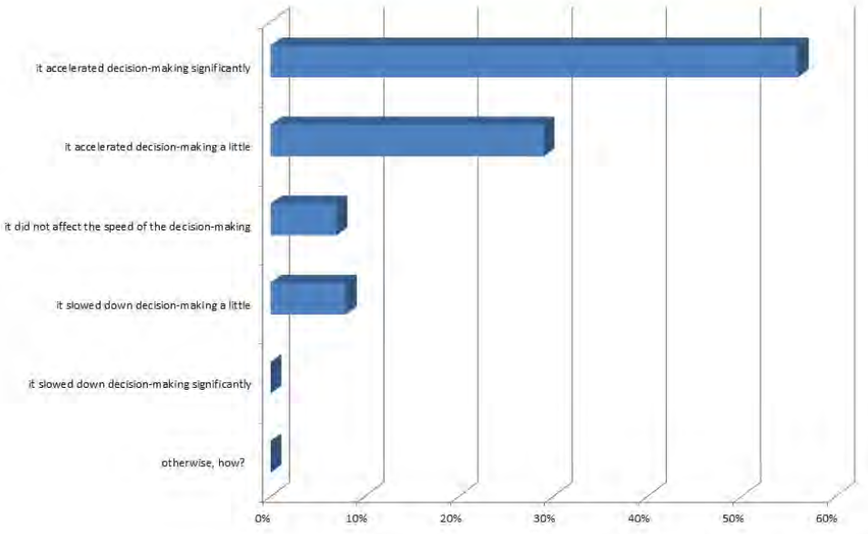

Chart 3. Speed of decision-making

What can we say?

Team members in a collaborative construction project should, "… be equally committed to a common purpose, goals and a working approach for which they hold themselves mutually accountable" but also "deeply committed to one another's personal growth and success" (Katzenbach and Smith, 1993). Project management should emphasize good performance results from clearly specified goals, knowledge sharing, and the reliance on a tightly knit and more or less constantly interacting team. The core team can help in this by setting and integrating the different viewpoints of the stakeholders.

Despite the importance of decision making based on all needed information in construction projects, this rarely happens in reality. It is crucial that all needed information must be in use on them who make decisions. This means that the university building must be based on the seamless cooperation between the separate parties. Otherwise it is not possible to build the best understanding about needs of an end user and the create solution which supports the best way they activity. The core team seems to be an interesting viewpoint in campus development projects.

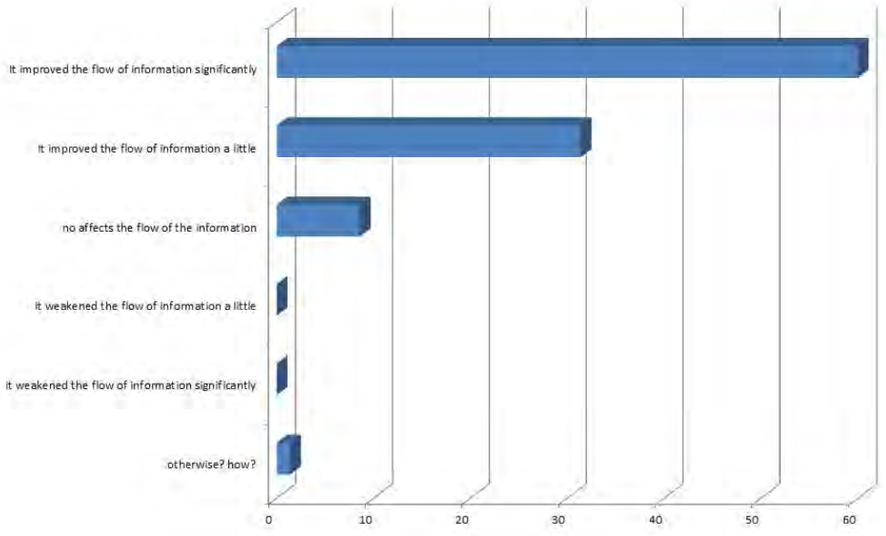

Chart 4. Affect to flow of information

In this chapter, we objected that a core team can play a very important role regarding efficient decision making and communication. On the basis of our study, we cannot say that the use of the core team improves the making of the decision and the transition of the information in all their sectors. What we can say is, that use of core team accelerates decision-making and it improves the flow of information. Even so that over half of the respondents say improvement in these fields was significant.

There are several possible ways to formulate the core team and select its participants. On the basis of our study, core team is in a most of the cases an official part of the organization and it consists of three to six people who make decision in the project. In the traditional way in which the leader makes the decisions the core team seems to be operating otherwise. Most cases the decisions are based on mutual understanding. In the traditional process of the building, the parties are changed during the different stages of the building. The understanding that has been jointly created is not able to "grow" during the process. The core team is responsible for decision making during the whole customer process. Working this way, the jointly created new knowledge and understanding is preserved through the whole process.

The core team is a concept where people truly, design together, making decisions, based on the best available information, leads and co-create new knowledge through the whole development process.

References and further reading

The publication behind this chapter is the journal "Core Project Teams as an Organizational Approach for Projects and Their Management" (see Kähkönen et. al. 2013). There are direct quotations parts of the journal which has been supplemented by the information of the questionnaire survey.

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Use of core team accelerates decision-making and improves the flow of information significantly.

Mine, Ours, Yours – Lahti Campus Development

Satu Hyökki, Hannu Kaikonen & Suvi Nenonen

This article will provide an introduction to Lahti Campus Development, the aim of which is to employ a user-centric approach to create a pioneering, unifying, multidisciplinary and synergy-oriented spatial and functional entity by 2018, Lahti Multi-operator Campus.

"Towards a cluster of shared resources and communal consumption"

The aims included in the Growth Agreement between the government and the City of Lahti form the background for the planning of the campus, with these aims being to strengthen and profile Lahti's knowledge base, and to increase the competitiveness of the urban area by developing a cluster specialized in the environment, design, and practice-based innovation. These aims will be realized through the renewal taking place around the combined higher education institutions and entrepreneurial multi-operator entity located in the district of Niemi. The concentration of higher education operations will also be supported by the aim included in the governmental program of assembling a university network with expertise environments that are sufficiently broad, high-quality and innovative. Campus thinking has been aligned in connection with both the incorporation of Lahti University of Applied Sciences and the licensing process, as well as with the University of Helsinki's The foundation of the Lahti research and teaching network, and the organisation of support services and administrative work in Lahti presentation and decision. The development of campus thinking has been carried out with the support of the Regional Council of Päijät-Häme as part of the Lahti Innovation Hub project.

The key factor in campus development is creating a pioneering, unifying, multidisciplinary and synergy-oriented spatial and functional entity. In practice this means shared resources, i.e. common spaces (working, teaching, meeting, service and well-being spaces, equipment, infrastructure) and new forms of cooperation and cross-boundary operations (common services; educational, project and area development work, and personnel resources) i.e. a completely new kind of operating culture and communal consumption. The joint use campus will lead to a more effective use of space, as well as allowing for both a responsible rate of usage and direct savings for operator organizations through joint usage.

The campus concept has been constructed with a strong user-centric focus, from the perspective of the campus's largest user by volume – Lahti University of Applied Sciences – but with cooperation between the University of Applied Sciences and the other universities involved as a starting point. All the key user groups have participated in the construction of the concept in order to achieve an end result that best serves the needs of all end users.

"We don't assume – we ask"

The most influential strategic framework for the Lahti campus development is user-centered design, with the aim of creating a campus designed with a high level of user interaction. Firstly, with the help of user research and service design methods, a specification for a future learning environment was created, and as a result of that, theses to guide the planning of the campus of the future were also drawn up.

The selection of participatory planning as the working method enables not only the creation of planning solutions that meet needs, but also allows those involved to engage with the change ahead. From Lahti's perspective, this is an important change, as the aim is to create a completely new kind of joint usage campus entity for higher education institutions, development organizations, and businesses. For example, from the perspective of Lahti University of Applied Sciences, this means both a spatial and functional move from decentralized individual units to a centralized, diversified multi-operator community.

We are moving towards a service-based society, where experience, personalization, and the availability of choice have

an ever-growing impact on individual behavior. With this change in consumer behavior, the education sector must also take the service perspective into account in their operations and the planning of future learning environments. Students have a wide range of options to choose from, and in addition to content that affects the choice and appeal of places of study, there are factors strongly connected to experience to take into account, such as comfort of the learning environment, flexible implementation models and channels for education, networks and partnerships of organizations offering education, and the brand of the place of study. When institutes of higher education are thought of as services, it is natural to select service design methods for development.

In Lahti's case, the iterative model for user-centered design, which is based on a process consisting of development of solutions, trials, analysis, and refinement is used. The starting point was an analysis of the current situation, and as a part of this the key user groups were identified. Students, personnel and interest groups were identified as higher-tier user groups. These groups were divided further into more precise user groups. In terms of research, it was regarded as important to keep the information gathered from user research together, and strong cross-analysis of interpretations in workshops with users and information gathered from different user groups (data and researcher triangulation) were used to generate a synthesis.

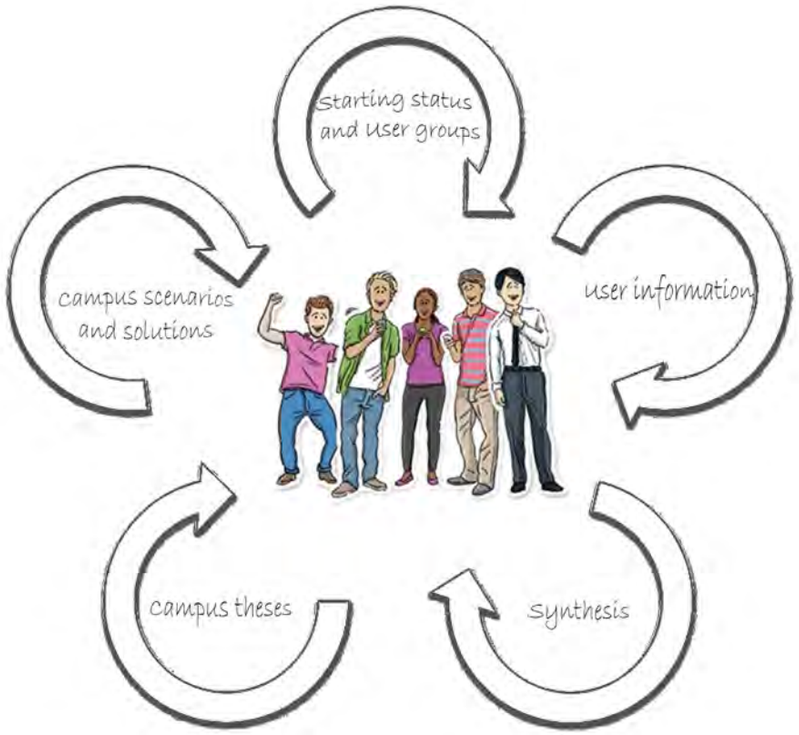


Figure 1: The campus development process

The range of methods used, applied and developed is deliberately broad, thus allowing users to participate in a diverse variety of ways. Interviews and analysis of the literature were the primary methods used in the collection of background information, and earlier results related to University of Applied Sciences campus development were analyzed, on the basis of which the key user groups were determined. In the collection of user information related to the context, culture and environments of learning environments, the focus was particularly on the methods used for self-documentation (probes, diaries), with the help of which the data gathered was processed in joint interpretation workshops with both different student groups and different personnel groups. For the examination of user experiences by theme, versatile interactive methods were used, such as different kinds of workshops and focus group work. Game solutions (design games about future learning environments) and tasks that make use of time perspectives (there and back retrospection regarding management) as well as future research study modules are examples of elements used with the aim of aiding future reports. In addition to these, crowdsourcing works well as a part of a variety of events (launches, fairs, science day), especially where students are involved. In terms of planning solutions, both workshops and new tools developed in-house, such as joint planning in the planning of an empty space were utilized. One example of this is the creation of user rules for a multi-use office in an as-yet unfurnished space, with the help of color codes for the shaping of the space and how it is to be used. In the data analyses, a basis of joint interpretation workshops was used, as well as affinity analysis by a number of researchers for the creation of a future learning environment synthesis.

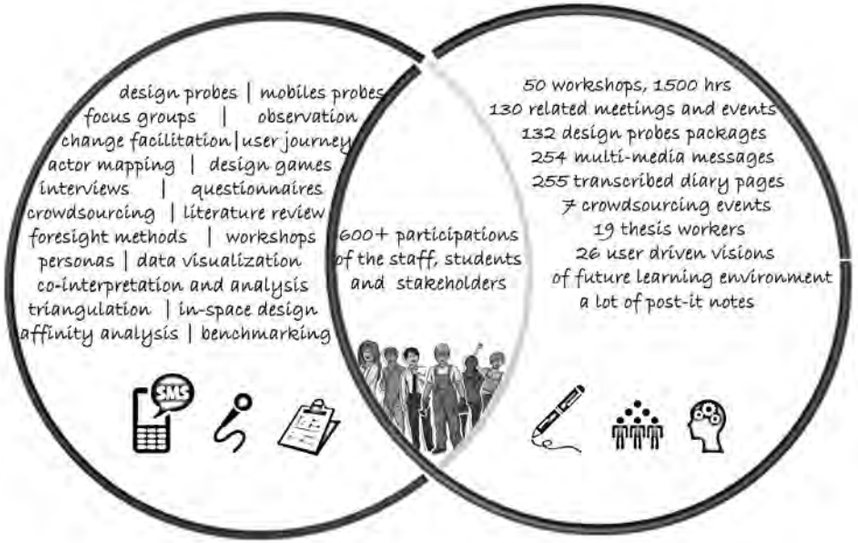


Figure 2: Methods and participation

The key perspectives to take into account for planning and communications in the Lahti campus development have been spatial, functional, and pedagogical perspectives. In addition to this, property developer, constructor, area development, and service perspectives have been discussed in detail. The future study environment synthesis has served the learning environment developer (walls) well, and to some degree the pedagogic development (operations) too, but in order to allow information to be utilized more widely in guiding the planning of different levels and operations, it has been transformed into campus theses relating to construction, and strategic theses to guide everyday operations, for example. From the perspective of district development, the focus has been concentrated, in particular, on accessibility, the opening out of the campus to its operating environment and (everyday) services perspectives, including "service exercises" for the campus's joint services.

"The user describes, the designer designs, and together we make"

The aim of the Lahti Innovation Hub project has been to create a nationally significant innovation hub and a model area of practice-based innovations, which involves the whole innovation chain, in Lahti. The aim of Lahti University of Applied Sciences' campus development is to define a modern learning environment and develop a campus solution that meets users' needs in order to support multidisciplinary and communal University of Applied Sciences education as well as cooperation between university operators. In the spirit of sustainable development, the modern, flexible and good use of space according to usage rates forms one of the strategic aims of the future campus area. Alongside the physical spaces, however, focus is above all directed to innovative pedagogy and functionality that serves the area in a broad sense.

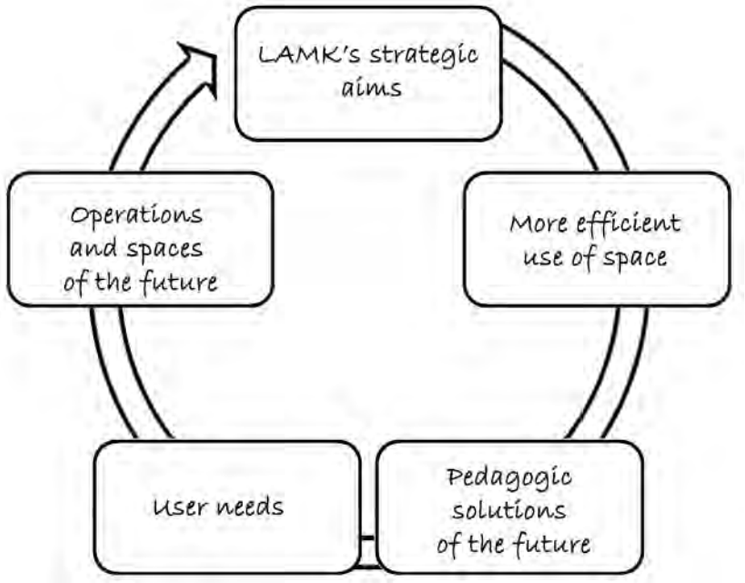


Figure 3: The framework for Lahti University of Applied Sciences' campus design.

The key choice in Lahti campus development – user interaction in design – is visible in all stages. The majority of the time was dedicated to forming a joint vision regarding the future learning environment from Lahti University of Applied Sciences' perspective. In practice, this meant phases of user research with both students and various personnel groups, as well as interest groups. In the student research phases, the perspectives of students from a wide range of different branches and types of education (day, evening, hybrid) were taken into account. Firstly, we tried to draw together a picture of the current situation (learning context, culture and environment) jointly for all the user research entities, after which visions for future learning environments were created together. Altogether, by February 2014, 213 students had been involved, of these the majority as research subjects, and approximately 40 participating in implementation in various different ways, as trainees, thesis authors and students partaking in project-based learning. Currently the students are involved in areas such as space conceptualization for the campus and examining the campus's multiculturalism.

Examples of student research phases include

- Master's Degree Program students participated in design probe research and created future learning environment scenarios
- Exercises of students of the Master of Hospitality Management program as part of their premises usability course
- Future learning environment blogs and probe research to map the current situation as part of the learning on the planning course on waste water systems for sparsely populated areas
- A design game about the future learning environment played by students from three different branches
- Business economics management strategies and stories, students' scenario production based on user research data
- Conceptualization work for the Niemi campus as part of the design of the future research course

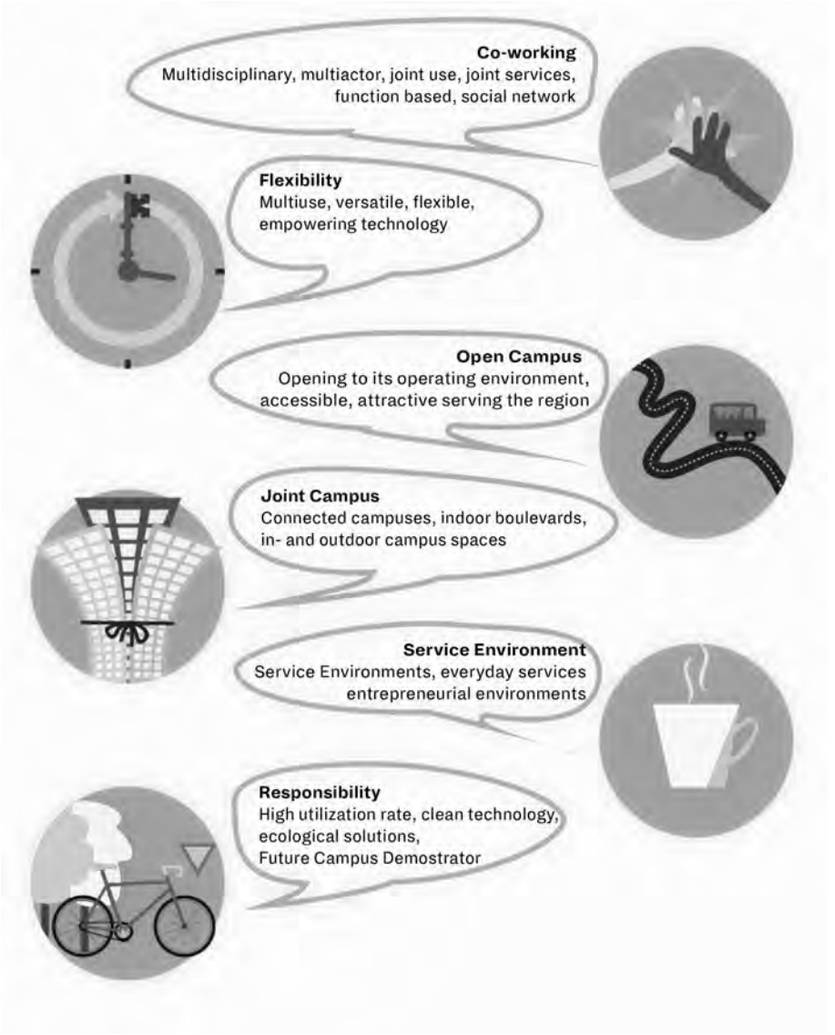


Figure 4.

Environmental studies students' perspectives from students of higher education institutions will be investigated next.

In addition to this, personnel from Lahti University of Applied Sciences and university operators, as well as other interest groups have participated in various ways. From the personnel's perspective, the two week probe research phases formed some of the most important elements, with the aim of these phases being not only to find out the current personnel work situation, but also to create a picture of elements such as the change to teaching. Both the analysis and the communication of results have been carried out in a dialogic manner. For example, the results of the teachers' user research were analyzed with the group of teachers that participated, and a picture of the change to teaching was created together. The change was depicted visually using A teacher's day storyboard. Research results as well as the synthesis for the future learning environment and further refined campus theses that were drawn up based on the results have been analyzed dialogically with operators from Lahti University Campus, too. Operators from the University of Helsinki also continued to work within their own process. As part of the user-friendly working environment process, user profiling surveys and user workshops were carried out, helping to identify four separate user profiles. The user profiles' needs for a physical, social and virtual working environment vary according to how fixed employees are to their own workstation, or how flexible and mobile their work is. Common user needs identified include: a need for spaces for small group work and meetings, spaces to support community and individual well-being (utilizing nature, informal meeting spaces), as well as equipment (ergonomics and adjustability) and fluid use and provision of a common virtual environment. In addition to the profiles, there is a desire to examine the forthcoming working environment zone-by-zone, with public, semi-public and private zone analysis. In addition to physical planning solutions, close attention is being paid to the importance of the virtual and digital working environment and equipment as part of flexible and functional working.

Workshops have also been held on the idea of joint usage with operators from the entire campus, and a conception of multi-operator campus services has been created. Which services support cooperation between operators, and which will draw in and bring about added value to the everyday operations of the campus? In relation to this, the campus's operating model was brought up, which has been used as a basis to begin the conceptualization of a model based on campus membership. Campus membership is to be used to reinforce the establishment and empowerment of informal modes of cooperation in particular. Developing this is a small process, but one that progresses step-by-step in a target-oriented manner, as well as facilitating the identification of membership offers, membership segments and operating models. Membership related communal consumption is being shaped for both mobile working and side-by-side working interfaces. Thus membership, for its part, responds to the new needs arising from working. Operating models are being formed from a so-called "in-house operator", either for the establishment of a completely new regional operator, or the expansion of a current regional operator into the Niemi region. The phased growth of operator operations in the Niemi region supports membership by supporting current strengths.

Renewed support for operators moving to the campus in the front line, as well as gathering together the user experience they have, are important factors in the success and planning of the steps to follow. The first major branch from Lahti University of Applied Sciences to move to the Niemi Campus was the Faculty of Business Studies. A series of workshops were held for the faculty, during which the focus was on the preparation for both the move and the change, as well as on pedagogic development in directing the campus vision. For pedagogic development and voluntarily – without dedicated resources in terms of working hours – the skills of a group of active and bold innovators in the field of pedagogy were harnessed with the purpose of developing

and piloting a variety of pedagogic resources and models to support future campus operations. The mobile support laboratory for virtual learning pedagogy is a concept begun as the result of an idea from the group.

The cross-organizational cooperation group's joint development plan also covers the joint aims, carrying forward both strategic and, in particular, everyday operational matters promoting cooperation. Matters relating to this include joint reflection on linking solutions for the physical and virtual campus (BYOD, web-based learning support), as well as planning of joint educational provisions between Lahti University of Applied Sciences and the other universities involved in terms of education leading to a degree and open education. Shared resources in services (IT, information services, communications and marketing) and physical environments (environmental studies laboratories as well as class and meeting spaces) are being reviewed.
A user research phases synthesis was produced on the basis of in-depth affinity analysis with the help of a number of researchers in April 2013. The synthesis was examined from various perspectives and with these interpretations as the basis, campus theses (Figure 5) were created, and it is these theses that guide planning.

The Innovation Hub project has indicated that in the pursuit of good quality on the joint campus, there is plenty to do in terms of formal, operational and value-based matters, especially when it comes to achieving shared resources. If challenges are manifested more easily in shared use models for specialist areas and equipment, it may be possible to make progress more easily with meeting spaces and environments, including around the well-being and sports area, in cooperation with the student unions, as, for example, experiences at the Skinnarila campus in Lappeenranta have demonstrated.

"Join us in making the campus your own"

A strong user participation element in the planning of the joint use campus is important as it is vital for achieving commitment and an end result that truly serves the users. This importance is highlighted even more when the operators are multiple different organizations or user groups and the cultures and structures they represent are different. Making the future together, however, is not so simple, as being able to see changing contexts, operating methods and cultures from just your own organization's perspective is challenging enough. For this reason, developing the joint use campus is a continual process that is still being worked on through an iterative process, although the basic starting points (campus theses) have been anchored to guide operations.

Co-working represents and creates a sense of community, a campus community. The shared resources model has been chosen as the form for co-working, allowing cooperation according to the traditional network model to be taken further by also creating new financial and functional resources and resource savings. Choosing this method also allows for an improved environmental impact and accountability through efficient and responsible use of space and optimization of resources. The use of resources often becomes more tricky the more the user and the producer are in the picture. Traditionally, the matter is thwarted by organizational boundaries, money, and cost sharing principles, even though the common intent for joint use exists. Taking this into account, a campus operating model based on shared resources usage was created, campus membership – a new kind of service model. The Niemi campus has a common shared ecosystem for all, allowing for the utilization of joint regional and functional visions whilst developing the operating environment and its continuity. Sharing resources requires the coordination of professional collaboration and the development of a seamless cooperation culture.

The campus opening up to its operating environment will

serve not only campus operators but also workers and residents of the area, i.e. the whole district. In the wake of the campus development, a diverse range of everyday services is also available to a wide audience. From the campus's own services these can include meeting and co-working environments, exercise services, information services, restaurant services and educational provisions. The aim is that the whole district will develop along with the developing campus area.

Campus development work and cooperation between campus operators is continuing within the Future Campus Demonstrator project, funded by the Ministry of Education and Culture. As part of the project, the gap between the multi-operator campus and innovative pedagogy will be narrowed, and the themes of the future campus's physical operating environment, the learning environment and technology, management and services, as well as methodologies and ideologies will be embraced. These themes occur in three separate fields: quality (shared functional and spatial resources), impact (expanding study environments) and efficiency (regional, financial and ecological review). Campus development will not end with the generation of campus solutions, rather it will continue as an iterative development process that returns to the user interface in which the service known as "the campus" is developed according the services' continuous design principle, service design thinking and with a significant degree of participation from campus operators. Join us in creating a campus that is truly your own!

Co-creating **Learning Center**

Päivi Hietanen

Modernization of the Otaniemi Library designed by Alvar Aalto will begin in 2015. With the renovation, Aalto University's campus libraries will be co-located in a historical building. The strategic aim of the library is to transform itself into an inviting Learning Center. This goal directed the programming for modernization, which was carried out in a user-centered manner and with multi-disciplinary cooperation.

Libraries in transformation

Libraries are experiencing tremendous changes in their operations. Circulation is declining and the amount of printed material is shrinking as knowledge is being transferred into virtual worlds. Presently, libraries are undergoing a metamorphosis, which turns them into citizens' meeting places and platforms for learning, new discoveries and joint activities. This transformation is underway also at Aalto University. In the coming years, the amount of printed material in the library will decline by several shelf kilometers. On the other hand, the number of e-journals there already amounts to 50,000.

The strategic aim of the library is to transform itself into an attractive meeting venue as a part of the university's Learning Center. It will be connected with the new Bachelor Center and the new building for Aalto ARTS rising in the heart of the campus. But what will the operational concept of the future Learning Center be like? And what kinds of services should the library provide for its visitors by now numbering a half a million each year?

The modernization project of the library commenced in August 2013. Invited to participate in the development were an architectural office, an interior designer and a design agency. The planning started with a service design, the goal of which was to create for the library a new service concept and an environment to support it. Kuudes Kerros was selected as the consultant for this design project.

Co-creation generates services

Currently, at least seven different customer segments use the library's services. It was important to find out about the needs and motives of these customers to form a brainstorming base for new services.

Data collection started with user interviews. At the initiative of the designers, the project established three service design teams in which Aalto's students and staff were invited to participate. Under the guidance of the designers, these teams carried out extensive interviews of the university's students, researchers, staff and other stakeholders. The aim of this undertaking was to commit the participants not only to the project but also to design thinking. Recruiting participants to this kind of work is always a challenge: students were induced to participate by promising them study credits and an interesting reference to their resume. These ethnographic interviews did not pose the question about the kinds of services the customer might desire. Instead, they sounded out the respondents' motives and work and study routines. The aim was to understand users' daily activities at the campus.

Based on the user needs collected through the interviews, six different user profiles were defined. Three differently acting groups were identified among the students; to these were added the profiles of researcher, teacher and company representative. The interviews were followed by a series of workshops, to which the library's staff and customers were invited. With the help of

Cafe

Starts the day with a morning coffee, talking with his fellow students.

Goes to a self-service point to borrow more exam books.

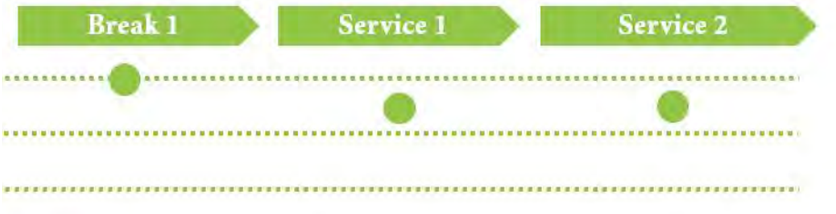
Self-service exam room

Drops in to do, supervised, an exam still waiting for completion.

Terrace

Writes his essay about production economy while on the terrace in sunshine.

"Jack of all trades" is one of the student profiles. Customer journey visualized by Kuudes Kerros describes a student's service and space needs at the library.



Lock & Load

Picks up his overalls, football and washing gear from a storage to attend a guild event.

Pop-up studio for graphic design

Sees in the Compass that the student-led pop-up service is available today precisely.

Compass

Sees in the Compass that an interesting event in which also two of his friends participate will take place in Otakaari 1.

customer journeys, user needs were outlined and ideas about new services and environments supporting them were generated. After that, the best of the service ideas were selected and prototyped among the users.

Along with co-design, the library's current and new services were grouped under four different themes. In addition to the present information services, the new focus areas include spaces for individual and group work, event management, and personal productivity. New ways of learning require more and more cooperation from the students and group work spaces are needed to support it. Students also carry many kinds of things with them, and storage space is needed for their back bags and mobile devices. The "Lock and Load" concept developed for this need can be utilized also in other campus projects. Personal productivity is supported by, for example, a digital goal board, with which the students can make their goals visible and real to themselves and others. Obviously, healthy food promoting well-being, multi-use 24/7 areas and an inviting café form a part of the concept. Many stakeholders expressed the wish for Aalto University's own showroom where more visibility could be given to the university's many activities and results. The library could serve as an excellent platform for this purpose. To manage these activities a new "Community manager" team was created.
The service design generated an ambitious service promise for the library: "Learning together will make us the best in the world". In the future, Aalto University's Learning Center will be an attractive meeting venue that will promote both individual and joint learning.

The Learning Center's service concept groups the current and new services under four different titles.

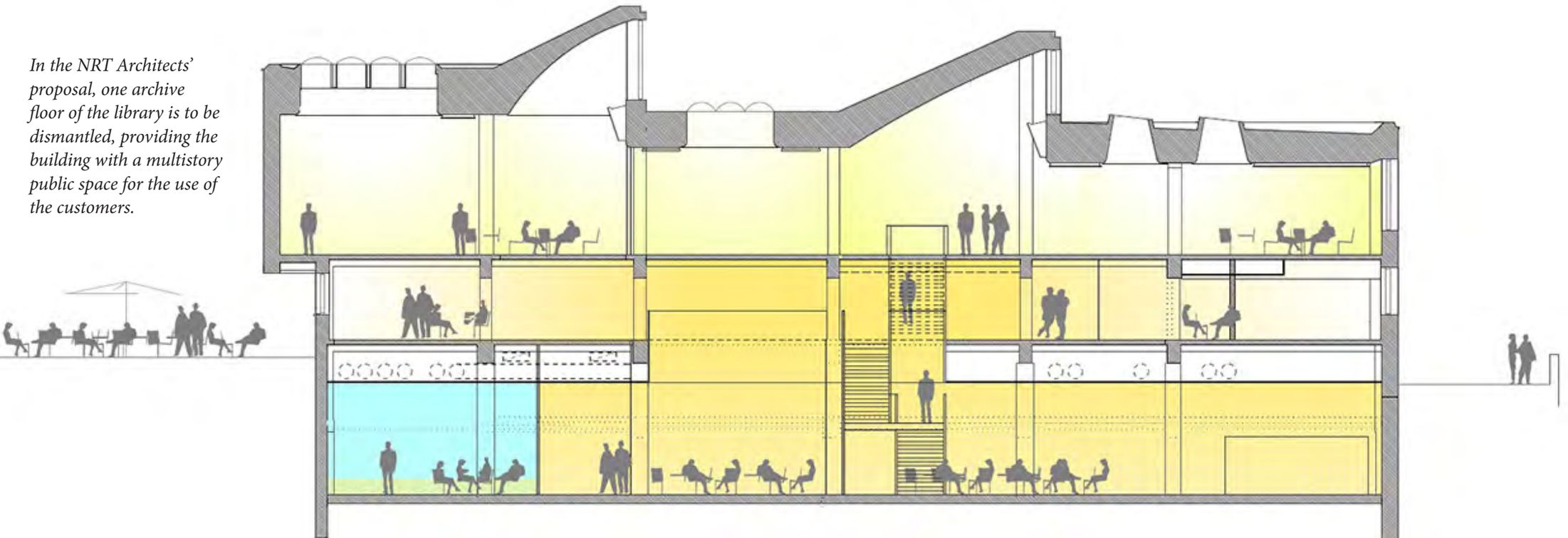
Service transformed into space

In the beginning, the library project did not have a spatial program. The program came into being on the architects' desk after the design project had been completed. The architects converted the new service concept into a space design by grouping the services onto the different floors and by designing the layout and furnishings to support the new functions. Thus, even in this way a project can create a program for modernization.

The chief architects for the programming were NRT Architects. Their task was to investigate the historical building in order to find out what kinds of changes would be possible and how the Learning Center's vision could be realized there. In the architectural concept one secondary archive floor was to be dismantled and an opening for a new internal staircase would be made on the first floor. In this way, the building would have a multistory public zone, which would get natural light through roof windows. The solution would also allow for more space for new HVAC systems, which would enable keeping the most valuable interiors nearly untouched. These proposals have received the green light from the authorities.

The visual identity for the library was the responsibility of JKMM Architects. The designers took an inventory of the library's artifacts and analyzed both the building's values and the history and vision of the library. "Alvar Aalto's hand print" will dominate the interior in the future, too, but apart from this we can celebrate "Aalto University's children" – today's designers – with the help of dedicated alumni areas. The library staff is persuaded into flexible working and to use the whole building as a their work space.

Space design – and the entire programming – was guided by the management's vision that the most important thing is the customer. The new service concept must be implemented in future solutions; collections are less important.



In the NRT Architects' proposal, one archive floor of the library is to be dismantled, providing the building with a multistory public space for the use of the customers.

Why use user-centered concept design?

The concept of the new Learning Center was co-designed by three design agencies and the users. This turned out to be a learning process for all. The library ended up with a comprehensive solution and, from the service design, got a tool for profound understanding of their customers' needs. The project team, for their part, needed resilience as the evolution of the services took its time. Also new kind of cooperation was required: the architects were invited into workshops, solutions were developed in many small focus groups and the results were shared in town hall sessions. This kind of approach requires that the project manager has the courage to question dominant design practices and is willing to procure and manage multi-disciplinary team work.

In a building project, major decisions are made in very early stages. Because the spaces are built to last for decades, it is advisable to put enough effort on redesigning activities and developing new concepts in the programming phase. The costs of this kind of development work are easily absorbed by the investment costs of the whole project.

Another question then deals with user-centered design. Without understanding user needs, we cannot design spaces and services that work well. This realization is gradually entering the real estate sector. However, architects and engineers do not have the tools to analyze the user needs or manage co-design, nor do they have the training for that. As far as the clients are concerned, they are just waking up to the realization about what a valuable resource users are in the design process. This is why, in the field of construction, we often end up copying old-fashioned solutions. Those are, however, a risk for both the users and the investor because they may lead to expensive spatial changes soon after the building has been occupied.

Co-design provides the project team with a common language to deal with a complex entity. At its best, it also assures user engagement to design solutions so that there will be less changes in the following project phases. In fact, user-centered design offers a great chance for renewal in the real estate and construction sector and provides an opportunity to create better customer value.

The concept of the Learning Center is now complete, but the work will not cease yet. New services are being piloted in swing spaces to which the library will move. Our challenge in the building project is to figure out how the users could be involved in the following design phases.

NRT Architects' vision about the future customer space of the Learning Center.

2 Campus as a **sustainable platform**

In this section, attention is drawn to the individual and sustainable development. Kaisa Airo and Eelis Rytkönen examine academic identity. The following three chapters study the theme of sustainable development from the points of view of learning, energy self-sufficiency, and comprehensive social and ecological responsibility. The last two articles drill deeper into the realities of indoor environment as part of user well-being.

Does **academic identity** reflect the campus image?

Kaisa Airo & Eelis Rytkönen

The identity work of a campus user is in a substantial role in experiencing places and spaces. Also, organizations are keen on developing and maintaining a certain image of the spaces they manage. However, often the organizational image does not meet the identity of the users. This is even more crucial during large scale change processes, such as mergers. This article discusses the Aalto University Campus image by looking into the Aalto Strategy and reflecting it to the academic identity displayed by the employees of the university department after the merger of three leading universities in Finland.

During extensive changes in large organizations, the image of the organization may collate with the identity of the employees. This is the case, for instance, in large scale organizational mergers. An example of a large organizational merger is Aalto University, which began operating officially in 2010 and strives to be a world-class university by 2020. It aims to find synergies and innovative approaches through a strong focus in interdisciplinary actions, as it is a merger of three distinct higher education institutions from the fields of business, technology and arts.

The identity of campus users is in a substantial role in experiencing the campus. User experience is the key issue in developing spaces and places. However, the intentions of the management and designers of places and spaces do not necessarily meet the users' perception and experience of them. As users' identity can be defined as something that, in fact, is experienced in real life, image is the identity that stakeholders want to display. In this article the concept of identity is seen as an ongoing process, in which the notion of self is constructed from personal history, ideals and values etc., which are then reflected onto physical artifacts, namely in this case the spatial features of campus locations. The concept of image is also an ongoing process, but as identity can be seen as something that is developed interpersonally, image is, by definition, something that is strategically constructed.

This article presents how Aalto University deploys its image in campus development and how university employees display their identity. The identity of users and the image of Aalto is then compared. The article is based on interviews of employees of the Department of Real Estate, Planning and Geoinformatics of Aalto University and the strategic outlines of Aalto University and Aalto University Campus.

The Interviews

The employees of the Department of Real Estate, Planning and Geoinformatics were interviewed. The Department of Real Estate, Planning and Geoinformatics was relocated from the old university premises to the newly built Business Park in autumn 2011. The participants belonged to the Geomatics Research Group and the Real Estate Research Group (REG). Out of 16 interviewees, 2 were professors from Geomatics and 1 professor from the REG, 5 were employees from Geomatics and 8 employees of the REG. The employees of both Geomatics and the REG were researchers except for one secretary and one controller who had previously worked as a researcher.

Identity, place and space

Identity is an often used but rarely completely understood concept. Identity is used as a synonym for the "self" or for the "image" or the "brand". However, identity is not just the perception of self, but neither is it the image of the object. That is, as the notion of self is somewhat static, identity is a process constructed on the border of the self and the perception others have on one. The identity of the user can be constructed from various attributes including history, values and culture, but also of physical artifacts, such as clothes, things and the environment. In this article, the latter is discussed. That is, how the academic identity displayed by the employees of the university facilities correlates with the image of the university.

The identity of the users is produced in the stories of the self but also in the stories and the history of the environment. The identity and value of the environment are not derived just from the factual, objective features of a space or an object. In fact, the identity of the environment may be established from the implicit networks of stories related to a vast body of phenomena, such as the value of the organization, or notions of cultural constructions, such as the image of the university. Place identity and environmental identity can be differentiated by their geographical scope, but also more specific, localized experiences, and thus more specific memories and possibly other differences in cognitive structure. The environment and identity are, then, constructed both from the premises of personal and geographical location and history. These issues were discussed when interviewing the employees of Aalto University, namely the researchers in the department of Real Estate, Planning and Geoinformatics. A month before the interviews the department had relocated from the old university main building to a newly built business park.

The academic identity and university facilities

According to the interviews, the academic identities connected to campus locations were often described with general claims concerning

the ideal of the university world. They were not connected to Aalto University in specific nor to the field of study the employees practiced. They were more about the questions of the philosophy of academia. For instance, the responses could be categorized into two groups, in which the first represented those who saw their place in the university to be to endorse the tradition of research, independently from business, and the second consisted of those who saw the economical and practical issues as the reason for the university to exist in the first place. For the first group, the business park was not an adequate place for academic work and for the second group it was perfect. The fact that everyone was satisfied with the functional issues implied that it is actually their identity and ideal that governed their experience of the space, not the space itself.

Additionally, it was not all that clear what is the difference between functionality, aesthetics, heritage and symbolism, since they are all interconnected. For instance, many thought that the new business park is "beautiful" since it is clean and light, but their perceptions of beauty were connected to an appearance that represents a different history or a certain style. Accordingly, the new business park cannot have a history and it is not seen as representative of a certain style or era. Therefore, it wasn't seen as beautiful. This concludes that for instance beauty is not just a question of an architectural feature such as building material or layout. It is connected with various other factors, and thus aesthetics, or functional issues for that matter, cannot exist individually without other cultural references. Subsequently, the experience of the space, affected by the above mentioned, cannot be measured without complex contextual issues. As identity is partly constructed in relation to materialistic issues such as space, consequently the experience of the space is constructed in relation to abstract factors such as identity.

According to the interviews, academic identity is constructed in a historical and philosophical context. Academic identity is always connected to a certain paradigm and tradition. Additionally, academic work always takes place in an academic organization, as it is defined by it. Thus, the interviewees claimed that the academic space should reflect the history and the ideal of academia. The challenge is to define whose tradition and whose history, since the ideal of academia seemed to differ between the interviewees.

How then could and should Aalto University reply to these kinds of claims in the strategy and the image of the university? The strategy is discussed next and then reflected onto the identity claims in the end of this article.

The Aalto Image – the Aalto Strategy

The image is perceived as a strategic choice of an organization and is therefore more artificial than the concept of identity, which can be seen to be constructed "naturally". As spaces have an integral role in shaping identities and a large impact in facilitating organizational action, the importance of organizational strategies that are then manifested in spatial strategies should not be underestimated. Especially in times of large organizational mergers that largely affect organizational structures and tend to aim at affecting individual identities, having a mutual agenda across the merging organizational units can be beneficial.

Aalto University's strategy culminates in its motto "Freedom to think, license to act". According to its strategy initially outlined in 2012 and updated in 2014, it has one goal, two missions, three disciplines, four core strategies, five values and six schools. The visionary goal is to achieve world-class status by 2020. The missions are characterized by reaching for global impact, and simultaneously manifesting local focus through aiming at a stronger Finland for the sake of national well-being. The three disciplines that come together under Aalto are technology, business and arts. The four core strategies consist of research, teaching, artistic activities and cooperation. Its five values consist of passion, freedom, courage, responsibility and high ethics. And its six schools to be treated equally are School of Arts, Design and Architecture; School of Business; School of Chemical Engineering; School of Electrical Engineering; School of Engineering; and School of Science. Finally, a peculiar element outlined in its strategy is that it is never considered ready but ever evolving.

Aalto Campus strategy

Building on the university strategy, the Aalto University main campus is developed towards a vision to which more than 2500 people from the university community had collaboratively contributed by June 2011.

The vision of a unified campus for Aalto University indicates interdisciplinary values and a strong sense of sharing. It is based on four corner stones: students, community, faculty and staff, and economy. For the students, the vision promises a world-class, engaging learning experience with freedom of choice on a single site. Concerning faculty and staff, the vision promises a co-location that stimulates communications, sharing and production of new knowledge. Considering community, the vision emphasizes interaction in an open and vibrant campus environment and opportunities for people with different interests to meet. Regarding economy, the vision outlined that people will always be prioritized in investments over walls, which is another reason for focusing on and sharing resources and facilities.

The interdisciplinary vision challenges the traditionally siloed academic community to collaborate across organizational and disciplinary boundaries. The most fundamental strategic decision regarding the existing structures was to centralize a majority of the functions to the main campus of the former University of Technology and totally abandon the existing Arts school campus. The process of centralizing is on-going as this study is being executed. Multiple projects to reach the visionary dreams have been implemented since 2008 on different organizational levels: the university level, the school level and the pilot project level.

The strategies, in other words the processes, of the projects on different organizational levels vary largely. The university level projects, such as conversion of the old main building of the University of Technology into a “bachelor cradle” named OK1 are bureaucratic by nature. The major school level project – planning the new main building for Aalto to house a majority of the Arts school activities and reflect mainly the Arts school identity – has been conducted through a bureaucratically heavy architectural competition. These two levels of processes take time and are mainly conducted in rather traditional ways by units that are officially responsible for the facilities, such as the owner of the facilities, the campus and facilities services, and other service units. An alternative approach has been employed in the pilot level projects that have been initiated by pioneer individuals and are operated as projects throughout their life cycle. These projects are rather experiments that focus on an interdisciplinary theme, retrofit existing underutilized spaces and observe how the spaces should be redeveloped according to their use. They have all evolved rather organically from the grass root level to meet the demands outlined in the vision. These alternative learning and working environments include Design Factory, Startup Sauna, Aalto Hubs, ADDlab and Urban Mill.

How do identity and image relate to one other?

The image Aalto University intends to strive toward is built on openness, collaboration and innovation. In facility management this means alternative learning environments, grass root projects concerning facilities development and more efficient space usage. These claims were not elaborated in the stories of the employees of the department of Real Estate, Planning and Geoinformatics. They were not contradicted either, it was more a question of speaking about totally different issues. As the strategic intentions of Aalto aimed at building a coherent identity of Aalto University, the employees did not even consider the Aalto identity at all. They contemplated academic identity in general. The identity work was built on tradition and history, whereas Aalto University intends to display future and innovation.

These contradictory elements raise the question of through what kinds of processes can the identity in change best be supported? Or do different sorts of identities require different sorts of processes? The visionary statements of providing freedom of choice for an engaging learning experience for the students and a co-location stimulating communications, sharing and production of knowledge

for the faculty and staff of the campus are rather vague promises but support the idea of heterogeneity in the physical environments. If so, which kinds of projects should be approached by experimenting from the bottom up and which kinds of projects from the top down? Or should all the projects be results of an iterative constant idea exchange between the bottom and the top? Or do the processes matter?

As a matter of fact, should the university management follow the identity claims of the users, employees in this case, or should it continue to engage itself to its vision? The answer probably lies somewhere in between. This is because, first of all, users tend to want something they are used to. Identities are not constructed based on something that might happen, but rather on something that has already taken place. However, it is not reasonable to repeat the same routines in a situation that is totally new to begin with. A ready-made Aalto identity cannot exist if there is no history for it to be based on.

Secondly, an everyday user may have difficulties seeing the strategy and the image of the facilities, he/she uses on daily bases. Thus he/she constructs his/her identity choices based on more general lines of history and tradition. It is not in any way surprising or alarming that the image and the identity claims did not correlate. Additionally, when discussing with people who already have a history in a certain location, it can be anticipated they do not identify with new strategic choices, but rather repeat the old ones.

Thirdly, even if the image and the identity would contradict, the positive thing about the concept of identity, or image for that matter, is that they are continuously evolving. The question of high importance is that there is a vision and a motivation to go along with it. It will never be totally ready, but it is constructed all the time. Thus, the future image and the identity of the Aalto University Campus users might just be a mixed synthesis of all the above mentioned. Every year new generations of students inhabit the campus and new identities are constructed. In this situation the most important strategic choice is to have one.

Should, then, the tradition and the historical identity of the users be forgotten altogether? The answer is no, since without a history, one is just a blank page without headings. Thus the history should be acknowledged but not worshiped. It is impossible to stand in front of the change, but it is nearly as impossible to be born from nothing. Accordingly, the campus should endorse flexibility, acknowledge the modern user needs, but remember the past.

The old main building of Helsinki University of Technology – HUT

The main building of the Helsinki University of Technology (Figure 1.) was designed by Alvar Aalto, a well-known Finnish architect. The building was constructed in 1965, and it represents typical functional style. It is situated approximately 10 kilometers from Helsinki city center and 2 kilometers from the technology cluster of companies such as Nokia Headquarters. In the sixties, the building and the whole campus area was constructed for the needs of the growing number of technical students, who had formerly been located in the center of Helsinki in multiple locations. At the time, the campus area was unique in the Finnish landscape, since it was entirely designed for the university and student purposes and barely catered other forms of usage, such as private (other than student) housing or business.

The office settings are typical for those times, concentrating on private and shared rooms. Other areas comprise lecture halls, lobbies, administrative spaces etc. Both the office and the teaching spaces are preserved by the Alvar Aalto foundation, which ensures the continuation of the heritage of Aalto. Thus during the renovation of the old main building the original materials and design are kept as they are, keeping changes as minimal as possible.

Figure 1: The main building of the Helsinki University of Technology

Figure 2: The Business Park

The Business Park

The new location of the Department of Real Estate, Planning and Geoinformatics in the Business Park (Figure 2) is situated approximately one and a half kilometers from the old main building in Otaniemi, Espoo. It is located near the technology cluster, which was built about 10 kilometers from Helsinki. It consists of four buildings and houses 1200 workplaces. The offices are either open plan solutions or a combination of open plan and enclosed space. The department was the first user of the office spaces on the fourth and the fifth floor. They were not allowed to make changes to the layout of the interior design. The Department of Real Estate is located on the fifth and the Department of Geoinformatics on the fourth floor. Most of the interviewed employees were sitting in an open plan location apart from secretaries who shared a room. Two professors and two researchers were working in private rooms.

Learning sustainability in campus areas

Katri-Liisa Pulkkinen & Aija Staffans

Sustainability is one of the key challenges facing future learning environments and campus development. The everyday use of campus areas can be seen as an opportunity to do research and produce new knowledge on sustainability. Campuses could be developed in explorative ways, for example as living laboratories, which are an emerging way to do research and produce new knowledge. Living laboratories have learning on the course of change as their root configuration. In the field of sustainability, the aim could be at reaching more sustainable technological solutions while developing more sustainable ways of living and a deeper understanding of the interconnections of human and ecological systems. In this article, we discuss some of the basic settings behind the need for these solutions and suggest processes to produce inspiring campus areas that advance sustainability. While the transition to sustainability is often seen as a top-down governing challenge, the processes suggested here are pioneering bottom-up ways to create change. Bottom-up action in innovation should be given recognition and nurturing, as the bottom-up initiatives often challenge systems that resist change. We also discuss how some of the current ways of producing campus areas are problematic for this need of new approaches. We use the Aalto University Otaniemi campus area as an example of a future sustainability learning environment.

Sustainability is one of Aalto's main goals: "Aalto University will be incorporating sustainability and responsibility perspectives into all our research and teaching by 2015", writes president Tuula Teeri in her blog in 2012. Also, the Aalto campus area has set a strategic goal to be "the leading sustainable university campus in Finland by 2020".

Sustainability has often been divided into social, economic and ecological sustainability. Ecological sustainability seems to be in many cases submerged under the quest for social and, even more so, economic sustainability, which is problematic especially when ecological sustainability is viewed as a need for the regeneration of an already damaged planet. And indeed, research shows that the planet's carrying capacity has been exceeded already in the 1980's and we are continuously crossing the planetary boundaries especially on the biodiversity loss, climate change and distorted nitrogen and phosphorus cycles. For future learning environments, understanding the priority position of ecological sustainability is crucial, as is the notion that it is not enough just to reduce the pressure on the planet when there is a need to regenerate stressed systems. The discussion of planetary boundaries is also linked in many ways to social and economic equity and power distribution.

For sustainable development, at least three aspects are important and related to the creation of future learning environments. First, it is well recognized that technological improvements are needed, for example, for a reduced carbon footprint and increased energy and material efficiency. Secondly, and perhaps a bit less recognized, there is a great need for transformation in the everyday behaviors of people; no amount of technological improvements are enough if people's everyday behaviors are not sustainable. And thirdly, currently probably least recognized, there is the need for a deeper understanding of the many levels of interactions in socio-ecological relationships that affect the environmental context where we exist. The need for regeneration of the living conditions on the planet links especially to this third aspect.

All of these aspects require both research and practical development that enables testing of new ideas. It would be a great benefit if the university campus area with its resources and societal status could serve as an open field for this kind of research and experimentation. After all, the transition to sustainability is essentially about the production of new knowledge on many levels, from basic research to more applied models. Experiencing the campus area as an everyday learning environment for sustainability would thus, in fact, mean that the research and creation of new knowledge would happen simultaneously as the campus area is used. The need to change everyday behaviors and the need to find deeper understanding of the social-ecological interconnections would be connected to technological innovation, which often tends to dominate and leave the other aspects shadowed.

Next, we will refer to the discussion of the emergence of learning labs and then suggest, based on our research, how the above mentioned aims could be approached in living laboratories trough what could be called "bottom-up pioneer processes". We will also discuss why many of the current ways to produce campus environments are not supporting these transformative learning processes.

Living laboratories can also be attractive hubs that collect stakeholders to work together, creating new communities of interest around emerging developments in transition to sustainability.

Living laboratories

Aalto University is a part of the International Sustainable Campus Network (ISCN) that "provides a global forum to support leading colleges, universities, and corporate campuses in the exchange of information, ideas, and best practices for achieving sustainable campus operations and integrating sustainability in research and teaching".

Living laboratories is an approach that the ISCN has recognized to hold strong emerging potential to study and develop transformative technologies and behaviors. In a book published by the ISCN network, Regenerative Sustainable Development of Universities and Cities, Ariane König and James Evans describe living laboratories as "platforms for visioning processes to define needs, what progress means and how to realize it, with the power to stimulate changes beyond their boundaries". Living laboratories can also be seen as an important mechanism to realize the third task of universities, i.e. to interact with and serve the society.

Living laboratories can also be attractive hubs that collect stakeholders to work together, creating new communities of interest around emerging developments in transition to sustainability. The aim is naturally to generate lasting behaviors that have a wider impact on the society – not just within the living laboratory itself.

Living laboratories have already been created in many universities around the globe, and many of them feature also co-operation with cities that host the university campuses, showcasing how the effects of the living laboratories can transcend the boundaries of the university context. The book, Regenerative Sustainable Development of Universities and Cities, presents several examples. – Given the increasing interest and success of such living laboratories in the research and development for sustainability, it would be surprising if Aalto University, with the aims to reach a leading position in sustainability, would not use such an approach in the Otaniemi campus development.

Bottom-up way to create change

It is possible to steer living laboratories as prescriptively designed and run top-down processes. However, we suggest that bottom-up initiated change processes that are encouraged to develop into living labs would have several benefits. One of these benefits is that bottom-up pioneer processes challenge the sometimes overly resilient behaviors of the governing systems that make changing the rules of the system difficult. These obstructive systemic behaviors in the production of sustainable campus environments will be discussed in the next chapter.

Our research has studied the urban pioneering movement in Helsinki as a successful bottom-up process that has influenced its environment. The movement comprises of many separate "pioneer projects" that have happened over time. The movement has been studied as a complex, adaptive and open system of several independent groups of people. These people, the urban pioneers, are producing new ideas, behaviors and structures to the cultural scene of the city. Mostly these are some kinds of events, or activation of places and spaces. Over time, the separate pioneering projects have formed into a movement that is recognized by the city governance, the public media and, of course, also by the pioneers themselves.

The urban pioneer projects can be described as a dynamic growth process. Seen this way, the movement is aiming at creating a series of so called positive feedback loops – a snowball effect – by producing urban culture, especially events, that create demand for even more of the similar kind of action. Simultaneously, the urban pioneers have to work with so called negative feedback loops that are restrictions and rules that inhibit the pioneering initiatives. Over time, the movement has become increasingly successful in their endeavor as they have diminished the amount of resistance that has originally been there – in fact, the city of Helsinki now supports the pioneer activities and even uses it in its branding and marketing.

From the point of view of living laboratories, the pioneer movement can be seen as a self-organized living laboratory that explores the possibilities to create culture and enhance citizen democracy in the city. Many of the pioneer initiatives are experimental and rule-bending. Examples of such pioneer projects are as diverse as the transformation of the Cable Factory into a cultural center, the Restaurant Day (and other popular one-day events) and the latest initiatives, such as Nappi Naapuri, that are closer to social entrepreneurship and raising awareness of social and ecological sustainability issues.

The dynamic process of a successful pioneer project includes a modest beginning with bold dreams, followed by self-reinforcing growth through experimental trial and error, and the negotiation processes that are needed to enable the activities. The growth includes both the growth of the urban idea as a concept, and the movement itself. The possibility for growth is linked to how the pioneers engage themselves to minimize the effect of limiting rules as mentioned above.

Referring to the discussion of the need for sustainability and living laboratories as a possibility for a new approach, the pioneer process has supportive features: first, the strong learning orientation that is guided by a bold, magnetic vision that requires change in the current situation. Secondly, the bottom-up approach requires negotiations with the existing system – just because of this element of change. Bottom-up processes differ from top-down processes especially in this aspect – in top-down change initiatives, the emerging system itself does not necessarily have to negotiate its way to existence. And, with the pioneers, the negotiations are a part of the process that intensifies and structures their own systemic behavior as well. Pioneering initiatives in Helsinki have already created and negotiated some room for themselves, and today they get support both from within their own open community of interest and from the city of Helsinki.

The current constraining practices and processes

The prevailing practices of the production of our built environment inhibit the innovative pioneering in many ways and for many reasons. Resilience is the name of the game in urban development, but we ask whether some existing practices are dubiously too resilient to produce new kinds of urban environments. Some of the current practices are simply stuck to old organizational silos and routines, some others being more a result of intentional policy-making. As an example of the latter we present two institutional and systemic practices which both have some difficulties to open their processes and adopt new thinking. These practices are the architectural design competition and the current land use planning system.

An example of the process of an architectural design competition is the new center of the Otaniemi campus. It has been explored by an open, international architectural competition, and the center will be designed by the winner of this process. From a sustainability point of view, the competition process revealed some systemic, built-in challenges. First, the anonymity of the proposals and participants during the competition process closes the process and excludes the possibility for a dialogue and interaction between the stakeholders and competitors during the process. This also excludes the indispensable discussion prerequisite to any sustainability interpretation.

Secondly, the anonymity and closed character of the competition process increases the meaning of the competition program. In case it is not possible to intervene in the ongoing competition process, it is necessary to anticipate as precisely as possible what the future will be like. However, it is unfeasible to create a competition program that covers the whole multidimensional and even controversial field

of urban planning, including the challenges of sustainability. Sustainability in general would also benefit rather from larger than smaller geographical outlining of the project area, which, once again, makes the programming more demanding. To summarize, the pitfall of the competition process is that the closed process leads to an extensive and precise programming which, however, is unfeasible in the complex urban planning context.

Third, an architectural competition is a competition for architects. It is a way of doing credit to the winners and getting new projects. The strong professional status and rigorous rules impede opening the competitions to other types of expertise. In achieving sustainability, the need for multidisciplinary dialogue is crucial; architectural expertise is valid but absolutely not enough. The hard professional competition and even protectionism can be detected in the discussion of the competition institution.

Our second example is the current land-use planning system. The directing capacity of land use planning is basically strong, but in practice it is slow and even contradictory. Planning is a hierarchical system defining the land use guidelines from regional regulations to local and more detailed ones. From a sustainability point of view, each level of planning has its own essential impact on sustainability. Planning is most effective when it succeeds to guide urban development on the regional level where the most important "sustainability choices" of built infrastructure are made. These include urban structure, transportation and energy decisions. However, the regulatory planning efforts are very much concentrated on the local and detailed level, where choices to impact sustainability are very limited, such as direction of buildings, opening windows, etc. The constraining character of detail plans and other building regulations is a constant argument of several actors in the field of urban development. This also partly explains the pioneers' interest to act in localities and buildings that are under a bigger change process and, because of this uncertainty, are open to temporary experiments.

Even if planning aims at making new solutions possible, in practice it limits possibilities as the strong guiding principles are tied to an overall solution – that is, tied to the existing way of interpreting the future. The reason for this is that the choices that direct the possibilities are always based on existing knowledge, and old methods of measuring success are not often capable of foreseeing changes. This delay can be seen especially in how environmentally sustainable solutions are at first sight often estimated to be expensive or not productive, and are thus rejected. In reality, ignoring them may cause much bigger costs later on.

Both of these examples, the architectural competition process and the current land-use planning system, show the strength and depth of our institutional practices and concretize the difficulty of the systemic change towards sustainability. Moreover, this example is only one small part of the containing systemic whole in producing our urban environment as there are also many other practices that prevent change.

Discussion

Enabling and allowing support is crucial for the extending growth of pioneering. In the living labs and university context, the lesson from the urban pioneers in Helsinki is that there should be active recognition and support for emerging pioneer projects and groups. Simultaneously, there should also be some element that requires that the pioneers do negotiate with the governing system that tests the ideas and also strengthens the pioneer group. Most importantly, the role of the university should be supportive and the growth potential of such pioneer initiatives should not be lost in other processes.

There are already some examples of pioneer initiatives at the Aalto Otaniemi campus, for example Design factory, Startup Sauna and Urban Mill. These projects do not, however, have environmental, regenerative sustainability as their core goal. All of these pioneer initiatives have occupied old buildings and in that sense they have similarities with the well-known pioneer case of the Cable Factory in Helsinki. It should be noted, though, that the urban pioneering movement in Helsinki has developed into many forms, from intermediate use of urban spaces into one-day events and other initiatives. This possibility for several types of living laboratories should be kept open

also in Aalto University.

The City of Espoo has been active in developing and promoting the planning of the Otaniemi campus. However, the main efforts of Espoo have focused on the innovation potential of the campus, not on sustainability issues. But innovations seldom happen top-down; this was clearly concluded in the report "The Well-being of the Metropolis" in 2011: "Helsinki metropolitan competitiveness 2.0" will be compiled of sustainable well-being, sustainable innovations, partnerships and design thinking. The future is characterized by wicked problems that can only be solved by innovative and enthusiastic persons. Bottom-up thinking allows and supports these processes.

The difficulties in top-down governance are confirmed by the politicians of Espoo. In the forewords of the Otaniemi Vision (from August 28th 2013) the City Planning Committee notes that the system is unable to attract all the stakeholders to commit to a shared vision and process in Otaniemi. Bottom-up processes instead enable the stakeholders to build up the vision gradually in the course of change.

What Hautamäki writes of competitiveness and the politicians of governance is widely relevant for sustainable development as well. Innovativeness is needed for achieving the sustainability goals and, as our examples from the planning and design practice show, many of the current top-down processes do not meet the expectations despite of their ambitious goal setting.

A campus is a learning environment for future professionals. It could offer a unique opportunity to encourage young people to actively search for sustainable solutions, to co-create and make hands-on experiments in their daily environment and to take responsibility of a more sustainable future. The responsibility of senior professionals is to listen to these voices and to give all support to these efforts.

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Human and Green Workplace Design in the University

Virpi Ruohomäki, Marjaana Lahtinen, Anssi Joutsiniemi, Miimu Airaksinen, Pekka Tuominen, Pirjo Kekäläinen, Janne Porkka

University buildings need to be energy efficient, technologically up to date, meet the needs of the users and be healthy in terms of well-being for people working within them. Energy-saving solutions must not deteriorate the quality of the indoor environment. Instead, the objective should be healthy and safe space solutions. User participation is relevant when planning working environments that support fluent and effective working and the well-being of users.

Towards energy efficiency and user well-being

The objectives of the study were to develop a participatory design approach to promote energy efficiency targets and to support effective working and the well-being of employees in the university. The driving forces were sustainability and the workplace needs of the university staff. This research is based on multidisciplinary collaboration of work and organizational psychology, architecture, construction and energy engineering as well as practical viewpoints of health and safety at work. This paper introduces new energy efficiency indicators and new participatory methods for designing Human and Green Workplaces in the university context.

Space and energy efficiency

In the context of sustainable development, buildings should be constructed with adequate occupant comfort, limited natural resource use and low environmental impact, measured over the entire life cycle of the building.

Typically the aim in construction and renovation processes is to calculate the energy, space and cost efficiency in the design phase (Airaksinen 2011). These factors influence the decision making during the whole planning and building process. The building owner decides on the level of efficiency that is aimed for and the designers set the actual levels in the plans they produce. Often end-users are not involved in the process, since they are typically not known in this early phase of the process. In addition, end-users do not have a professional understanding about different options and thus, there is a clear need to illustrate the different alternatives to users. However, in this pilot study end-users were engaged in the process. There is also lack of guiding indicators towards optimal solution in energy and space use. The indicators introduced for studying the pilot case are presented and discussed below.

Generally, in measuring the energy inputs the following issues need to be addressed:

- Life cycle. How to take into account the energy consumed in the energy chain, embodied energy in materials, and energy recovered from recycled materials.
- Value of energy. How to accommodate different values of different kinds of energy, be they of a physical nature, such as the ability to do work, or of an economic or some other nature.
- Process integration and co-production of energy and the ensuing allocation problems.
- Reference values when benchmarking or potential calculations are wanted.

Measuring output requires addressing the following issues:

- Quality of the service or good produced, as this usually cannot be taken into account with the simple measurement of physical production quantities.
- The role of load curves and time series, as the indicators have to accommodate different levels of consumption at different times.

It is important to study different alternatives and how they impact the reduction of energy consumption and how energy consumption is measured. The new indicators for energy efficiency presented here aim to take into account not only the energy consumption per floor area, called specific energy consumption or SEC, but also the energy consumption that takes into account space efficiency. Space efficiency is taken into account both by used floor area per person and the efficiency of the space use in occupied hours.

A typical indicator takes the form of a ratio, where energy consumption is divided by a demand indicator meaning a number that somehow represents the good or service the production of which requires the consumption of the said energy. For buildings this most commonly means dividing the energy consumed with floor area, but in the context of space efficiency the problem of such an indicator is that more efficient use of space will show no improvement in energy efficiency.

The energy usage of buildings consists of the base consumption that takes place regardless of the actual use of the building and of the user's energy consumption. Since the base consumption, consisting

of heating, minimum ventilation and other continuous energy services, runs regardless of the usage of the building, energy efficiency can be improved by increasing the utilization rate of the building. An added benefit is that this can counter the need for more built space.

Therefore it is suggested that an indicator should be devised that measures simply the amount of energy consumed per person hours (T_{pers}) spent in the building, namely the energy intensity of usage:

$$EIU = \frac{Q}{T_{pers}}$$

This indicator, however, loses the information concerning the size of the building, as there is no variable for floor area. Therefore another indicator is suggested that attempts to include both the area of the building and its level of use. Here SEC is modified so that it allows for different utilization rates of the building. It is therefore suggested that SEC be adjusted for utilization rate (UR) with

$$SEC_{UR} = \frac{Q}{uA}$$

where u is the utilization rate of the building, which, in turn, can be defined in different ways. The most obvious way is to measure the ratio of actual daily person hours Tactual to the highest possible usage hours T_{max}:

$$u = \frac{T_{actual}}{T_{max}}$$

T_{max} is at highest limited to 24 hours per day, but in some cases there are other practical limitations.

With these indicators, any planner with a professional understanding of building energy and space use can estimate the effects of efficient space use on energy efficiency, a matter that is lost if only SEC is used. It is recommended, nevertheless, that SEC is also kept in use as it is a very useful indicator of the technical energetic properties of the building. SEC is particularly helpful in the beginning of the planning process when details of building use are often still vague. As the building use profile becomes clearer as the planning advances, the indicators proposed here can be used alongside with SEC. It is recommended that building planners calculate values for these indicators and present them to the decision makers to allow informed decisions.

Once the building has been taken into use, actual measured information concerning the number of building users and person-hours should be used to follow up on the calculations made during the planning process. This way, if necessary, adjustments can be made to the use of the building, its layout, energy use or other relevant parameters.

Participatory design approach

Various user-centered and participatory design approaches have globally been the dominant theoretical approach e.g. in organizational development, ergonomics, architecture, and urban design in the last decades. Despite this, there is uncertainty in how the user-centered problem solving should be implemented in a beneficial way. Participatory ergonomics and Scandinavian participatory design (i.e. co-operative design) have been adopted mainly in the software industry, product design and management. However, in the highly conservative construction sector their influence has, until recently, been nearly non-existing (or at least not developed systematically). (Ruohomäki et al. 2013).

The theoretical background for most of the methods is based on socio-technical system design, action research and progressive/iterative problem solving. In this research, participatory design refers to the active participation of the users of the premises in the design process. We assume that participatory design is pivotal when pursuing an indoor environment that supports well-being and the productivity of users as well as a fluent change process. In the same manner, the users of the premises could be motivated and their commitment to energy saving objectives could be strengthened. The idea is to improve the design process and its outcome by utilizing users' expertise and experiences of their work. Common knowledge generated during the learning process, strengthening participants' commitment to changes

and facilitating the implementation of changes, could also be considered as key advantages of participation. (Ruohomäki et al. 2013).

Participatory design requires close cooperation between the users of the premises, the designers and other specialists, and well-functioning cooperation forums. Participatory design needs methods that help parties representing design, research and practical aspects to understand each other and help in supporting the implementation of the change. The starting point for space planning should be organizational strategic goals, the users of the premises and their work requirements.

Participatory methods and their application

A key difficulty in communication in the team consisting of experts and multiple stakeholders is to find a common ground where fruitful discussions are possible. It is rare to find a framework that would easily fit together the various conceptual backgrounds and systemic boundaries and therefore often the "greatest common divisor" and the "least common multiple" is found on the spatial arrangement of the design object itself. Therefore to improve communication, a method for visualizing and merging information in a common spatial frame has proven its strength in various disciplines.

We introduce participatory methods for collecting systematic data from the users and their work requirements as a basis for the workplace design, especially at the early phase of the planning process that is usually ill-defined ("fuzzy-front-end"). The participatory methods include the Work Environment and Well-being Survey and Workshops, tailored for this research by the authors of the Finnish Institute of Occupational Health, as well as the Visualization method developed by the author of EDGE Laboratory. Next, we illustrate their applications as part of the participatory renovation project of the case building in the University of Turku.

The project was started by forming a space team and setting objectives for the change in common planning meetings. The objectives for the renovation were: to chart functional space solutions, to optimize space utilization, to bring flexibility into space utilization, and to improve energy efficiency. The personnel and students were informed about the renovation at a joint kick-off meeting.

Work Environment and Well-being Survey

The Work Environment and Well-being Survey is a new method for job analysis and assessing user needs and experiences of premises. This survey serves as a basis for space planning before renovation. It also acts as a post-renovation follow-up method when assessing the effects of the renovation on the users' satisfaction with their working environment, well-being and work performance. The survey looks into various factors, such as job content, work tasks, working places, the functionality of the premises, the problems, complaints and symptoms associated with the indoor environment, the perceived well-being of the users of the premises, attitudes towards changes of the premises and ideas for improvements. (Ruohomäki et al. 2014)

In the university, the survey produced a many-sided view of the job content and work specific needs of the personnel. With the help of the survey, different user groups could be profiled, with different tasks, tools and space requirements. Furthermore, it provided information about problems related to the indoor environment and the development needs of the current premises to be taken into account in connection with the renovation. The results showed that the facilities supported independent, individual tasks well, but collaboration and teamwork less. The identified problems were related to the quality of

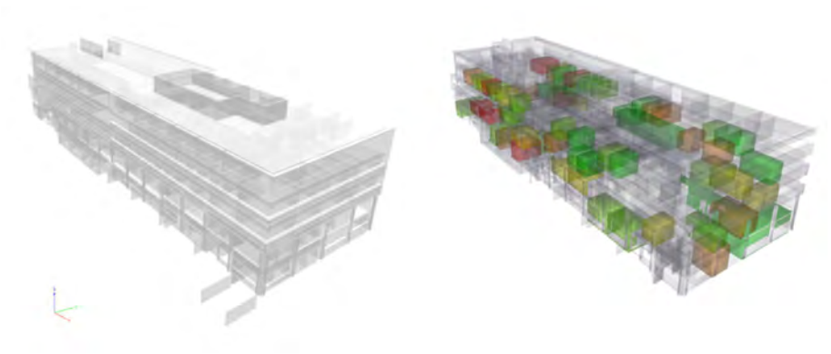

Figure 1. Example of the visualization of the survey results in the university building. Perceived satisfaction on the work environment on a scale of 1 (very unsatisfied, red) to 7 (very satisfied, green)

indoor air, temperature and acoustics. The respondents submitted a great number of feasible development suggestions with regard to their working environment. (Ruohomäki et al. 2014).

To support communication and collaboration between different stakeholders, like the owners, designers and users of the premises, a visualization method is needed. The geosciences have a century-long tradition of creating cartograms and thematic maps to slice and highlight various features to do this in large surroundings. In the case study, this method was adopted and introduced in the smaller but more complex spatial arrangement of a building. The survey results were visualized with a 3D model showing users' experiences and satisfaction in specific rooms of the premises. (Ruohomäki et al. 2013).

To get a comprehensive overview of the questionnaire results, data were combined with the building geometry using individual room space. The IFC industry standard for building information modeling provides an optimal starting point for this, but due to the limitations of the base data, additional steps were needed to create visualized solids "on the fly". The ordinal questionnaire answers were color-coded to present the intensity and spatial distribution in a manner that is understandable to both users of the building as well as design experts working with 2D representations on a daily basis. (Ruohomäki et al. 2013).

Setting goals for energy efficiency in the planning phase

The value of a building can be framed in many ways. In order to help building owners and designers, Perfection methodology has been created (Desmyter et al. 2011). The methodology describes Key Performance Indicator (KPI) Framework, which is a result from an inventory of current performance indicators, standards, regulations, guidelines, research activities and policies used in the design and construction phases. The framework consists of 31 indicators composed in four categories. Each indicator is evaluated with a performance grade that ranges from the lowest (class E) to the highest (class A). When all indicators of the framework are assessed, the quality of indoor environment is presented as a KPI score; a number between 0 and 100, indicating how well the indoor environment performs. The highest values indicate the best performing indoor environment. The structure of the KPI framework is the following; Health and Comfort 19 indicators, Safety and Security 7 indicators, Usability and Positive Stimulation 7 indicators, Adaptability and Serviceability 7 indicators.

This framework was used in the design phase in the case building of the University of Turku to help to set the goals for design and also to help to communicate between building owners, users and designers. When the current situation was assessed, Figure 2, the results show that the highest scores, 75, were achieved in Safety and Security, and Adaptability and Serviceability got the second highest scores being 69. Usability and Positive Stimulation got 55, and the lowest scores, 23, were achieved in Health and Comfort. Both the building owners and designers found the tool useful for analyzing the current situation and it helped them to shape the efforts and targets for the design phase.

	Category		Indicator	Value -	E	D	C	B	A	%	
Health and comfort	Health	1	Mould growth risk	D		X				3,6	23
		2	Ventilation / CO2	E	X					5,3	
		3	Combustion sources / infiltration	E	X					2,9	
		4	Particulate matter	E	X					2,8	
		5	Drinking water quality	D		X				3,5	
	Comfort	6	Operative temperature / PPD	E	X					3,3	
		7	Illuminance	C			X			2,8	
		8	Daylight factor	B				X		3,2	
		9	Background noise level	D		X				3,2	
		10	Reverberation time	C			X			2,5	
Safety and security	Safety	11	Safety in use	B				X		6,4	75
		12	Feeling of safety	A					X	3,9	
		13	Meeting current regulation	B				X		4,5	
		14	Building type specific	C			X			1,8	
	Security	15	Personal and material security	B				X		4,2	
		16	Security of Information	C			X			2,5	
		17	Reliability in exceptional cases	B				X		2,7	
Usability and positive stimulation	Usability	18	Access to and in the building	D		X				4,7	55
		19	Wayfinding	C			X			3,1	
		20	Adjustability	D		X				2,8	
	Positive Stimulation	21	View to outside	B				X		3,1	
		22	Privacy	B				X		1,6	
		23	Feelings and sensations	B				X		3,5	
		24	Availability and quality of recreational spaces	B				X		3,8	
Adaptability and serviceability	Adaptability	25	Versatility and protection	B				X		3,1	69
		26	Tecnical service life	D		X				2,8	
		27	Adaptability to climate change	A					X	2,1	
	Serviceability	28	Branding and cultural heritage	A					X	1,5	
		29	Availability of services in the building	B				X		3,1	
		30	Cleanliness	C			X			2,6	
		31	Maintanibility	B				X		2,7	

Figure 2. The KPI results from the case building target setting

Common workshops for users and designers

Participatory workshops for the users and designers of a building can promote their communication and collaboration as well as support co-creation of future workplace solutions and change management. In the university of Turku at the renovation planning phase, we organized half-day workshops with 20–28 participants. These four dialogical and future-oriented workshops had a clear focus and structure (Ruohomäki et al. 2013):

1. The first workshop reviewed space and other requirements of work carried out at the university in the light of the results of the survey and interviews. The participants created a common view of the functionality of the current premises and future space requirements in order to support design.
2. The second workshop focused on creating an understanding of the current state and renovation needs of the building as well as contemplating the users' opportunities to promote efficient space utilization and energy efficiency. The workshop reviewed the personnel's experiences of the indoor climate on the basis of the results of the survey and interviews. The participants produced ideas for improvements and for shared use of spaces.
3. The third workshop focused on planning the concrete move into temporary premises. In addition, feelings related to the change, well-being and the ability to cope were discussed.
4. The fourth workshop provided information on the progress of the renovation project. The guidelines for communication were created and the roles of different parties were clarified. Different options for shared laboratories and hot-desking were visualized in order to promote participatory planning.

The users and designers participated actively and enthusiastically in the workshops. According to the feedback questionnaires, the discussions were open and different views could be expressed freely, and the participants were able to commit to the results. The follow-up interviews after one year showed that the participants perceived the workshops very useful in (Ruohomäki et al. 2014):

- preparing for relocation and working in the temporary premises
- promoting effective use of workspaces
- idea generation for new workplace solutions
- supporting communication and collaboration between users and designers
- learning and committing to workplace changes.

Guidelines for implementing and using new workplaces

Increasing space effective planning of workplaces and economic pressure have created a need to plan more working environment with open-space and multi-use spaces for the personnel of universities with different kinds of tasks (teaching, research, planning, administrative work).

The Helsinki University's Occupational Health and Safety (OHS) Committee approved the basis for space planning at the workplace and a guideline for managing new spaces. These instructions originate from the discussions in the campus OHS committees and the indoor environment group of the university about the rules on how to use the open-space offices. These guidelines are based on one of the aims of the OHS strategy: "During relocations in conjunction with facility reorganization physical and psychological occupational safety should be considered. When planning relocations, more attention should be paid to the psychical stress caused by the move as well as any changes in the work community and the related risks. The responsibility for the planning and the consideration of the occupational safety perspectives is carried by the superiors and the staff."

The purpose of these practical guidelines is to aid planning and implementing new workplaces in the University of Helsinki. They were formulated for groups who are planning reconstruction projects in the Center for Properties and Facilities, faculties and department leaders and users of the spaces in the university.

The different phases of change management at the beginning of the project

- Setting objectives for changing and developing the work environment
- Forming a "space team" (comprising of a supervisor, a finance specialist, an ICT specialist and representatives of each staff group
  - Defining the tasks and sharing them among the team members
  - The space team assists the construction committee by preparing matters and keeping both the committee and the users of the work space informed
  - The Centre for Properties and Facilities offers a space planning service (various specialists)
- Profiling users and determining their job and task descriptions
- Determining the spatial needs of both the physical and the virtual (online working) workspace
- Including and informing users according to established communication practices
- Learning new ways of using and managing the space

This checklist includes practical things to consider when compiling guidelines for open-plan and multispace offices. The checklist aids in creating guidelines that support both the individual and the community in physical and virtual encounters and cooperation.

The checklist includes etiquettes at the workstations (discussions, phone calls, computer/phone signals, music), the use of common facilities (booking of facilities and purpose of their use), common rules of practice (walkways and getting around in the office, tidiness and the maintenance of overall order, and perfumes and plants), and, finally, the need for modifying and updating the guidelines according to feedback.

These guidelines have been introduced in the University of Helsinki in the units that have relocations and renovations especially to multi-use spaces. The first experiences of the use of these bases and guidelines have been positive, but more information about these guidelines must spread to the personnel who organize and plan new work spaces.

Lessons learned and discussion

Our study suggests that a particular challenge is posed by the timely and flexible anchoring of the participatory process to the renovation project. Architectural and engineering design tasks are commonly seen as integrative expert work, where spatial arrangement is in focus. This is the part of design work that is referred to in Figure 3 as "standard" construction process, defined slightly differently from country to country, but containing subsequent logical project phases such as *feasibility study (FS), concept exploration (CE), preliminary engineering (PE), construction (C) and post-construction operations & management (OM).*

Since the work is synthesizing by nature and all but easy to divide between induction, deduction and abduction based reasoning, participatory approaches easily seem like just an additional burden. Too often the role of participation is only seen as a commentary of a minimal number of predefined design alternatives, which naturally loses the major potential of distributed knowledge in the organization. This is also a typical source of conflict, if the alternative creation phase does not share the same value base or understanding of typical work flows within an organization.

Therefore a successful participatory process requires specific routines, which we have started to explore in our research. Both the setting of proper technical indicators and the determination of spatial needs of the users are the basis for an architectural facility program of a project and therefore essential to be evaluated through a participatory process. Figure 3 summarizes the subsequent phases that need to be managed to cover a realistic understanding of organization specific demands. This early phase of a construction process is still lacking standards and methods are by and large in their infancy, which forms a major threat for any large scale renovation project, like our university case. Figure 3 outlines the topics and scheduling of workshops in our study.

In summary, this study contributes to the future design of campuses and universities towards Human and Green Workplaces by integrating

attempts towards energy efficiency and user well-being. This paper introduced new energy efficiency indicators and new participatory methods as well as practical guidelines successfully tested in the university context. Promising results encourage to broaden these applications also in other contexts in the future.

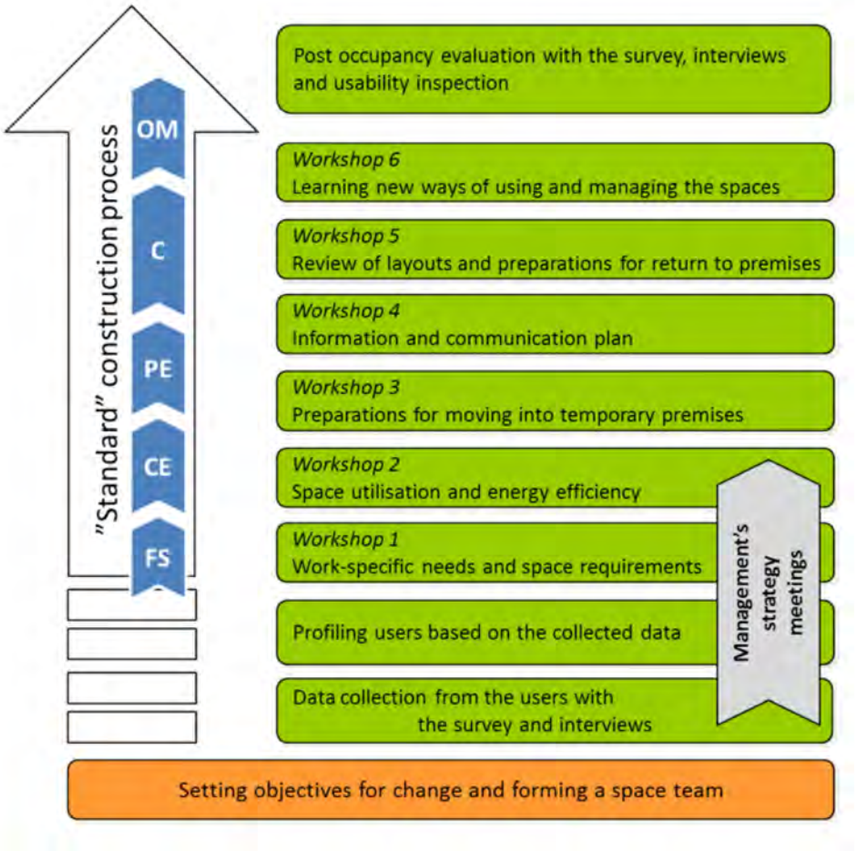

Figure 3. Human & Green action model. Proposed phases for creation of a facility program in participatory design process.

Acknowledgements

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3 **Methods** of campus development

The third section concentrates on the experiences of campus users and joint development. The seven chapters of the section present the methods and processes through which campuses have been jointly developed in different parts of Finland. Common to the methods is that they consider the user as a part of the entire process and utilize users' knowledge and skills in designing and customizing learning environments.

Digitally supported **collaboration and communication place**

Sari Tähtinen

An attempt to develop complex systems like a campus in such a way that we can name the process to represent "co-creation," poses some challenges. Co-creation demands, for instance, many participants taking part in the process. Having different actors with diverse backgrounds, views, and expectations, can make e.g. the planning process complicated and time consuming. The traditional way to avoid this has been not to co-create, but to use only limited number of "experts" instead to do the planning or problem solving on behalf of the diverse stakeholders. However, this top-down planning has not produced satisfactory results. Today it is increasingly widely recognized that no matter how difficult it may seem, the best outcomes are achieved when all the actors are able to take part in the planning process as early on as possible. One of the significant challenges is to facilitate people to use the typical communication channel for each individual based on their personal preferences, perceptions and experiences as well as expertise. Therefore, despite the challenges, the early involvement of a group of stakeholders as comprehensive as possible, as early as possible is widely accepted in many contexts as the most desirable approach. Therefore, there is a certain need to develop techniques and procedures to alleviate the challenges such a process faces. Aalto Built Environment Laboratory (ABE) is a project that aims at developing a set of such methods and a platform to exercise the challenging interdisciplinary communication needed to facilitate a true co-creation process.

Shared working space – ABE

Initially the ABE project was set out to establish a new facility that would connect researchers and education within Aalto University by utilizing emerging immersive visualization technologies. The project was initiated in the spring of 2012 as a collaboration between the dept. of Applied Mechanics and the dept. of Real Estate, Planning and Geoinformatics at Aalto School of Engineering.

According to the initial plan, the strength of ABE would lie in a user-centric and boundary-crossing approach, which has the potential to enhance common understanding of complex research and development processes. ABE's practices and techniques would allow faculties and other actors with similar interests to overcome the limits of traditional ways of thinking and approach upcoming challenges with novel methods. The facility was also planned to be strongly linked to the interdisciplinary research topics of Human-centric living environment and Digitalization, which are important cornerstones in Aalto University's strategy.

While the starting point of the project was on the practical implementation of immersive environments for research and education use, the feasibility study soon suggested more varied interest among the actors interviewed. In their feasibility report Kauppi and Vanamo point out that "[I]nstead of immersive technologies, most interviewees expressed more interest towards developing basic

Figure 1: The ABE workspace (photo by Maria Viitanen)

tools and techniques that would facilitate collaboration, encourage exchanging of information, and improve model-based ways of working in general. Thus the original scope was extended to cover also these topics."

The early phases of ABE development have confirmed the expectation of Kauppi and Vanamo, that collaborative visualization and model-assisted decision making tools have the potential to create a lot of excitement and enthusiasm among the diverse interest groups. While modern technology and software development work are an essential tool in the process of achieving ABE's goals, the primary objective of the project is to enable and support face-to-face communication by providing the physical space, techniques, and tools. The current ABE facility consists of an 80 square meter room, which can comfortably house a group of about 25 people. The current ABE space is situated within Urban Mill, an urban planning themed co-working space, which provides additional spaces and services for ABE users.

Visual tools

In urban design, most of the work has traditionally been done with different kinds of drawings and images. The understanding of these drawings often requires a high level of field-specific knowledge, as the drawings are filled with specialized symbols, which people not familiar with the specific profession often find hard to understand and interpret. This is especially typical for people who, for instance, do not find visual perception their primary way to approach such problems but prefer, for instance, ideas presented in aural form. Therefore, new techniques not requiring drawing based spatial reasoning, such as 3D models and rendering, have been developed to ensure the understanding of the complex spatial problems of planning and design. Today the scope of visualization and number of different tools to help with it exceed the traditional design process and its imagery. Lindquist and Sibbet have made a map of the world of visualization demonstrating the wide scope of use of images and image making in

Figure 2: Map to the world of visualization (Lindquist and Sibbet, 2013)

almost everything we do in life.

The hardware framework currently used to prototype ABE techniques consists of an array of three large projection displays, which can display both 2D and stereoscopic 3D information.

The set of main displays is complemented with supporting equipment, such as cameras, microphones and secondary displays. The display system is powered by a fairly standard Windows workstation, which is equipped with a pair of professional-level display adapters providing the processing power and connections to smoothly display fairly complex 3D content on the main displays. The setup, which consists of off-the-shelf components, is fairly cost-efficient to acquire and run, and it allows for the utilization of standard Windows software, which the users are familiar with, such as Office, Prezi, and InDesign. Additionally, Unity Engine is used for the visualization of three dimensional models.

Working with many experts – finding the process

Instead of concentrating solely on outcomes, the underlying process is given an equal amount of attention. Providing the stakeholders with a detailed understanding of the process and its interconnections leads to greater opportunities to communicate and affect the project in correct time, which has the potential to make their participation more conscious and patient. So in addition to the development communication enabling tools, one of the important objectives of ABE is to develop tools to visualize complex processes.

One of the aspects that ABE helps to visualize is the process of a project. Within the ABE space the participants can create an understanding of from where they are beginning and what they are trying to achieve as well as how to get there.

The ABE facility with its new equipment has not yet been in operation for long. For a couple of months, some test workshops, presentations and lectures have been held in the space. In general, the response has been positive. The big screen has fascinated both the makers of presentations and viewers alike. “The big screen was

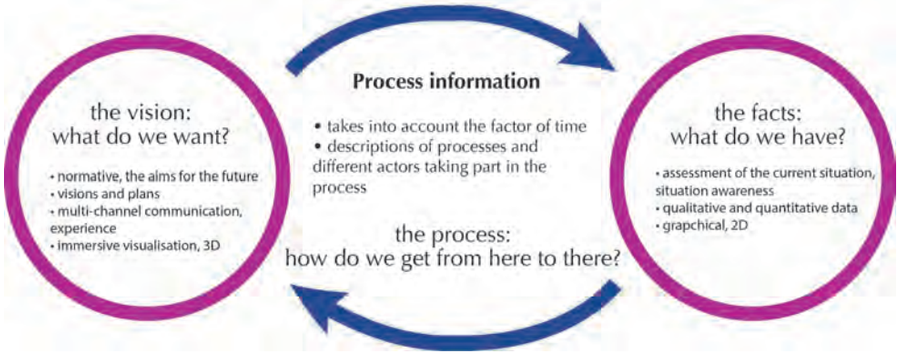

Figure 3: The iterative working process (Tähtinen, 2014)

interesting and worked well during the presentations." In some cases the navigation in the large area takes some getting used to.

We made an experiment with several researchers making an integrative presentation of their research results, which proved quite fruitful. With three screens, different researches could be presented and compared at the same time. However, as the big screen consists of three regular computer screens, making the presentation – especially as a group – can be a challenge. One cannot see properly on one's own computer what the presentation is going to look like. For this reason, when presenters want to use all the screen space available, they should have the possibility to prepare and rehearse the presentation in the ABE space before the actual presentation.

The ABE space poses new questions for performing a presentation as well. Like one viewer noted: "There is a need for a premeditated choreography for the presenter. Does one stay outside the presenting space, or does one move inside it and still manage not to blot out the presentation?" One presenter stated that he felt like the weatherman on the news waving his hands around. Someone noted that the big screen and the time needed to take it in and then move around it calms the pace of a presentation. Many noted that on this kind of a big screen also a pointer might be useful.

" ABE offers a space and technology for interactive human-centered co-creation of built environment

Concluding

The ABE space, tools and processes can enhance multi-, inter- and transdisciplinary research by responding to four different challenges. They are:

- Communication challenge in connection with developing a common language among diverse users and experts – not only communication by words but also, and especially, communication with pictures and images.
- Collaboration challenge in connection with trust building. This is facilitated with similar and democratic possibilities to visualize the processes and results. And offering a possibility for discussing and asking questions in a shared space and learning situation.
- Interpretation challenge in internal learning within the group of participants and during the process: it is important to be interested in other people and their work, however unknown the topic or discipline is.
- Dissemination challenge in providing possibilities for an external audience to learn more, too – not only discipline-based findings, but the findings that could not have been reached without collaboration between disciplines. It is important to visualize both the process and the outcome.

These challenges do not vary from the typical challenges of a multidisciplinary research project. The challenges demand time and it is important to identify the phenomena that make more complex multidisciplinary co-creation processes different from traditional narrow monodisciplinary attempts. ABE is one means to increase confidence and competences for rich co-creation processes. It orients especially to work with different fields of perception – vision and sound included – and reminds us that image and word are interlinked.

Charrette Supports Facility Development – Case Musica

Marja Naaranoja, Pekka Ketola & Olli Niemi

A Charrette involves facility users, owners, designers and, for example, a representative of the Finnish National Board of Antiquities to negotiate and plan how to renovate facilities. The result of the Charrette process is a plan that is accepted by the participants since the opinions of each participant is incorporated in the plan.

Charrette

A Charrette is a collaborative planning and negotiation process. During this process the project stakeholders, such as users and managers of the facilities, with the designers produce alternative solutions and further improve them into a concrete plan. To ensure an excellent result, different kinds of experts and viewpoints are needed, and the process should be situated at the site that is being planned. Charrettes have been used, for example, in town planning and in architectural or structural planning. A Charrette can be used in functional and spatial development in public and private organizations. During the Charrette, the users of the facilities recognize functional improvement areas and develop both strategic and practical solutions on how to support the needs with the facilities. This chapter does not cover how the voice of stakeholders is heard during the later stages of the development process.

A Charrette takes 1–4 months including preparations. The core design process takes 3–7 days. The effort is realized in 2–3 hour intensive sprints that are logically scheduled. The speedy and controlled process typically creates the feeling of flow that results in the desired objective.

The process should not be compressed to be too short. According to our experience, a Charrette can technically be realized in three days but the best results are reached during a 4–5 day process. NCI (2011) recommends a 5–7 day process.

Why is the Charrette type of method needed?

Functional and facility development requires understanding future needs so that the need to alter newly built facilities does not occur. Typically spaces are altered somehow every fifth year. A future oriented planning process enables a better understanding of forthcoming spatial requirements and reduces future alteration needs.

The benefits of a Charrette are a shared mind-set and a fast process when specifying future functions and facilities. The process uses the ideas of individuals, which generate new insights and good plans. The end result of the process is not only efficient facilities but also development, functions and vitality of the organization.

Without a co-creation process good ideas can be rejected due to the natural behavior of humans that want to avoid risks. Due to our natural resistance to change, fast thinking easily leads to a situation where the current spaces are observed good enough and the design process does not start (compare Kahneman 2012). The participants of a Charrette process are challenged to think slowly both during the intensive sprints and during the open house evaluation.

The end users of the facilities understand the functions and the future needs best. Construction professionals bring in the facts, opportunities, examples and trends of construction and design. During the Charrette the construction professional and end-users of the facilities have an equal position. This enables the shared learning process.

What is a Charrette in workplace planning?

Workplace planning often starts when the facilities do not support the current or changing requirements. A Charrette guides to use a lot of time to recognize the usage and activities in the facilities prior to the actual start of the design. The functional vision and the actual design problem will be crystallized.

The designer, end-users and other professionals co-create solutions to the design problem physically in a space. There will typically be also functional experts, like pedagogical experts and pioneers. The design problem will effect on how the Charrette is implemented. The Charrette, however, always contains a series of workshops, workgroups and active knowledge sharing between groups and in open feedback meetings.

The Charrette collects the development ideas of both end-users and construction professionals. The shared vision and design alternatives are fast shaped by using the ideas of stakeholders. It is important to solve the problems, questions and conflicts as soon as they appear. The main difference between a normal workshop and a Charrette is that ideas are fine-tuned into the plan in real time. During the Charrette it is important to integrate facilitation and design knowledge.

Case study

Musica is a building at the Jyväskylä University Campus where music is researched and learned. There was a need to change the use of the soon-to-be former restaurant spaces. The restaurant was planned to become a 24/7 living room and learning/research space for students. One of the goals was to bring music out for display in order to demonstrate what happens inside the rooms. At the moment the building does not show what happens inside. There was a need to have both electronic and acoustic music; and to enable the listening of the music of the club also outside the building.

Who will participate?

In principle, the Charrette is open to everybody. By inviting participants we ensure that the so called critical mass is reached in every stage and that there are enough knowledgeable people who can produce the needed information and plans. Activating participants is typically a critical task of the Charrette preparation.

When selecting who will participate, it is important to find the people who (1) will bring the best ideas and knowledge and who (2) will benefit most from participating in the Charrette. In different workshops different kinds of knowledge (Lennertz & Lutzenhiser 2006) and viewpoints are needed. The more diverse and enthusiastic the participant groups are, the better the plans will be.

In Musica, the Charrette participants included university personnel, researchers, professors, students, an architect, a representative of the Finnish National Board of Antiquities, a developer, a quantity surveyor, high school students and other interested parties.

Steering group

For the Charrette process, a steering group is set that defines the goal for the Charrette process and evaluates the result using the viewpoints of a cost estimate and objectives. The members of the steering group are typically the facility owner, the architect and also representatives of the users. The main role of the steering group is to specify what the goal of the Charrette is and the level of accuracy of the plan.

The role of the steering group is to guide the core team if there are important questions or surprising proposals. The steering group meets at least three times in a 1.5 hour meeting. Before the Charrette, the steering group sets the goal and accepts the process blueprints. During the second meeting the created vision and space concepts are presented. In the third meeting at the end of the process, the building plan is presented and the results evaluated.

Core team

Since there are plenty of participants it is necessary to select a core team of 4 to 6 persons who participate in all stages. The core team is responsible for the process: the practical arrangements and the flow of work. These people need to have multiple skills. The core team is responsible for collecting and sharing the knowledge received during the Charrette and linking the events together.

The original Charrette has six phases

In Northern America the original Charrette process begins with (1) a public workshop, where the vision is created. Based on this vision (2) a design team creates alternative plans, from which (3) the public meeting selects the best to be modified. After that (4) the design team further develops the plan and (5) presents it to the users. Based on the comments (6) the detailed plan is created, costs etc. are evaluated and the proposal is presented to the decision-makers (Figure 1). Feedback is thus received as widely as possible. The main principal is to be as open as possible and all the persons who are willing can participate in the planning process.

In the Learning spaces research project, Charrettes have been three to five days long. In each stage the aim has been to get 20–30 participants. The process always started with a vision workshop, where the focus was in the future activities at the university in 20 years. When the vision was clear, the workshop focused on developing alternative concepts that supported the future activities. Using the concepts, the plans were developed, and the plans were tested with either mock-ups or scale models. The last stage was the refining of the plan and decision-making related to the planning.

The Charrette emphasizes the importance of transparency, interaction and negotiation. Transparency and active collaboration

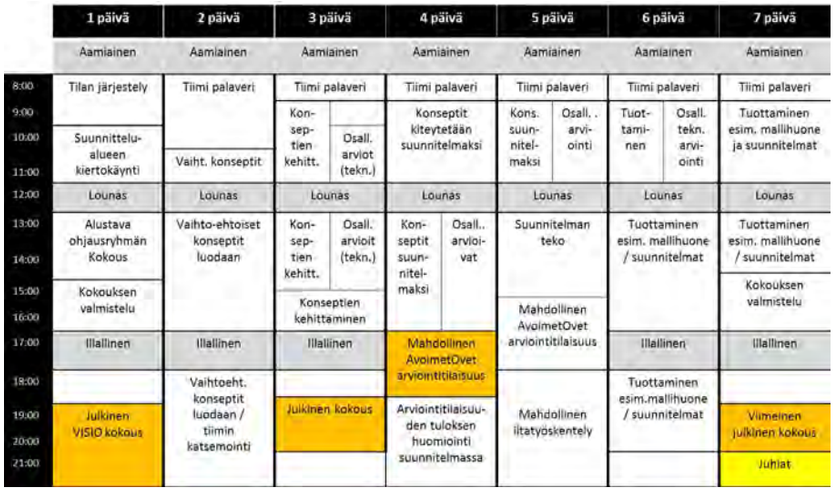

Figure 1. The Charrette process (NCI 2008)

make it possible to create the conditions for rapid ideation; to approve the plans extensively; and to minimize the number of possible protests in the future. In order to ensure the mentioned benefits, Open House events can be organized during the process. During the Open House the plans are presented and feedback collected.

Vision statement describes the pursued future achievement

The vision workshop aims at producing a vision statement of activities, and specifying what it will be like to work at the organization when the vision is realized, what the supreme possibilities of the organization are. The workshop, thus, foresees the future.

The vision workshop starts with short presentations, where the goals of the Charrette and possibilities of the facility development are presented. After that the groups use methods to create future scenarios and what kind of a future they would like to have. The groups present the results of their work (Figure 2). By using the future studies of the groups, the core team creates a description of the vision.

Spatial concepts are created and tested by using the vision

Conceptualization means processing scenarios and ideas to design proposals. In the conceptual workshop it would be helpful to have a number of designers to visualize the thoughts and suggestions. During this stage work happens mainly in groups.

During the first stage of conceptualization, the vision is further developed into activity concepts (Figure 3). For example, how collaborative digital technology is used in studying folk music. Based on the concepts the technical requirements of the spaces can be specified.

During the second stage of conceptualization, the concepts are visualized into concrete plans and space models, for example by using floor plans, scale models or hand drawn renderings. Space models illustrate how the space will look like, furniture, and describe what happens in the space. Constructing the model together forces the participants to describe and integrate the ideas of participants into the space model.

Modeled concepts of the Musica workshop were, for example, the open learning space, the café, the stage for acoustic music presentation, and the showroom of music research.

At the end of the conceptualization, experts evaluate the plans. Five to eight persons were invited as experts. The aim is to get as wide an evaluation as possible in order to get information for decision-makers. The selected persons should not have taken part in the workshops earlier; with the aim that they would be able to give neutral, objective critique. The evaluation method is heuristic. The experience of the experts is used in order to find the problem areas of the plans both from the production and use point of views.

Figure 2. After the presentation the groups start to work in the vision workshop

Figure 3. Group work during the conceptualization

Decision making ends the Charrette

The results of the Charrette are rapidly further developed, typically during the night, to support the decision-making. Details are planned and design decisions are made during the last day of the process. The participants of the decision-making group are, inter alia, the architect, representatives of the owner and users, the developer and the quantity surveyor. The group specifies the concrete guidelines for the renovation and how the planning will continue after the Charrette. Decision-making refers to concrete planning decisions and the selections that are made in the fast phase. During this stage also the cost estimate is checked. Immediately after the decisions the architect produces the first version of the plan.

Figure 4. The results are modeled, for example, by using modeling clay

Evaluation of the results as broadly as possible

The collaborative process needs to continue for as long as possible. Feedback to the plan is needed as widely as possible in order to give as much information as possible to the next stage planners and decision-makers.

At the end of the Charrette, an open house event can be organized. To it, as broad an audience as possible is invited, for example future users and VIP quests, who can evaluate and comment the produced plans and proposals.

The evaluation can be done by using the mock-ups. During the Musica Charrette, the plans were made concrete by constructing fast by using creative solution mock-ups i.e. demo spaces. There were, for example, a stage, uplifted floors, marked areas on the floors and walls. The spaces were made lively by student music presentations and other demos that demonstrated the new ways to use the space.

The characteristics of a Charrette are speed and intensive workshops

A Charrette is a fast and intensive working method. Theoretically the creative process has the following stages (1) preparation, (2) problem definition, (3) alternative solutions creation, and (5) selection using the alternatives (compare Koski et. al 2014). These stages were realized well in the pilot projects and after the process the participants were happy with the results.

During the process some participants kept contact with their peers via social media, which enabled the participation of the background groups if needed. The open planning process also made it possible that anyone could participate in the workshop all the time. Planning sprints often contain the stages: ideation, conceptualization, presentation and connecting the ideas into a whole. In the process each stage contains the possibility to criticize the last when the results are presented at the end. In addition, there is the possibility to evaluate the integrated result of the workshops in the open house event.

The sources of the open criticism have to give their opinions rapidly since there is not a lot of time reserved for these events. In the open house the participants test whether they can use slow thinking rapidly. The aim is to solve conflicts as soon as they appear in order to be able to support a smooth planning process.

Why does a Charrette function?

A Charrette is effective since it links local tacit and explicit knowledge –concerns and values – with outside expertise. A Charrette forms an enriching community that looks for relevant questions and develops solutions. A Charrette is simply a process that helps the community to find a workable solution.

Participants of a Charrette form an expert group that learns from one another and thus creates better results than individuals would. The process challenges to participate in a creative process and to learn together from previous mistakes. Learning new viewpoints empowers the experts to do things differently than normally. This inspires the architect and other participants to find novel solutions. A Charrette guides to use time effectively. When participants understand the limited time resource and the complexity of the challenge they want to express their viewpoints clearly.

Only some participants are able to participate continuously to the 3–7 day workshop. The process has been designed so that one can participate in 2–3 hour shares. Most of the participants in addition to the core team, however, participate in 1–2 days. This enables a smooth continuation of the functions though people may change. The core team works 16–20 hours every day, ensuring that the results of the day's workshop are ready to be further developed the next morning. The Charrette process creates both valuable and seemingly so called invaluable data. All data is written down so that it can be later utilized. Architects who have participated in pilot Charrettes have enjoyed the effectiveness of the Charrette. Charrette facilitators help to formulate the problem carefully and guide to divide it into sub-problems. Ideas evolve when contrary-minded people discuss.

The Charrette process purposefully pursues to reach the experience of "flow" through:

- Goals that are clear and harmonic and knowledge of the next steps
- Immediate feedback
- The challenge and skills are harmonized
- Disturbing facts are left outside
- Acceptance of failing
- Accepting different kind of thinking
- Working intensively so that time consciousness disappears
- The motivation comes from individuals, there is no need to motivate

When flow is reached, the situation is maintained by taking care of blood sugar levels e.g. by eating, drinking and also by giving a good rhythm for working. It is not necessary to ask participants to switch off their phone or computer, since everybody understands what the process requires. A Charrette functions also in an open environment, which is essential when planning open/public environments in their real context (compare Design Charrette 2011).

Does a Charrette work?

According to the participating professionals, the process resulted in good thoughts: things fell into the right places, going outside comfort zones and surprises helped to produce new results, expectations were exceeded, the change was well received, and a good result was reached.

Architects commented that the Charrette inspires and generates creative novel ideas for planning. End-users were delighted that their thoughts and ideas were visible in the plans as soon as they were expressed and they could see how they affected the plans. The co-creation process was often a surprising and positive experience, and participants wanted to use it also in other projects.

During the later stages of a construction project, it is important to ensure that the voice of the end-users is heard. Later, there will often appear needs to cut down costs by excluding some features. Pruning should be done by co-creating the cost reduction solution so that the perspectives of activities and priorities of end-users would not be forgotten. Typically, as the project progresses, the end users continue to learn about the possibilities and want to be involved when the changes are decided on.

Conclusions

A Charrette provides a powerful tool for planning new activities, environments and/or facilities. The method challenges traditional design methods. The Charrette has been tested in Musica, as well as in several other projects. The tests showed that the Charrette accelerates the planning and improves the quality of design.

To utilize the Charrette, the developers of facilities have to be brave enough to try the new method and study how it functions. There are numerous documented case studies of Charrettes. It is necessary to collect and process the knowledge related to the Charrette and organize training on the subject in different fora. Though the Charrette method is well-known, professional designers and educators have remarkably little knowledge about it.

The pilots have demonstrated that there is need for Charrettes of various lengths. A Charrette is often perceived as too demanding. Charrette consultants must therefore be able to choose a suitable process for the situation including the length. A major development area is to tailor the Charrette process according to the Finnish working and construction culture.

This case study did not yet study how the Charrette effects the later stages of facility development. The researchers are challenged to investigate the effects of Charrettes in the later stages of the construction process and to create co-creation methods also for the post briefing stage. In addition, it is necessary to compare how the so-called normal and the Charrette process affects facilities development and the operations in facilities; as well as how a Charrette changes the role and work of construction professionals – especially how the role and work of the architect is changed.

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Charrette enables mutual learning

Co-designing learning spaces: Why, with whom, and how?

Tiina Mäkelä, Anette Lundström & Inka Mikkonen

Participatory co-design (i.e., collaborative design) of learning spaces is expected to impact positively 1) the design, 2) organizational culture, and 3) ways of teaching and learning. At best, the co-design process fosters an educational organization's learner and learning-centeredness by involving the largest user group, the students, in the design without marginalizing other important stakeholders such as teachers. This is often, however, easier said than done. In this chapter, we will first describe why, with whom, and how learning spaces were co-designed at the University of Jyväskylä Teacher Training School. We also present some challenges faced during the project and how they were overcome. This is followed by a summary of the perceived benefits of the participatory design.

Why was the co-design project implemented?

Increased understanding of the complex interrelations between the physical environment, student engagement, emotions, wellbeing, attendance, and learning outcomes has drawn attention to contemporary educational premises. Learning spaces are expected to foster learner-centered knowledge construction and lifelong and life wide learning of so-called 21st century skills (i.e., creativity, critical thinking, problem-solving, decision-making, learning to learn, communication, collaboration, ICT, information literacy, citizenship, life and career, and personal and social responsibility). The desire for lifelong learning is wished to be supported by surroundings nurturing engagement, positive emotions, and wellbeing. Further, increased use of mobile devices and collaborative learning calls for exploring novel space solutions. Hallways, corridors and even school yards are now seen as potential learning spaces when (re)designing educational sites.

In the Finnish educational system, teacher training schools (comprehensive and upper secondary schools where student teachers carry out their teaching practice) are important parts of universities organizing teacher education. It is at these schools, where innovative pedagogical ideas are both developed and put into practice in close collaboration with the faculty of education and other educational research groups. Student teachers' flexibility and adaptability can also be viewed as an enabler for change both within these schools, and after their graduation, throughout the country wherever they end up teaching. For this reason, it is of great importance, that the teacher training schools' physical, virtual, social, and personal learning spaces reflect the state-of-the-art educational views.

This in mind, the University of Jyväskylä (Agora Center) and the University of Jyväskylä Teacher Training School proposed a demo case for the Indoor Environment Program in spring 2012. The aim was to re-design a Natural Science classroom and its closely connected hallway. Lessons learned during the demo were then to be used when designing larger changes both within the school and elsewhere. The most important objectives of the demo were

- to convert the Natural Science classroom and hallway into an inspiring, stimulating, and comfortable technology-enhanced space that allow diversified 21st century learning, and
- to connect formal phenomenon-based natural science learning to informal learning, thus creating possibilities for continuous learning processes that are independent of space and time.

The contemporary educational ideas of ubiquitous learning and going beyond the classroom matched perfectly with the more practical objective, namely, the need to augment the usability and utilization of the large but underused hallway next to the Natural Science classroom. The hallway was thus seen as a chance to expand the learning space outside the four walls for teamwork and also for self-motivated and self-regulated learning.

Participatory co-design – understood here in a very broad sense as collaborative design efforts between various internal and external stakeholders – was chosen as the main approach for this project due to its expected positive effects on 1) the design, 2) organizational culture, and 3) ways of teaching and learning. As an example of the first benefit type, involving actual users in the design process augments the understanding of users' precise needs and wishes and can thereby improve both the desirability and adequacy of the design. With regards to organizational benefits, participatory design is likely to promote a democratic organizational culture. And third, co-design can be used to foster novel ways of teaching and learning: This collaborative project per se can be seen as an engaging real-world learning experience in which participants practice the aforementioned 21st century skills. Further, increased ownership and dominance of co-designed solutions can lead to their more efficient use, and thus support, obtaining better learning outcomes.

With whom and how was the co-design process carried out?

This participatory co-design project was co-coordinated by the University of Jyväskylä (Agora Center) and the University of Jyväskylä Teacher Training School, and supported by the University Properties of Finland Ltd. The project brought together various internal (school administration, teachers, student teachers, and students) and external (researchers, constructor, designers, companies, etc.) stakeholders, all experts in their experience. In the spirit of contemporary learner and learning-centered views, we gave students a key role as designers of their own learning and learning environments. In addition to student participation, teachers and student teachers were offered plenty of opportunities to influence the design as other important internal stakeholders of this school. Figure 1 illustrates the iterative development of the project. In the following paragraphs, we will describe each phase in more detail.

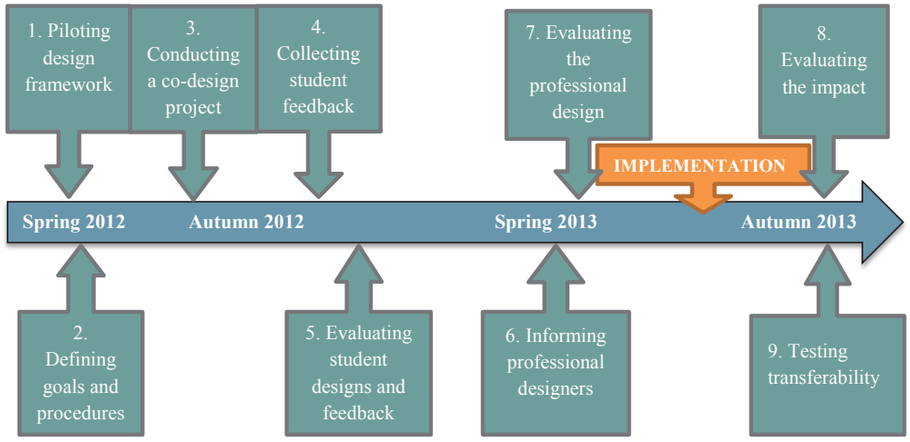

Figure 1. The iterative development of the project.

1. *Piloting design framework (spring–early autumn 2012):* We first piloted the preliminary design framework in a co-design project with four student groups. The students' perceptions about good learning environments were collected by means of design workshops consisting of

- a web questionnaire (sensitizing and introductory activity)
- scale model construction group work (generative activity), and
- group discussions (reflecting activity).

These pilots gave an initial understanding of the content and method-related issues to be considered in the actual co-design project.

2. Defining concrete goals and procedures (spring–early autumn 2012): The research objectives were then aligned with the school's specific vision, mission, and concrete developmental goals. After agreeing that reforms would take place in the premises mostly utilized by upper secondary school students, we started recruiting these students to the co-design project. As it seemed difficult to get enough students involved in the co-design as an extra-curricular activity, it was agreed that students who were about to take the visual art course Environment, Place and Space (n = 29) could study the course either in the traditional way or as a co-design project course (38 h) led by researchers. After employing the previously piloted web questionnaire on learners' perceptions of a good learning environment to the whole student group as a sensitizing activity, 11 students chose to join the co-design project.

3. Conducting a co-design project course (38 h, autumn term 2012): Some of the first sensitizing and introductory activities at the project course were:

- using inspirational images to discuss the ideal learning spaces, and
- taking photos of spaces that were intended to be improved (see Figure 2, Before).

After these activities students explored the topic and created shared understanding (immersion activities) for example by

- visiting and interviewing stakeholders in recently rede signed nearby schools
- visiting a furniture store and discussing with an interior designer,

- searching information through the Internet, and
- using a blog for sharing information and co-creating new ideas (see http://2012ideafactory.blogspot.com.es/2012/09/blogimme-our-blog.html).

As a result of generative activities chosen for the co-design project, the students created four space designs consisting of 3D-models, and color, furniture and technology plans (Figure 2, Student designs.)

4. Collecting written student feedback (end of the year 2012): The project course culminated in an exhibition, in which other upper secondary school students had an opportunity to vote for their favorite design and express their opinions in a written format. Students (n = 175) visited the exhibition with their teachers during their weekly tutorial.

5. Evaluating student designs and feedback (beginning of the year 2013): Student designs and summarized student suggestions were then presented to teachers and student teachers, who, first, evaluated the students' ideas and subsequently gave their own suggestions in a co-design session. The co-design session took place during teachers' weekly meeting. Student teachers were also invited to participate in the project by writing their Master's theses as a part of the research project.

6. Informing the professional designers (spring 2013): Subsequently, suggestions from both students and other learning community members were analyzed, summarized and communicated to the professional designers chosen to be in charge of the final design.

7. Evaluating the professional design (spring 2012): Finally, before implementing the changes, participants had the opportunity to familiarize with the final design in order to evaluate the design from their perspective. After some final revisions, the reforms were initiated in summer 2013. Alterations to the space were completed during the first months of the autumn term 2013 (see Figure 2, After).

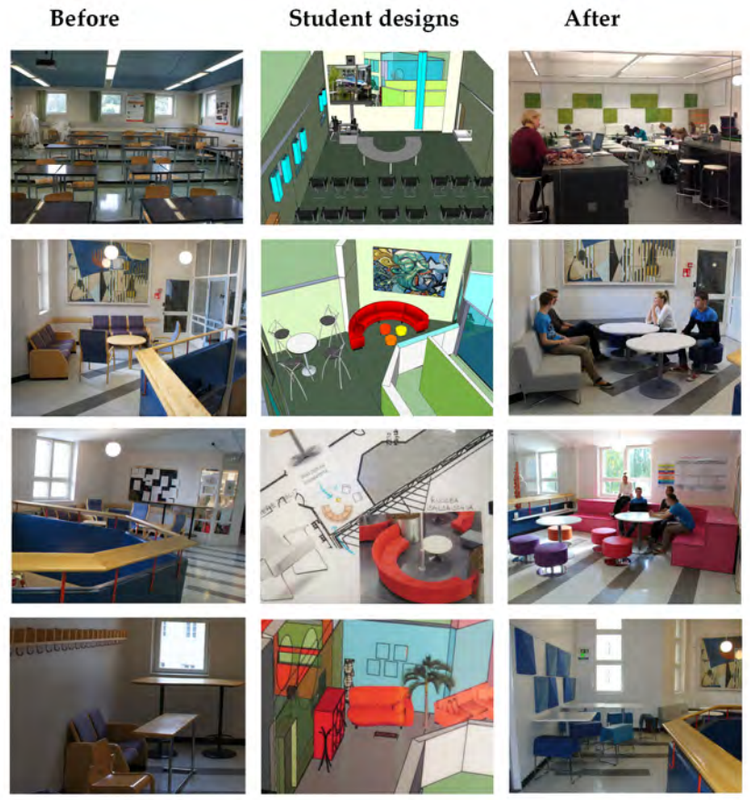

Figure 2. Comparison of spaces before, student designs and spaces after the project.

8. Evaluating impacts (starting from autumn 2013): During the co-design process there was constant informal self-evaluation, internal peer-to-peer evaluation and feedback from the external experts. The actual, still on-going, impact evaluation of participatory co-design and new space solutions consists of (a) a video analysis and observations for finding out the actual use of the reformed spaces, and (b) a student satisfaction survey (a web questionnaire) for upper secondary school students using these spaces. In the survey, we asked students, for example,

- to rate from 1 to 10 the renewed classroom space/hallway.
- if they felt their perceptions and wishes had been considered in the redesign (why/why not), and
- if they thought the redesign had influenced teachers' ways of working (why/why not).

In addition to internal evaluations, representatives of the European network KeyCoNet interested in initiatives supporting acquiring key competences for lifelong learning visited the spaces and interviewed and video-recorded various stakeholders (see http://keyconet.eun.org/finland-video)

9. Testing transferability: In the future, we wish to be able to replicate the process in other contexts both in Finland and abroad in order to test the transferability of our results. Pilot co-design workshops have already been conducted with one school in Spain in late autumn 2012.

Although the project progressed well from phase to phase, we also faced many typical constraints and challenges related to participatory co-design. They are summarized in Table 1 together with short descriptions of how they were overcome.

Constraint	Challenge	How we overcame it
1. Time	Difficult to obtain and summarize data in a limited time	Combining rich data gathering and analysis (e.g., interviews, visual data) with quick methods (e.g., ratings, checklists).
2. Money	Elevated cost of structural changes, furniture and technology	Implementing designed changes in phases starting from the most relevant and wished aspects.
3. Partnerships	Challenging to work in a multidisciplinary and -party team	Defining each partner's role clearly and maintaining frequent, open and democratic discussions.
4. Involvement	Extra-activities felt as an additional burden	Integrating co-design session in the participants' everyday routines (e.g., studies, tutorials, weekly meetings).
5. Expectations	Participants do not feel that their wishes have been considered	Assuring that some of each user-groups' ideas are really implemented, and also communicating it well.
6. Resistance	End-users feel former design and ways of doing things were better	Providing support during the implementation and giving changes time - choose evolution instead of revolution.

Table 1. Types of constraints and challenges faced and how they were overcome.

What did we achieve with the co-design?

Initial results of our still on-going impact evaluation indicate that involving various stakeholders, especially students, in the co-design has had a positive influence on 1) the design, 2) organizational culture, and 3) ways of teaching and learning. First, some of the indicators of the improved design are

- relatively high average ratings in the student satisfaction survey (n = 83, Figure 3) and
- clearly increased use of the hallway during both classes and breaks.

End-user participation also helped in avoiding implementing overly radical changes. As a result, teaching and learning in the renovated spaces is still a fluent combination of teacher-led activities with a chalkboard, paper and pen combined with self-regulated collaborative activities with an interactive whiteboard, tablets and other devices. Student participation was crucial particularly in designing spaces fostering overall wellbeing and good general conditions for learning. Teachers' participation, in turn, was seen as fundamental especially for gaining detailed pedagogical and subject-related knowledge. Teachers also further developed some of the students' ideas (e.g., using color changing lamps for teaching the color theory). Further, one student teacher contributed to the design by conducting a study on the use of ICT in teaching Natural Sciences.

Second, in respect to the benefits of the co-design for organizational culture, it seems that participatory design and decision-making processes have led to less resistance to change. Not everyone, however, was pleased with the changes such as removing the platform of the floor (see Figure 2, Before) as it worsened the teacher's visibility. Nevertheless, despite some critical views and a great number of students who did not have a clear opinion, in the student satisfaction survey, 43% of the responders perceived that students were considered in the design (Figure 4), indicating that the student involvement was not generally viewed as pseudo-consultation but as an authentic co-design. Naturally, the more one participated, the more conscious he or she became of the whole process, of various perspectives, and of the need for seeking compromises. Moreover, as evidence of the increased participatory culture, we have witnessed how the co-design project has

Co-designing learning spaces with their users improved the design, promoted participatory organizational culture, and fostered novel ways of teaching and learning.

inspired other similar projects within the school such, as redesigning the language studio, a project initiated by the language teachers.

Third, with regards to the impact on ways of teaching and learning, the co-design project itself was an opportunity to practice 21st century skills such as creativity, collaboration, and citizenship. The initial results from the video analysis and the student satisfaction survey indicate that we succeeded in co-designing

- more inspiring, stimulating, and comfortable, technology-enhanced spaces that allow diversified 21st century learning and particularly collaborative work (see also Figure 6), and
- flexible infrastructure and furniture solutions which encourage users to search new ways of working, and to extend their teaching and learning outside the classroom, both to the hallway and beyond.

For example, in the student satisfaction survey, 41% of the students felt that the changes had influenced the teachers' ways of working (Figure 5). Some participant students expressed, however, that the teachers would need more support in order to know how to best use the new premises and technologies. One interviewed teacher reported that especially student teachers had already innovated many novel ideas of how to use the new spaces in teaching. Time is needed, however, both for profound changes to take place but also in order to see, whether current changes observed reflect only a short-term wow-effect or a sustainable change.

> …teachers should be trained in how to take advantage of the new spaces so as to get all resources in use. (17 year old girl)

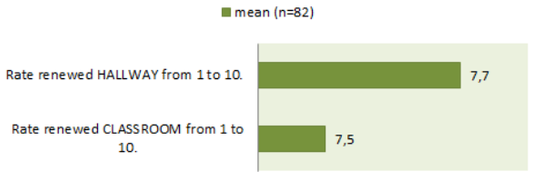

Figure 3: Student satisfaction survey: general ratings.

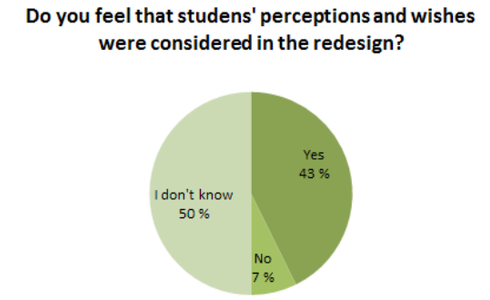

Figure 4: Student satisfaction survey: students' perceptions on if they were considered in the design

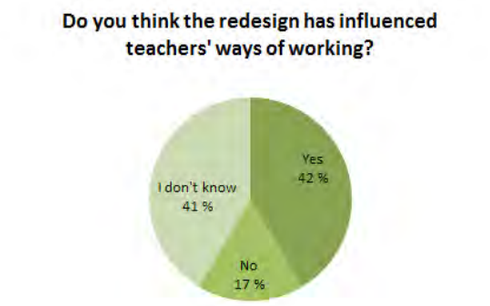

Figure 5: Student satisfaction survey: students' perceptions on changes in teachers' ways of working

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> **Easier to do group work on bigger tables and there is more technology. (17 year old boy)**

Figure 6. Panoramic image of the renewed classroom.

4 A campus for **versatile learning**

The fourth section examines the challenges that formal and informal learning present for learning environments. In addition to learning experiences, also technology-enhanced, we take a look at joint use of laboratory spaces, and experiences of co-operation spaces in lobbies and a multi-use restaurant.

Promoting **meaningful learning**

Kirsi Lonka, Lauri Vaara & Niclas Sandström

What are the possibilities and challenges for developing new kinds of learning spaces that promote meaningful learning and knowledge co-creation? Modern theories of learning should form the basis for integrating physical, virtual, social, mental and embedded learning environments. It is time for profound changes in designing schools and universities, due to the advancements in society, social media, knowledge practices, technologies and demands of the working life. The present paper introduces prospects for designing future learning environments especially in higher education.

Design change in education: shift from knowledge transmission to knowledge creation

In Finland, student activating and inquiry-based methods have become increasingly popular since the 1990s. It has been widely realized that these engaging and wide-ranging methods respond better to the demands of the complex and knowledge-intensive reality of today's working life by promoting collaborative problem solving, conceptual change and creative knowledge creation. For instance, the newest national curriculum for pre-primary and basic education in Finland (OPH, 2016) strongly highlights the importance of this kind of methods together with the application of 21st century skills. Furthermore, several studies indicate the positive relation of these methods to learning outcomes and school engagement when compared to more traditional teacher-centered learning processes. However, while such a socio-constructivist approach to learning and knowledge has become dominant in educational research and instructional practices, the current pedagogies in education still rely very much on teacher-centered methods where students have a passive role and the learning process is more passive and reproductive than constructive and collaborative.

In progressive inquiry-based learning, the subject of active learning is more familiar to an individual, team or community, that actively evaluates its own knowledge, carries out investigations and then assesses the results of such collaborative knowledge building as the premise of the following measures. However, an integrative model of innovative learning and instruction (Lonka, 2012; Lonka & Ahola, 1995) was developed in the context of higher education to foster the application of activating and inquiry-based learning in various fields of education. The activities embedded in this model of engaging learning characterize equally well the activities of teachers, students, professionals and researchers:

1. Diagnosing current knowledge and activating a meaningful context to guide and direct learning.
2. Going through and facilitating various inquiries in which new knowledge and understanding are produced.
3. Assessing learning gains and knowledge produced so as to engage the participants in a deepening learning and inquiry cycle.

The learning activities proceed in cycles and implicate that an engaging learning process includes multiple phases and activities that benefit from different kinds of tools and surroundings: flexible and multi-use learning spaces have the best potential to promote these kinds of approaches to learning. It has also been studied how students experience various learning environments from the perspective of learning. For instance, students experience high challenge with high competence in small group activities, which suggests that those situations are more likely to generate a flow experience and prevent apathy than traditional lectures (Muukkonen et al., 2008). Learning outcomes, on the other hand, are related to group functioning and dynamics in problem-based learning. It is thus not only the approach to learning but also the quality of the learning experience that relates to the potential to experience flow and engagement. It is also essential where the learning takes place. Overall, we found a significant effect for the space of learning.

If we study the phases of an engaging learning process from the perspective of school design, the following conclusions can be made: engaging learning is an active learning process which includes several activities that benefit from and are supported by different tools and learning environments. The physical elements should foster not only the different activities but also the transition from one activity to another. To achieve this, the physical environment should have varied spaces for different kinds of activities from individual to group work and from silent to more collaborative co-creative activities. The multi-use spaces should be organized and structured so that they do not interrupt the engaging learning process but instead, support and foster the process and form a solution that is usable and affording. This requires that the physical learning environment with its variously fixed spaces forms an innovative entirety which covers the whole engaging learning process without interrupting notably the learning process.

Design usability for 21st century learners: towards socio-digitality and blended learning environments

Student learning and intellectual efforts take place in the dynamic interplay between the learner and the learning environment. In the learning environment, learner activities are increasingly mediated by different technological tools and applications that are used to develop and manipulate artifacts that are co-created in the process. Currently, due to the rapid technological development, socio-digital technologies and social media mediate our forms of collaboration and learning. Furthermore, the new technology-mediated blended learning environments allow the generalization and refining of the knowledge practices that foster also the different activities and phases of an engaging learning process. Technology, in particular, co-evolves rapidly with novel learning practices. Learning becomes increasingly blended, which means that face-to-face instruction is often combined and improved with appropriate ICT-based elements, for example applications and software that foster collaboration, visualize the knowledge creation and its results and enable effective transmission and dissemination of the results. So, instead of talking about "learning environments" or "technological tools", we should rather talk about knowledge building environments (KBE) that enhance collaborative efforts to create and continually improve ideas.

However, more innovative effort is needed to integrate architectural and pedagogical designs with the new technological tools. For instance, the interaction-promoting technological applications, such as Flinga®, have had fundamental effects on how teacher students collaborate and organize their collaborative, co-creative learning sessions. Even when we are not using such aids ourselves, they inevitably change the ways of communication in the society. For example, many societal movements and revolutions have spread and been reinforced by Twitter. The societal and cultural changes are reflected also in the practices of institutional and organizational learning. As an example, the introduction of MOOCS (Massive Open Online Courses) now challenges many century-old practices of universities. Even though the effect of MOOCs may be temporary in nature, we know for sure that new candidates shall emerge to challenge our current institutional practices.

The change described above would not be taking place without the generation of young people, who were quite literally born and grew up with the rapid technological advancement. These "digital natives" were born after the 1980s and the use of the new socio-digital devices is surprisingly natural for them (Hakkarainen et al., 2015; Prensky, 2001). The concept of "digital native" is still a somewhat controversial idea, and more evidence is needed. For instance, it seems that there are remarkable differences between youngsters when it comes to using digital technology. Regardless, at least we can say that the knowledge practices of young people have drastically changed during the last decade, whereas educational practices have largely remained the same: most schools continue to apply the paper-and-pencil culture in spite of new technologies. The new generation has from the beginning of their lives been intellectually socialized to use various digital tools and communications applications, and conforming to a passive role as a listener and receiver of information is for many of them quite disengaging. We propose that the new generation of these digital natives requires more engaging, experiential and creative learning methods, including games, simulations, social media, knowledge-creation projects etc. Most future teachers are also part of this new generation, and they should learn how to help their own students to become life-long learners by using current and meaningful learning methods and sophisticated personal and collaborative learning tools.

Modern learners are not the same that the schooling system was originally developed to educate. However, there is no reason to assume that new technologies would automatically have a beneficial impact on learning and development. Without the support provided by parents and pedagogical support and vision from teachers, students may not achieve advanced skills and practices of using new technological tools. Although social media provides a strong sense of belonging to a community, it may also elicit self-presentation, virtual bullying, and exclusion of those without socially desirable characteristics. Because of this, new social practices and "netiquettes" are needed to integrate the digital possibilities into education in a pedagogical and wise way. In this it is obvious that teachers have a very significant role.

Design engagement: promoting agency and meaning to foster life-long learning

To promote life-long learning in any stage of education we need to foster the epistemic agency of learners. Epistemic agency means the amount of experienced and perceived control of the whole process of being able to deal with knowledge, of learning due to collaborative effort, of taking collective responsibility of shared goals that have been set in a co-creative fashion, and eventually also of evaluating the results. It is a broader view to knowledge advancement than a mere individual perspective (Scardamalia, 2002). Epistemic agency is promoted when students engage in multidisciplinary projects that are personally meaningful to them. It transfers the need of externalizing goals, evaluation and planning to the teacher (or to the manager in other organizations). Instead, the students take individual and collective responsibility of the essential dimensions of learning. When epistemic agency is promoted, learning becomes something more than studying for credit units and is personally more meaningful and engaging. In their joint effort and collaborative knowledge building, the students are increasingly using new technologies as learning aids, and they communicate more intensively with the surrounding community, which may eventually bring about changes in the real world.

Such a joint process is not only intellectually, but also emotionally challenging even for e.g. highly selected groups of teacher students. Student-activating and engaging learning methods are not only intellectually stimulating, but also emotionally and motivationally engaging. It is important to motivate the learners, and make them active agents of their own learning. It is very important to trigger situational interest, maintain it, and help students to turn it into personal interest. Self-regulatory skills are also essential building blocks for life-long learning. Motivational factors are essential in terms of successful studies in higher education. Self-directed students who had the best academic results and who did not suffer from emotional exhaustion, experience a positive, fulfilling state of mind, referred to as "study engagement". Study engagement means vigor, dedication, and absorption in the studies and comes close to the concept of "flow" (Csíkszentmihályi, 1988). The universal precondition for flow is the reasonably high challenge of the task as well as the feeling of competence. If the challenge is high, and the feeling of competence is high, there is a possibility of experiencing flow. In contrast, if the challenge is high, but the person feels inadequate, this results in anxiety. A low level of challenge combined with a higher sense of competence results in boredom or relaxation. Apathy indicates that both competency and challenge are perceived to be low. This fluctuation in the challenge–competence experiences is decisive in whether a learner experiences flow or not, and the pedagogical context should be designed so that the extremes of challenge and apathy can be avoided as often as possible.

We have also developed new contextual ways of measuring flow and academic emotions related to it. For instance, we have measured academic emotions, interest, sense of competence and challenge using the Contextually Activated Sampling System (CASS) method (Muukkonen et al., 2008; Inkinen et al., 2014), which has proven to be a valuable tool for contextual data collection. With CASS, it is possible to follow the daily dynamics of emotions and motivation and how they fluctuate in people's daily activities and the spaces they find themselves in. This innovation helps to trace real-time learning activities and motivational states by frequent sampling during periods of intensive follow-up. It also makes it possible to take pictures of or videotape the current learning environment. This gives valuable insight on how people perceive their physical environment in different contexts. With the information provided by CASS we are able to design multi-use and learning environments that promote engagement and meaning for different types of learners. One critical question would be how to create a link between the more formal learning environments in schools and the informal and non-formal learning environments that the learners are engaged in in their free time. There should be more room and possibilities for learners' interests and subjects of passion to flourish. Perhaps it could be possible to design an oasis of informal learning in the middle of formal learning facilities to counterbalance the hectic routines of formal learning. This oasis could then consist of elements and features that are typical for the learners' non-formal learning environments.

Design transferability: implement the best practices created in a research-based living lab

All the changes described above pose challenges to how the physical environment can adapt to the evolving needs of modern users. Our latest research projects are especially focused in designing universities, where teachers, researchers, and students work and study. In the RYM Indoor Environment project, a general aim has been to develop an aligned national pedagogical model for designing physical and virtual learning environments that elicit in-depth learning through student-activating and inquiry-based collaborative practices in contexts of blended learning. Furthermore, the project aims at developing learning environments by augmenting various university spaces such as lecture halls, seminar rooms and laboratory spaces with sophisticated technology-mediated tools (e.g., interactive white boards, wireless mobile devices, and systems for managing and monitoring learning). These tools will be tailored and customized according to the most advanced student-activating and inquiry-based pedagogical methods. The aim is to elicit deepening and engaging personal and collaborative learning and understanding of complex phenomena that are meaningful to the learners. An integrated and holistic approach on developing the spaces for learning and knowledge building makes the project unique.

The World Design Capital Helsinki 2012 (WDC2012) project Engaging Learning Environments (ELE) in teacher education (PI Kirsti Lonka) was a Living Lab of the RYM Indoor Environment project. Its goal was to create integrated learning environments for the future. This Living Lab is called Minerva Plaza and it includes a variety of spaces and services, contact teaching and digital tools, as well as Internet and mobile-based working and learning platforms dovetailing together. Minerva is designed to promote and engage learning along the pedagogy of ELE (Lonka, 2012, Sandström et al., 2015). The seamless fusion of pedagogic and psychological know-how and technology that support active learning and inclusive methodology is important. The ELE Living Lab is designed to trigger and innovate new socio-digital knowledge practices that are in constant dialogue with current pedagogical solutions. (http://blogs.helsinki.fi/wdc-2012/oppimisen-uudet-tilat-eng/). The aim is that we would no longer need to activate anybody, but that all students and academics would learn to enjoy learning and create new knowledge throughout their careers. RYM and Minerva aim at changing university environments into spaces where people collaboratively create new knowledge, new practices, and new innovations. The spaces should become places for the users. When users experience the spaces as places, they want to gather in the facilities and make use of the possibilities that the indoor environments have to offer.

The basic idea behind the activities on Minerva Plaza is to create new technology-mediated, research based pedagogical scripts and knowledge practices to improve and update especially education at universities. The solutions that are being developed are obviously meant to be scalable to basic education, as well. Lately, we have created new solutions to transfer the best practices developed at Minerva Plaza into other, not so well-equipped learning environments. This is possible with the latest mobile socio-digital technology and advanced insight on blended learning, which highlights the importance of natural face-to-face interaction instead of clumpy, heavy and unsubstantiated use of ICT: digital technology is oppressed mainly to foster communication and knowledge management of the group. At the same time, the use of own devices (BYOD) is encouraged to enable the use of individual digital tools. This approach makes a less ICT-heavy environment possible, since we don't have to offer every student an individual digital device, while the focus is on promoting collaboration and learning mediated by the best and most appropriate potential of digital technology. Technology should be seen as fire: essential for the advancement of humankind, a good servant but a bad master.

> **Modern learners are not the same that the schooling system was originally developed to educate.**

Conclusion

After the Finnish university reforms in 2011, the universities became the owners of their own material goods and facilities that were previously owned by the state. As a result, real estate now forms a considerable part of the property of Finnish universities. At the same time, the facilities and buildings remain the main places for learning and knowledge creation for the time being. Optimizing and tailoring the facilities according to users' needs is crucial. Investments in renovations and building projects must be based on the owner's and users' needs. For instance, in designing libraries, it is now more important than ever that we observe users' practices and ways of using the premises; it is as important to be observant of the future developments of the users' practices. It is time to keep the human user perspective in the center to eventually design spaces and facilities where the investment meets the true needs of the users and where the result – be it library, school or university – is actually useful and practical.

Facilitating the development of skills and competencies required in the future, puts pressure on the design of environments for teacher education alike. Today's knowledge-intensive society requires new skills from all stakeholders, and for instance teacher education should be designed so that it promotes active participation in knowledge building and collaborative learning – skills highlighted as quintessential for the learners of the 3rd millennium. The design principles that are tested in relation to developing and creating also new kinds of physical spaces with embedded collaborative technologies should be more intensively implemented in the concrete building of new learning environments. Spaces and the embedded affordances communicate strongly what and how can or cannot be performed in the spaces. In order to keep up the positive development regarding PISA results in Finland, we have to put more emphasis on using technology innovatively in education in order to foster collaborative learning and inquiry. The development of social competences such as communication and interaction skills should also take place in authentic and engaging learning situations and processes that are deliberately cultivated. Further, also the well-being of students is a challenge when developing and designing different facilities.

The methods used in education are becoming more student and thought-activating and student-led. This challenges the learning processes, curricula and learning environments. Currently, there is growing demand for more comprehensive and agile learning environments. The comprehensive approach is needed to respond to the social and psychological needs, while agility enables the utilization of activating and collaborative learning methods. Agility entails many kinds of multi-use spaces: open and comfortable areas for informal interaction and engaging learning, but at the same time more private spaces for differentiating instruction and learning, remedial education and effective individual work. Furthermore, the possibility to adopt 3rd millennium skills should characterize all elements in the surrounding learning environment. Furthermore, the development of technology sets new requirements for the overall learning landscape. Current understanding acknowledges the fact that learning takes place in both formal and informal environments, locally and globally, virtually and socially, in alternating phases of personal and collaborative learning activities.

We must develop new ways of learning that are both intellectually activating and that make students enjoy going to an educational institution. It is important to make efficient and meaningful, user-led use of the physical environments and tools that each university has. Teacher education is no exception. Even though Finland is very good in terms of PISA results, our school engagement is alarmingly low. Constant transformation and improvement of our school system is now needed. It takes a national effort to modernize teacher education on all levels. The learning environments in schools and universities should foster active learning, collaborative scientific inquiry, co-creative problem-solving skills, and systematic knowledge building. Current research suggests that this is not enough. Modern work life, teacher education and education should all be considered as partners in the creation of solutions that are fit for today's ever globalizing world where uncertainty has become the norm. Students should be able to regulate their own learning as well as support that of others. Our knowledge practices should therefore also facilitate motivation, engagement, and well-being. Those nations who manage to meet all these challenges are probably going to be the ones that flourish in a sustainable way.

New ways of designing building should be based on knowledge about organizational psychology and they should include pedagogical understanding. The challenge is to design spaces that are welcoming to and usable by a variety of different users: students, teachers, researchers and other employees. New technologies bring about new possibilities for organizing learning and research at the workplace. Challenging, it also provides business opportunities and markets for the technology industry, construction, design and pedagogical innovations.

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Those nations that meet all these challenges in education and service design are probably going to be the ones that flourish in a sustainable way.

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How to co-learn in campus

Alpo Salmisto

This chapter presents two course designs that were conducted using the knowledge creation and progressive inquiry learning methods in higher civil engineering education. The chapter is based on two peer-reviewed scientific articles (see Salmisto 2013; Salmisto & Nokelainen 2014) and it summarizes the main results of the articles. First is presented the basic idea of the knowledge creation metaphor to learning and the progressive inquiry learning method. Following the literature review, it is described how the knowledge creation and progressive inquiry methods were implemented in the Real Estate Business and Management, and in the Basics of Construction Management and Economics course designs at Tampere University of Technology. Also students' experiences from the courses are described in these sections. Finally, the chapter is summarized and conclusions are drawn.

The knowledge creation metaphor provides a new approach to learning

Paavola, Lipponen and Hakkarainen (2004) have presented the knowledge creation metaphor of learning. It is based on the three models of innovative knowledge communities and it provides a new approach to learning. The knowledge creation metaphor is developed based on Nonaka and Takeuchi's (1995) model of knowledge creation, Engeström's (1987) model of expansive learning, and Bereiter's (2002) model of knowledge building. The knowledge creation metaphor emphasises the creation of something new in the process of learning.

Bereiter's model of knowledge building is the basis of the progressive inquiry learning method. The progressive inquiry is a pedagogical model where the learning process is emphasized as an interaction between learning and knowledge building (Hakkarainen et. al. 1999). Progressive inquiry learning is designed to support typical data acquisition by the specialist. It emphasizes the activity of the learner and the impact of co-operation in a shared research project as well as the creation of new knowledge. It consists of the following parts: setting up the context, distributed expertise, presenting research problems, creating working theories, critical evaluation, searching deepening knowledge, developing deepening problems, and creating new working theories.

The progressive inquiry learning method involves the elements of three metaphors of learning: the knowledge acquisition, the participation and the knowledge creation metaphor. The knowledge acquisition metaphor focuses on "a process of adopting or constructing subject-matter knowledge and mental representations", the participation metaphor focuses on "a process of participating in social communities", and the knowledge creation metaphor focuses on "a process of creating and developing new material and conceptual artifacts". (Paavola & Hakkarainen 2005.) Compared with other learning methods, the knowledge creation metaphor makes the progressive inquiry model specific.

Master's students found the progressive inquiry useful

The first case course, Real Estate Business and Management (REBM), was developed based on the knowledge creation metaphor at Tampere University of Technology. The course is for Master's students and was implemented based on knowledge creation first time in 2011 (Figure 1). The course plan was built on the basic idea of progressive inquiry where the students themselves define research questions and problems. The objective of the first learning event was setting up the context, i.e. to provide an overview of the course subject and help understand the course's learning principles and the progressive inquiry learning process. The event adhered to the traditional lecture method, even though some activation methods were used during the lecture. The aim was to start group formation and show that active involvement of the students is hoped for during the course. Progressive inquiry within the groups of students began in the second week, when the students were divided into groups of 4–5 people. Most of the course participants were civil engineering students. Students from other study programs were divided among the groups so that the interdisciplinarity goal was partially met. The event started with a short presentation on the subject by the teacher. Then, the students prepared a concept map for "user-oriented development of shopping centers". On the basis of the concept maps, the students continued with setting up the context.

Distributed expertise was a key part of the study during the whole course. After making their concept maps, the groups examined the maps of other groups in rotation, spending 4–5 minutes on each concept map and added their own comments to it. The next step was presenting the research problems. The groups were to come up with 5–10 research questions on the basis of the concept maps. The questions were posted for all to see and each group selected two of them. The current knowledge-based working theories of the students were created by thinking about preliminary answers to the research ques-

tions. After the event, the creation of working theories continued with the research planning process.

Traditional lectures were held during weeks 3–6 in addition to research plan presentations by the students. The aim of the lectures was critical evaluation, searching deepening knowledge and developing deepening problems. At first, the traditional lecture in week 7 was delivered in the university lecture hall. The subsequent combined lecture and excursion took place at the office of University Properties of Finland Ltd. (Figure 2).

Five weeks after the last lecture, a seminar (Figure 2) where students presented their own studies was held. New working theories were created and new knowledge was shared in the seminar based on the studies. A group exam was held one week after the seminar. The groups were to do a peer evaluation of the two studies by the other groups. The objective of the group exam was to familiarize the members with the studies of the other groups as well as to get feedback on their own work. Peer evaluation also honed the metacognitive skills of the students.

The plan for the second course was developed based on teachers' experiences from the first course and student feedback. The

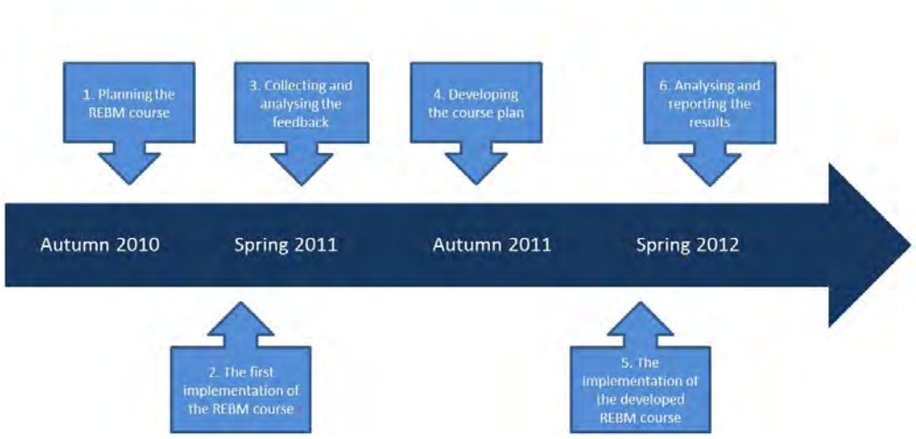

Figure 1. The developing process of the Real Estate Business and Management course.

students found that traditional lectures did not support progressive inquiry learning and hoped for more activating tasks during lectures. In addition, progressive inquiry was considered unrelated to lectures, which focused more on office properties. The main idea and structure of the second course remained the same as the first one. Traditional lectures were modified so that each lecture began with presentations by student groups. The presentations were related to the research questions formulated by the students. During the first lecture hour the groups were expected to lead the discussion of the students on the topic of the lecture. Meanwhile, other groups were preparing for the debate themselves. The weekly tasks allowed students to receive feedback and guidance for their own research from the lecturers and other students throughout the learning process. The metacognitive processes, which are typically the responsibility of the teachers, were transferred to the students through the weekly tasks.

Another aim of the weekly tasks was to improve the connection between the lectures and the research process of the students, to make the lectures more communicative, to hone the presentation skills of the students, and to help prepare the students for the lectures. Another significant change in the new course plan was to add a new topic, "user-oriented development of the university campus". After all, university properties are more like office buildings than shopping centers, which makes the connection between lectures and the research process better while university properties are also more familiar to the students.

According to the feedback, inquiry learning has facilitated the learning process of the students. Students considered as the best parts of the courses the tasks and learning events based on progressive inquiry learning. In 2011, four lecturers delivered traditional lectures the same way as in previous years for the corresponding courses. Three learning events were directly linked to progressive inquiry: the start of the progressive inquiry, the seminar and the group exam. There were also two other events that differed from a traditional lecture: a course opening lecture and a combined excursion and lecture.

The students' evaluation of each learning event (Table 1) attested to the need to develop traditional lectures to support progressive inquiry. According to the means of the feedback, students considered

the events that differed from traditional lectures the best learning events of the course in 2011. The start of the progressive inquiry was rated the highest in every aspect: contents, material, and manner of presentation. That event was based mainly on the students' own work only supervised by a teacher. All five different learning events, except the seminar, were preferred over all traditional lectures. Feedback grades for all lectures decreased compared to previous years. The progressive inquiry helped the students in their learning. When the more student-centered methods, which differ from traditional lectures, were used, the ratings of traditional lectures dropped substantially and the progressive inquiry based learning events were found more meaningful. Verbal feedback confirmed this assumption and indicated that the higher scores were based on a better learning experience.

In 2012, lecturers who managed to modify their lectures to support progressive inquiry were rated better than in 2011. The ratings of lecturers who lectured the same way as the previous year decreased further. The evaluations of all progressive inquiry based learning events stayed almost the same or decreased slightly, except for the start of the progressive inquiry. The combined mean for the start of the progressive inquiry decreased 0.68 points although the event was held the same way as in 2011.

> **The students found that traditional lectures did not support progressive inquiry learning and hoped for more activating tasks during lectures.**

n=18 - 66 *		Content			Material			Manner of presentation			Combined mean		
Learning event		2007 -10	2011	2012	2007 -10	2011	2012	2007 -10	2011	2012	2007 -10	2011	2012
Opening lecture	x̄		4,00	3,73		4,00	3,55		3,86	3,83		3,95	3,70
	s		0,39	0,63		0,39	0,60		0,53	0,65		0,44	0,63
Start of PI	x̄		4,35	3,88		4,18	3,56		4,65	3,69		4,39	3,71
	s		0,61	0,73		0,64	0,65		0,49	0,62		0,60	0,67
Lecturer 1	x̄	4,05	3,50	3,38	3,90	3,39	3,12	3,62	3,11	2,42	3,85	3,33	2,97
	s	0,48	0,50	0,85	0,68	0,49	0,86	0,76	0,84	0,81	0,67	0,64	0,92
Lecturer 2	x̄	3,90	3,32	4,23	3,80	3,40	3,96	4,66	3,73	4,59	4,12	3,48	4,26
	s	0,80	0,46	0,51	0,69	0,51	0,72	0,60	1,03	0,64	0,80	0,73	0,67
Lecturer 3	x̄	4,00	3,85		3,71	3,77		4,41	3,85		4,04	3,82	
	s	0,80	0,69		0,85	0,60		0,73	0,80		0,84	0,68	
Lecturer 4	x̄		3,57			3,54			3,46			3,52	
	s		0,65			0,63			0,75			0,66	
Lecturer 5	x̄			3,71			3,29			3,86			3,62
	s			0,72			0,72			0,85			0,76
Exc. and lecture	x̄		3,90	4,27		3,80	4,08		4,30	4,42		4,00	4,26
	s		0,74	0,67		0,79	0,63		0,48	0,50		0,69	0,61
Seminar	x̄		3,80	3,68		3,67	3,68		3,50	3,70		3,66	3,69
	s		0,68	0,80		0,82	0,80		0,52	0,81		0,68	0,79
Group exam	x̄											4,14	4,05
	s											0,66	0,74

The exact form of the question "Evaluate on a scale from 0 to 5 (5 = excellent … 0 = fail)"
* 2007-2010 Lecturer 1 n=66, Lecturer 2 n=59, Lecturer 3 n=29; 2011 n=18; 2012 n=29

Table 1. Means of student feedback for learning events in 2007–2010, 2011 and 2012. (Salmisto 2013)

Bachelor's courses should focus more on learning skills

Another case course, Basics of Construction Management and Economics (BCME) for first-year civil engineering students, was implemented for the first time in 2013 at Tampere University of Technology (Figure 3). The main content of the course is based on the course previously entitled Building Project. The Building Project course is still on offer for the second-year civil engineering students studying in the old degree program and for the students from other disciplines who study civil engineering as a secondary subject. In 2013, some lectures were the same for both courses, but the students' exercises, practices and learning process differed. The Building Project course is conducted using the traditional case-based learning method at the universities of technology; lectures and case assignments, which the teacher precisely predefines. The main contents of both courses are building project management, phases of the project, and tasks of the parties of the project. In addition, the Basics of Construction Management and Economics course consists of the entrepreneurship and innovation module, basics of cost accounting and investment calculations.

The syllabus of the Basics of Construction Management and Economics course was also built on the basic idea of progressive inquiry, where the students themselves define the research questions and problems. The course began with the opening lecture. The aims of the lecture were to get a picture of the field of construction management and economics, and to understand the learning process of the course and the progressive inquiry method. In the second week began the entrepreneurship and innovation module. It consisted of lectures, an entrepreneurship and innovation assignment, and small group sessions. The module began with lectures on the basics of entrepreneurship and innovations. A central part of the module was the entrepreneurship and innovation assignment. It was the key part of the progressive inquiry process of the entrepreneurship and innovation module. The main idea of the assignment was to identify the construction related problem and to try to solve the problem by developing a new product. One part of the innovation process was to build a prototype of the product. Students also described the business idea of the product and

presented simple cost accounting and investment calculations. During the innovation process, there were three small group sessions, and two lectures on cost accounting and investment calculations were given. At the end of the entrepreneurship and innovation module there was the seminar where students presented their solutions.

After the entrepreneurship and innovation module began the building project management module. It consisted of two-hour small group sessions and two-hour lectures every week. On the first lecture, a picture of the building project as a whole was given. The objective of the first lecture was setting up the context. After the first lecture, the building project module proceeded in three two-week learning cycles. The basic idea of the rotation of the small group sessions and lectures was that the students would explore the subject of the week before the lectures. In the small group sessions, students defined the preliminary research questions and, on the basis of the lecture, further defined their questions. In the second week's small group session, students presented their research questions to other students and received guidance for their work from the tutors. The students prepared for the small group sessions by performing an advance assignment for the sessions.

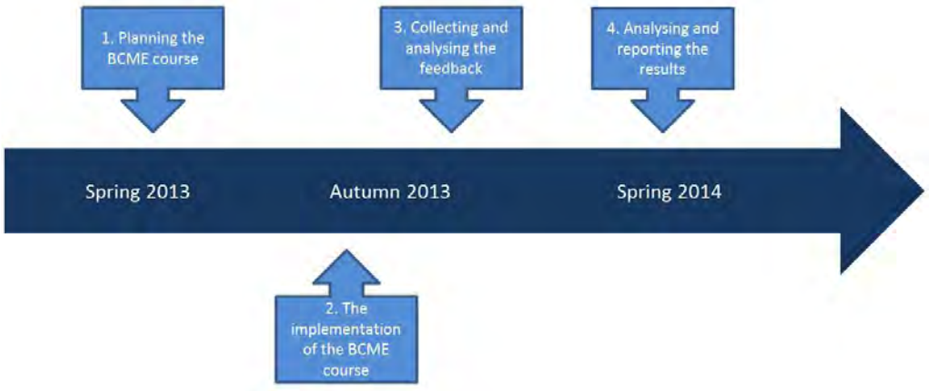

Figure 3. The developing process of the Basics of Construction Management and Economics course.

The subject of the first cycle was the briefing of the building project. In the first small group session, the student groups selected the project type and defined the research questions on what they need to figure out in the first phase of the building project. The topic of the second learning cycle was programming the project. Students continued to work with their project from the results of the briefing phase and began the second phase by defining the research questions on what they need to figure out in the programming phase of the project. The third part of the students' learning cycle was the design and construction phases of the building project. In its entirety, three cycles composed one learning process. During the last small group session, the students presented their entire assignment to other students.

The results of the student survey (Figures 4–6) demonstrate that there are challenges in applying knowledge creation learning for the first-year engineering course in mass teaching. Students thought that case based learning supported their learning process better than the course based on knowledge creation. On the case based course, the learning tasks were well-defined and students thought it was easier to see what the aims of the course are and what they were expected to

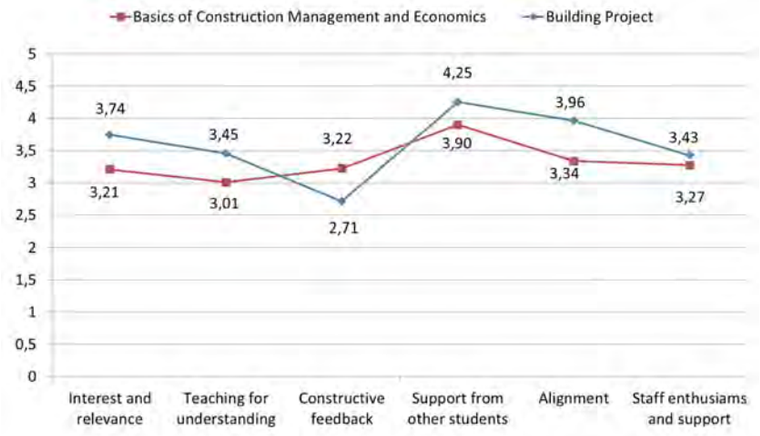

Figure 4. The means of the six factors measuring students' perceptions of the teaching-learning environment in the courses Basics of Construction Management and Economics, and Building Project. (Salmisto & Nokelainen 2014)

learn. The course based on knowledge creation provided students with more and better feedback because of the weekly small group sessions.

The most important need for improvement lies in the instructions for the knowledge creation based learning tasks. Students felt that the instructions for the learning tasks were unclear and that they received too little guidance for their learning process and group work. The most significant differences between the courses are in the alignment factor. The open and unlimited learning tasks confused the students and they were unable to see the whole learning process and what they were expected to learn. On the other hand, the main thing in knowledge creation learning is that students themselves present the research questions.

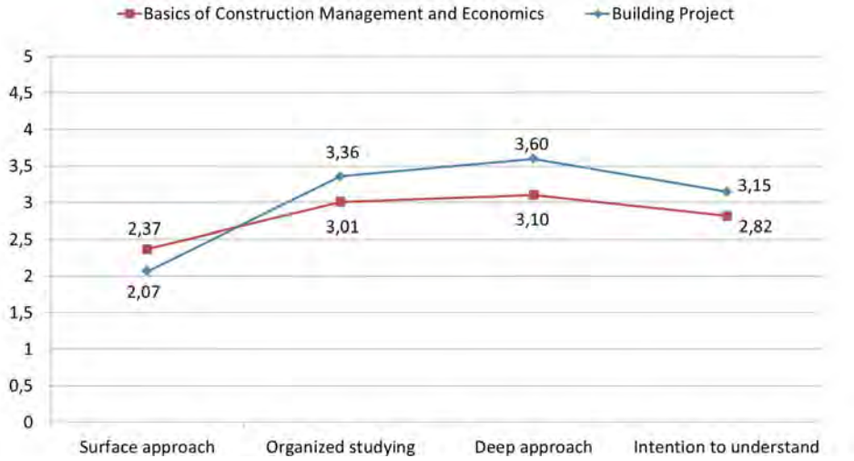

Figure 5. The means of the four factors measuring students approach to learning in the courses Basics of Construction Management and Economics, and Building Project. (Salmisto & Nokelainen 2014)

Also, the results indicate that first-year students' metacognitive skills are inadequate for the unlimited learning tasks, because they are used to solving limited tasks predefined by the teacher. The ability to formulate research questions is an important skill for engineers. In the working life, engineers will encounter unstructured and complicated tasks. They should be able to define problems and find the solution to them. Engineering students should practice these kinds of skills from the beginning of the university studies. The better metacognitive and learning skills students have, the better learning is possible in later university studies. If students learn these skills from the beginning of their first-year studies, they can use the skills later in their university studies. They are also better prepared for self-steered learning. Knowledge creation learning enhances not only professional skills, but also the learning of the contents.

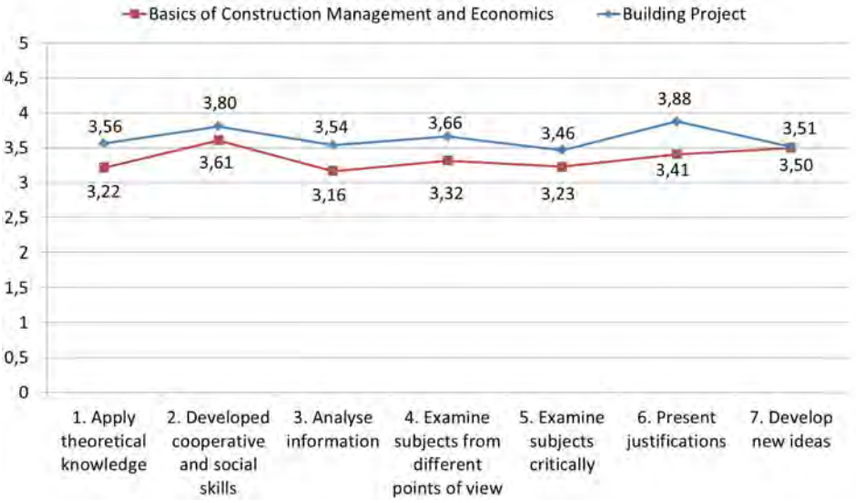

Figure 6. The means of the items measuring professional skills in the courses Basics of Construction Management and Economics, and Building Project. (Salmisto & Nokelainen 2014)

Summary and conclusions

The first case study demonstrated that the progressive inquiry learning method is a good way to improve higher engineering education courses. The results can also be used to develop other courses to improve learning outcomes as well as help students to find learning more meaningful. The second case study emphasizes the need for more focus on the metacognitive and learning skills of first-year engineering students. The results showed that first-year students are not ready for completely open and unlimited learning tasks. Their self-regulation and higher order thinking skills are inadequate for the knowledge creation based learning process, where they have a large responsibility for their own learning. The students are used to solving limited tasks predefined by the teacher. After all, the case study demonstrates that it is possible to apply knowledge creation based learning in mass teaching in higher engineering education. However, it requires good planning and implementation of the course and the learning events. Students also need sufficient guidance for the unlimited tasks and for defining the relevant research problems.

” Also, the results indicate that first-year students’ metacognitive skills are inadequate for the unlimited learning tasks, because they are used to solving limited tasks predefined by the teacher.

Higher education is changing. The learning in universities should be more student-centered. Traditional lectures are not the best way to learn the skills of the knowledge society. The new learning methods are setting new requirements for campus development. The traditional class rooms do not meet the demands set by the new learning methods. In the developing of the learning environments attention must be paid to physical, social and virtual aspects of places. Professionals of the construction sector have a significant role in the development of campuses. The changes in society have increased the need for new competencies in all fields. In the construction sector, these changes have been noticed in required competencies, but the learning methods of higher education have not been developed enough to meet the future competency needs of the industry. Key competencies in the field of construction, which current higher education does not support enough, are related to the interdisciplinary, collaboration and group work skills, and meta-cognitive knowledge and learning skills. Engineers also need better skills in shared expertise, entrepreneurial skills, and skills in creativity and innovativeness. Present engineering education does not support the development of these competencies enough. This chapter provided examples of how the new learning methods could be used in higher civil engineering education. Knowledge creation and progressive inquiry learning improve the competencies of the knowledge society and also develop learning of the contents.

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What makes a Place? Claiming Spaces for Informal and Social Learning

Jenni Poutanen

How to redesign an under-used secondary space into a lively social and informal learning space? Here, three case studies are compared to shed on light what spatial elements create a Place for learning. At many university premises informal learning spaces are often limited to libraries and social interactions to cafés. However, secondary spaces, such as halls and corridors, which are located in popular areas on campuses, have great potential when redesigned into novel social and informal learning spaces, which increases the efficiency of the spaces, too. The cases differ in design and development manners: two novel learning spaces created in a lobby, a renovation of a campus café and co-created learning spaces in an academic library. The cases offer practical implications and elements on how to create new learning spaces successfully. Common for all these cases is the positive feedback produced by a pleasant, uplifted environment. These realized cases suggest that relatively small, acupuncture-like changes to existing spaces can create a relatively big impact.

Give students what they want: informal and social learning

Informal and social learning spaces have widely been recognized as one of the focal points for developing learning spaces on campuses in higher education. Our campus premises consist of a vast number of square meters of traditional lecture halls and other teaching spaces, but the change in the learning paradigm puts emphasis also on the informal and social aspects of learning. The scale of learning methods has widened, the culture altogether has become more complex, variable and the choices free. Hence, the spectrum of spaces should be considered.

Student expectations can be seen coherent with the change in the learning paradigm. Learners choose their study place according to their own personal list of requirements and preferences, which vary depending on the learning activity. Spaces for collaboration and interpersonal communication are important. Learners use different spaces at different times and for different purposes, seemingly valuing the ambience and the identity of the various learning spaces. An informal and relaxed ambience is on the learners' wish list, but this is not an equivalent to laziness; on the contrary, spaces suitable for studying are wished for. Learners also seek spaces that are active and full of "happening" and people. (see Harrop and Turpin, 2013) Our case studies support these viewpoints; the aspect of "suitable for studying" has emerged in student expectations. Students see university as their "workplace" and wish for spaces for "work". Studying among other people in an active place is also shown popular.

Informal and social activities are here interpreted to include all activities outside of the curriculum and outside of allocated spaces. Of course, informal activities can take place in formal spaces and vice versa (see chapter "Dreams"). Another practical reason for concentrating on informal and social learning spaces is in their location; such spaces are not usually confined to one faculty or department. This allows us to seek solutions that are beneficial for almost all of the students.

What is social learning?

Social learning is a group activity, based on discussions. However, students seem to also seek the closeness of fellow students, whether strangers or friends, and working solitary next to each other. This activity can be seen as "alone together" and communal as such: An "experience of seeing and being seen by others, quietly engaged in the same serious, studious activity" (Gayton 2008).

Campus acupuncture and small changes

Where, then, to refurbish novel learning spaces, when campuses seem to be already full? A new building for informal and social learning is not only expensive but also indefensible from a sustainability point of view. One answer to the dilemma are secondary and circulation spaces; these spaces allow small surgical developments, which can be adjusted according to the place and requirements. Like with acupuncture, the whole campus layout could be energized through small changes across the premises. The impact of these changes can be bigger than their size. Campuses have refurbished existing learning spaces and developed new spaces worldwide. On the other hand, the developments (of informal and social learning spaces) have focused mainly on changes within academic library premises. Looking from a wider perspective, what is needed is diversity of spaces from flexible or multi-purpose spaces to relaxed spaces still suitable for studying that students can take over, to many more spaces from active, collaborative places to quiet communal spaces. The redesigned secondary spaces could add to the flexibility of the campus environment and work as additions, or adjustments for multiple functions.

Secondary spaces possess great potential by square meters. The vastness of circulation spaces seems to be typical for so-called modernist Finnish campuses from the 1960's onwards; circulation spaces compose up to 22% of the total floor area. Circulation spaces also naturally attract people: the connecting paths are highly trafficked and can encourage or prevent interaction. However, these secondary spaces as such are usually not functional, suitable or attractive enough to be places of study. An empty corridor is rarely invaded by students studying for a longer time period or randomly placed sofas filled with lively discussions and group work. The places of a naturally active flow of people are usually most spacious, too, and therefore more suitable for acupuncture-like redesigns. Then again, some corridors and halls are too narrow, inaccessible or dark.

Informal and social activities are enabled in all secondary spaces by the campus-wide ICT support and the culture of Bring Your Own Device (BYOD). Cafés are popular not only as places for relaxation but also for studying. Main halls are often in close contact with a café or a restaurant, and these are especially potential places, as food and drink is seen important for socializing and community (Oldenburg) and humanizing the space (Brown and Long).

Introductions of the Cases: Pilot Studies

In the following, the case studies are introduced and we discuss what spatial and architectonic elements define the spaces. Common for all these cases is that the novel spaces are in an open plan and are accessed freely. The locations of the areas are unique as they are not a part of any faculty or curriculum. Hence, reservations are not required either. The first case is located in a main hall. The second case in administrated by a café's business operator. The third case is situated within an academic library. All of the universities provide a wireless network for students and staff.

To measure how successful these designs and refurbishments were, it was essential to learn whether the spaces were used in the first place, secondly, for what activities and, thirdly, by individuals or groups. In all cases the changes were made to interior design, but not to load-bearing constructions. The novel spaces can be seen as adjustable spaces, adding flexibility and choices to the spectrum of spaces.

Pop-Up Spaces: How to test fast and cheap?

Pop-Ups are here seen as a method for testing a hypothesis relatively risk-free, fast and cheap. The idea is to build a temporary space with inexpensive materials, preferably together with the "clients" and after that to monitor how the change is accepted or how it affects the situation.

Main hall is now an active study place

The area was chosen for development in 2012 by the property owner, University Properties of Finland Ltd (UPoF), and was designed and evaluated as a part of this study. The case is exceptional in development. During a design course architecture students were assigned to carry out the spatial and interior design of café Motivaattori, located in the Konetalo building at Tampere University of Technology (TUT). The students were encouraged to expand the designs to the whole entrance area and search for novel spatial solutions for multipurpose use, keeping in mind the change in the learning paradigm and its effect on spaces. UPoF chose two of the designs for further development, which were combined into one. An architecture office took care of the completion of the design and construction. Eventually the café was left as it was and the main entrance hall area with coat racks and one side of a busy corridor were transformed into an informal learning space.

The pilot area consists of two neighboring areas, which are separated from the surrounding area with a carpet floor. One area consists of "Decks" (see Fig. 1); elevated platforms on different heights, which form a concise entity. The other area is an open flat-floor area (see Fig. 2), which is defined by two Glass Boxes, literally approximately five square meter rooms made of transparent glass walls. When the choice of transparent glass was made, an interesting question related to spatial elements arose: how would users respond to the lack of visual protection and whether transparent glass would create enough privacy? All furniture in the areas is movable.

Figure 1. TUT Motivaattori case. On the left: initial situation. On the right: The Decks along the corridor

The place has proven to be well received. The closeness of the liked café might add to the popularity. However, apart from an occasional cup of coffee, any other food activities are uncommon in the area. Instead, groups studying mainly use the spaces. By the number of users, the most popular spot in the whole area was Deck #3, on which one third of all users were seen. So how does this place differ from the other five decks and the other area, too? The platforms are elevated on different levels, which separate them from the neighboring corridor. Deck #3 is above the floor level, yet easy to access and the ceiling is not too low. The real difference seems to be in the furniture. Only Deck#3 has certain type of soft armchairs that allow proper leaning back. The proportions of these chairs is perfect for holding a laptop on your lap. Students seemed to prefer the open Deck area, but only half of them were spotted studying there. This differed greatly from the other area; in the Glass Boxes, four persons out of five were observed studying, and also, predominantly groups occupied the Boxes. Also the Table Groups between the Glass Boxes were more popular for studying (72% of persons using).

The area can be said to be successful in so that it is clearly seen as a study place and not an extension of the café. This implies the need for such spaces, too, maybe close to food services, but separated so that students can define the use of the space. A café can be easily understood as a semi-private place at the university, because of the business related to it.

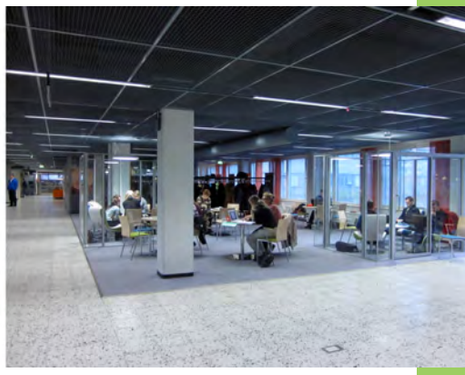

Figure 2. TUT Motivaattori case. On the left: the coat racks block natural light. On the right: after renovation: The open-plan area with the Glass Boxes and the Table Groups

A once dull café is now a popular and pleasant place

The second pilot is a café at the University of Eastern Finland, Kuopio campus. The café is situated along a corridor close to the biggest lecture halls. However, the visibility of the café was obscured by the location and the lack of "interior design". The café counter was on the side of the corridor with furniture for café-goers spread along. The café was invisible and many people were unaware of it, despite it being the only café in the building. Clients found the interior dull and "corridor-like" ("just furniture along the corridor") (see Fig. 3). Together with an out-dated interior design, also the supply of the café was found limited. The service provider wanted to develop the business, too, in order to help the overcrowding of the only restaurant in the building complex during rush hours. It was no wonder that the café was chosen as a case development by UPoF. The pilot was designed and developed in a more typical manner: a local architect was responsible for the changes and the space management department together with UPoF took care of the development. The spaces were refurbished during summer 2013. Post-occupancy observations and interviews took place in fall 2013.

So what happened? The popularity of the café has increased tremendously. Both students and staff use the spaces. The spaces are found pleasant and inviting. The café is now very visible thanks to the blue carpet floor, which separates the café from the surrounding brown tile floor, and the contrast of colors, such as the green booth-like sofas next to the brick walls. The corridor space has become a place. It still functions as one of the main corridors, but the image is now inviting and the long view has now been shortened. The café has become "mentally" closer to the large lecture halls. The acoustics have improved due to the soft surfaces, and the corridor-like atmosphere (physical and acoustical) has changed dramatically.

What is the space for? Clients from the staff use it mainly for coffee breaks and lunch, but also for ad-hoc business meetings. Students, on the other hand, find the space mainly a place for relaxation. However, they use it relatively much for studying, too, and when asked, they mentioned "others" doing study work in the café. The only informal study place in the premises is the academic library, which the learners name as the only study place.

The café now serves light lunch also, which has added to the popularity. The "downside" of the well-liked lunch opportunity is that some clients find it annoying when students study in the booth-like sofas of the café during lunch break peak-hours. These sofas are the most popular places altogether and clients wish for more of them instead of the other lounge-like furniture that are ergonomically suitable only for lounging and coffee instead of eating and studying. The booth-like sofas are equipped with desk/dinner tables (see Fig. 4).

Figure 3. Kuopio case. On the left: initial situation, the image of the café is unrecognizable. On the right: after renovation. The green booth-like sofas are popular places. The colors are found fresh.

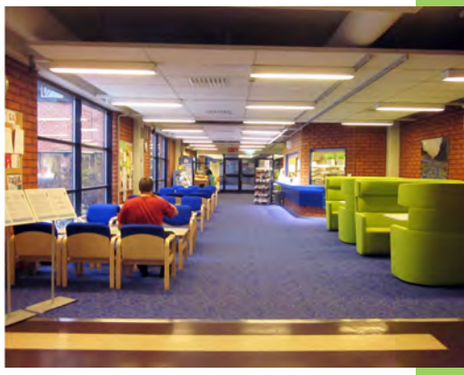

Figure 4. Kuopio case. On the left: the café is almost invisible in the long corridor. On the right: the colors and the carpet floor bring the café closer to the access direction and create a distinguishable look.

An academic library got a successful and inexpensive face-lift

The case presented last is somewhat experimental and untypical. The spaces were designed and built by a group of architecture and engineering students together with members of the library staff of TUT. I organized, in collaboration with the library, a joint course for architecture and engineering students (who all are clients of our academic library) during winter 2014. The completed spaces were meant to be temporary and can be seen as "Pop-Up Spaces"; they were cheap and relatively fast to execute and intended for testing the target places, but also for creating and testing novel informal learning spaces. The input from the students was essential for the successful outcome.

Libraries can be seen as the mother of informal learning spaces. The library premises of TUT are somewhat out-dated and do not represent the contemporary developments of the library (see Fig. 5, 6, 7, 8). The library will move to new premises in 2015, so it was clear from the start that any developments of the spaces were to be temporary. This was also one of the goals: to create spaces with a very small budget in collaboration.

The members of the staff were actively involved and attended some of the sessions, too. The course included several workshop days during which the problems of the learning spaces were dealt with. The students were encouraged to design different learning space ideas suited for the use and facilities. The students analyzed the target spaces and designed "theoretical" and whimsical solutions for novel learning spaces. They bought the materials and built the spaces. The final versions of the spaces were designed during construction. The opening of the spaces was celebrated in March 2014. Both the staff of the library and the students visiting it all seem to be very pleased with the results and the fact that the novel spaces were executed in the first place.

Figure 5. TUT Library: On the left the initial situation. On the right after refurbishment: the environment is more coherent.

Figure 6. TUT Library. On the left: the initial situation. On the right: after refurbishment: the transformation of the spaces.

What novel spatial elements create a Place?

All of these developments seem to be successful in either attracting people or increasing the popularity of the space. On the whole, the different development and execution manners do not seem to play a part in how well the places are adopted, even though one is a temporary and inexpensive development. As the spaces are considered popular, one can also state that it indicates a certain need for such renovations and perhaps a need for such novel learning spaces, too. The location is most likely to affect the popularity of the spaces: two of the cases are situated along active paths and in close contact with major auditoriums, yet "private" enough and not in front of the halls. The third case is within a popular existing informal learning place, the library.

One definition common to all three developments is the "pleasant" qualities and updated image acknowledged by the users. The places (and spaces) are now Places. So, what creates a "pleasant" environment and a recognizable/distinguishable Place? First, the significant change from out-dated to upgraded, a contemporary look plays a major part. The spaces differ from the initial situation, and one might assume users see the renovation of spaces as appreciation of them, too.

Secondly, the use of a carpet floor defines the places from the surroundings and adds to the "pleasantness". In all three cases, a carpet floor is used on top of the former tiled floor, or other effects to separate the area from the surroundings, such as the "decks", are created. The acoustics are also improved by this. Carpet floors are very untypical in public buildings in Finland and due to the texture of former carpet floors they have been frowned upon previously.

Thirdly, the atmosphere has changed in all of the three cases. The use of colors has been appreciated greatly. In the Kuopio case, the new colors, which are in contrast with the old surrounding colors, are found fresh and pleasant. They also make the place visually closer to the main halls (see Fig. 3, 4). At the TUT library, the former colors of the tile floor and the furniture were found very out-dated and conflicting. Even though the new color palette can be found in contrast with the old, it still draws inspiration from the old and completes all of the colors into one coherent and fresh entity (see Fig. 5, 6, 7, 8). Typically,

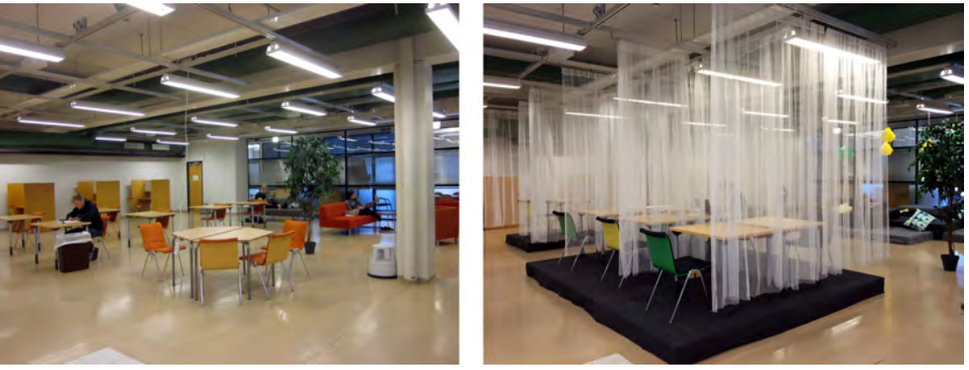

Figure 7. TUT Library. On the left: the initial situation, an open, dull space. On the right: after refurbishment: the curtains separate individual study places. The curtains can be opened and tables combined into one group space.

Figure 8. TUT Library. On the left: the initial situation. On the right: after refurbishment.

the use of colors in public buildings has been very conservative and cautious.

For the atmosphere, also the overall look and the access of natural light are important. For example, the entrance hall of Konetalo in the case of Motivaattori was formerly full of furniture and natural light was "blocked". Now the hall is spacious (see Fig. 1). In addition, the space is efficiently used for various activities, and the secondary services are still sufficient. At the TUT Library, curtains were removed to let natural light and views in.

The atmosphere is greatly affected by the acoustics, too. Both the Motivaattori and Kuopio case areas are naturally noisy and active with a constant flow of people through them. However, the noise is not loud, but rather constant. The carpet floor and the soft furniture lowered the noise level. Even though noise is usually found a negative element, as stated earlier, a "buzz" can be found positive. The results indicate that learning, especially group study, can take place in a noisy area. Then again, old assumptions seem to stick, as in the TUT library case, students find libraries places for intensive, hard studying. There, noise is often found negative and the sound level is altogether low in the library.

The case studies have revealed the importance of furniture; the ergonomics, the look and the movability affect how the spaces are used. Lounge furniture supports "lounging" and might hinder studying. If halls and corridors are changed into learning spaces, the furniture has to be ergonomically suitable for working. In other words, tables should be on desk height with chairs to match. Feedback from the students in the Motivaattori and Kuopio cases reveals that low tables are found ergonomically inappropriate for (collaborative) learning activities due to their height. Then again, ergonomically pleasant armchairs in Motivaattori allow solitary laptop use. In an open plan, furniture should be movable. Power plugs are an absolute minimum requirement for any on-campus informal and social learning space based on BYOD. The lack of such a small necessity may impact largely on the use of a space. The modern look of the furniture seems to be important too – the spaces are now found fresh. Another element preferred by users is the softness of the furniture, but sometimes also the indefinable softness of the place.

The cases differ in flexibility and how the spaces have changed after implementation. The open plan layout of the Motivaattori case allows adjustments of furniture, and users have created various settings open-mindedly. Regulations were not given either on how to use the space, or how the furniture settings were supposed to be laid-out. Motivaattori also shows us that the space measurements are suitable for even more furniture as the furniture has clustered leaving space empty. Even though some groups of furniture are now further apart, this also implies that the requirement for "personal space" is smaller than assumed initially. Altogether, Motivaattori can be seen as flexible and multi-functional.

Then again, the Kuopio and TUT library cases are supervised places, hence the furniture is restored to its original place if changes are made. In the Kuopio case, the furniture is also rather heavy, which inhibits changes. On the other hand, the customers are especially happy with the booth-like sofas (see Fig. 4). Also the space measurements restrict possible layouts there. At the TUT Library, the layout allows flexibility to a certain point, but more so offers affordances and different sets of learning spaces and is multi-functional as a whole (see Fig. 5, 6, 7, 8).

Altogether the furniture and the layouts seem to be inviting in all three cases and suggest various uses. Any purposes users find suitable are allowed. An exception is the TUT library where conflicting interests have occurred between users: some would like to do group work in the library, but others find it disturbing despite the affordance of the silent room. The choices of various spaces and freedom to adjust the places according to activities should, obviously, be the essential outcome of successful (interior) architecture. However, not all examples of spaces are successful. The layout and location might give mixed messages or the suggested function be inappropriate in the designated area. (Harrop, Turpin, 2013).

Together with architectural elements, the placement of furniture is important. Users seemed to prefer architectonic elements that create a hint of privacy whilst studying, and have moved tables closer to walls, too. The Glass Boxes create a unique sound ambience inside, as the walls reflect voices and quieten down the surrounding noise without isolating it completely. The transparent walls complete the

communal experience of "alone together". It is surprising how well the Glass Boxes have been adopted given what a risky choice they were. The users appreciate the (slight) privacy that the booth-like sofas in Kuopio create with the relatively high backrest and the soft fabric. Then again, in the TUT Library regular desks and chairs are separated from each other with see-through curtains (see Fig. 7). This architectonic element creates possibilities for colleagues to study alone but close to each other, allowing occasional peer-to-peer discussions.

Revision of viewpoints

How, then, can secondary spaces be turned into informal and social learning spaces? First of all, the ergonomics (of the furniture) has to be suitable for working. An absolute minimum requirement for any space nowadays is the availability of power plugs. Do not neglect the potential of noisy places, but create a pleasant acoustical environment, which does not have to be silent. Students like to study among colleagues and a lively place can make an enjoyable atmosphere. But remember to locate the spaces so that there is a hint of privacy even within an active place. Also remember that old assumptions live long. Some can read the implied function from the furniture setting, and some can not. The affordances of the spaces are also important. In other words, how and where are the spaces located; do people find the spaces and do they want to enter them? The last point of view is to create a spectrum of spaces, combine together different spatial elements: for example nooks in a lively place.

Informal and social learning spaces have the focus here. However, the definition between informal and formal is becoming increasingly blurred and what is needed is a mixture of spaces, which allows variation of activities. People who utilize the space (should) define it. Even small changes in the spatial structure and the interior design may have a relatively big impact on the environment. Hence, multiform learning is supported and can happen anywhere. These successful case studies show, on their part, that there is a need for informal and social learning spaces on campus.

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Pihazzo - multiuse of campus cafeterias and restaurants

Satu Kankaala, Jan-Erik Gussander & Suvi Nenonen

Where to meet, do groupwork and hold a quick meeting on campus? Where to arrange to meet for a date, meeting or brainstorming session? Where to hold a seminar or a weekend flea market? Where to invite people for post-dissertation coffee and cake? At Pihazzos you can do all of these things. Pihazzos are in central locations on campuses and even better, you can eat and drink there, too. The idea for the Pihazzo concept was born in the Aalto University Properties' Restaurants as a multiple-use space development project. The concept will be realised as a joint development project of the university, designers, service providers and the property company. The traditional third place is going to become the first place for informally working together: a new type of space for universities.

The birth of Pihazzo

The need for multiple use campus spaces and the knowledge of the significance of informal learning environments gave rise to the Aalto University Properties development project, resulting in the outline of the Pihazzo concept. The aim of the project was to depict the conceptual framework for the multiple uses of restaurants and to determine the parameters for collective use.

The restaurant offering of the campus area is being continuously developed by both the university and service providers. The Aalto University restaurant committee annually coordinates and carries out the customer satisfaction survey of campus restaurants. The committee has as its aim the development of campus restaurants and their services in active cooperation with service providers and the students at the university. The operations of Aalto University's restaurants are however restricted by different regulations and bodies, such as the government decree on the basis for subsidising university students' meals and the Alvar Aalto Foundation as regards the cultural historical value of the buildings. Kela is in charge of granting subsidies for student meals. The requirements for granting subsidies include price, as well as the quality and nutritional composition of the student meal. In the recommendations for university meals, the procurement of foodstuffs, the steering of student dining, the cooperation between parties and putting food services out to tender are all also taken into account. In addition, in accordance with Kela's regulations on meal subsidies, the university is to give over space for student dining without recompense. A joint target for developing campus restaurants involves several actors, all of whom should have the same vision.

The manual for designing and using a multiple use restaurant is an aid for steering and discussing the Pihazzo concept. The manual is based on user journeys and interviews in different restaurants. As the focus of the user journeys, five student restaurants, one staff restaurant and one cafeteria, operated by a total of three service providers, were selected. The aim of observing was to recognise the challenges facing the selected restaurants and those solutions that have been found to be good. The multiple use and usability of restaurants was investigated as regards the identity of the restaurant, the range of services, the use and the layout of the spaces (Table 1).
These themes were surveyed in the user journey; the contact points were: finding the restaurant, arriving at the restaurant, using the restaurant and leaving the restaurant. In conjunction with visiting the restaurant, the staff were interviewed about how the restaurant was used and busy times.

Communications and brand	Service assortment	Facility usage	Space solutions
• Guests • Aalto University • Service providers • Reception • Electronic communications	• ICT solutions • Giving feedback • Coat racks • Toilet facilities • Multiculturalism • Opening hours	• Security and clearance • Suitability for working • Space efficiency • Queues • Signs	• Closing the kitchen • Sensory stimulation • Flexibility • Location and accessibility • Maintenance

Table 1 The framework for observing the user journey.

A usable restaurant – what was learnt from the user journeys?

Where the canteen is found – the customer's viewpoint

The analysis of the multiple use restaurant environment begins even before the customer arrives at the location. Those coming to the campus do not necessarily know the area's restaurants, making them hard to find without signs. The signs can be in either the physical or virtual environment. Directions via electronic media are particularly important for those visiting the area for the first time. The lunch menus of the campus restaurants can usually be found on the restaurateurs' websites. So, in order to find the restaurant website, one has to know either the name of the restaurant or the restaurateur. The lunch menus are easy to find for regular customers, who expect lunch break to be a reviving oasis in the middle of the day.

The customer experience continues in the restaurant. The journey to the restaurant, be it by public transport, walking, bicycle or car, is part of the restaurant and dining area's brand and, as such, a seamless part of the user experience. The reason for the signs on-location is to aid in the use of the restaurant – they help to inform the customer how to order and what services are meant to be used.

From the customer's viewpoint, the signs can have an effect on the ease of using the restaurant and give help in finding services. Signs also have an effect on the functionality of the service environment, the formation of queues and safety. The significance of signs grows if the space, or parts of that space, has a specified use. If the space can be modified and has, for example, movable walls, furniture or equipment for working, the usability of the space can be improved with clear instructions for use.

Here, the brand of the restaurant is strongly linked to the brand of the service provider. From the customer's perspective, the restaurant could be tempting if it had an identity that is easy to identify with. The appearance of the restaurant can be used to highlight associations with, for example, the quality of the food, environmental friendliness, innovation or even student activities. Raising the Aalto spirit is also possible in dining spaces.

Figure 1. A vibrant space with diverse furniture.

What is on offer in the dining hall – the service offering viewpoint

The service provider offers their services and products both in a physical and virtual operating environment. For example, free WIFI is a value-added service for users of the restaurant, which is particularly welcomed by mobile users studying in different places. Aalto open, an open and unencrypted wireless network is available on all Aalto campuses.

It would be nice to accommodate wireless users from morning till night, but this is not always viable. The timing of the service offering can be formulated by providing services in shifts and offering self-service. This way, cafeteria services could be available nearly 24/7. The use the space as a communal resource is also linked to opening hours – efficient and sustainable space use is the target of the whole university campus. Shifts would however bring challenges related to cleaning the restaurant and keeping it clean. Cleaning has to be agreed separately when the dining area is used for function other than just eating and is used outside regular opening hours. Sharing the resources also means sharing responsibilities.

The campus environment's products and services can also be influenced by both the everyday grind and the fun of university and academic life. With some ingenuity, traditional student dining can be made into an experience where one can expect more than just having pea soup every Thursday. Food is an important part of a person's identity. Taste is the deciding factor in judging food, but now in addition to healthiness, environmental friendliness and an ethical background, new trends are emerging – unique and experience-rich food can be made by collecting recipes from people coming from different cultures and these can be used to foster a sense of community.

Figure 2. Feedback can be collected in many different ways.

What can be done in the dining area – the use of space viewpoint

Trying to fit your life around your timetable and finding a convenient place to study are parts of student life. Increasingly, studying involves working on tasks either alone or in small groups in informal settings – for this cafeterias or spaces in their immediate vicinity are ideal. The campus restaurant can also be a centre for learning and meeting when lunch is not being served.

In many places on campus an access pass is needed – this affects the accessibility of some cafeterias. Moving easily using the indoor walkways without locked doors is beneficial in enhancing the user experience of cafeterias. There also has to be places to store belongings. Cloak rooms and their location have significance. If it is possible to work in a restaurant, cafeteria or in their immediate vicinity, are the users able to leave their belongings on the table when going to the toilet without having to worry.

At lunchtimes, there may be queues, congestion and the danger of collisions in the campus restaurant. From the point of view of space use, it is worthwhile investing in forecasting and the planning of customer flows. The line in a closed dining area typically starts at the door, which means that the queue that forms there can easily blocks entry and exit. Potential collision points include pathways from the lunch counter to the table via the drinks area and when returning dishes.

So-called ”no-man’s land” or grey areas may appear near dining areas They tend to attract all kinds of stuff in their corners: boxes of paper, unused trolleys and reams of brochures. These grey areas and their level of tidiness have an impact on the overall experience of users.

Figure 3. Guide signs as part of the restaurant experience.

How is this all planned – The planning viewpoint

The spaces and activities going on in the surrounding area have an effect on the multiple uses of restaurant services. Outside areas are also a part of the location, but they are often overlooked with activity being concentrated in inside spaces or in winter. Outside areas and nature have though significant potential to offer experiences relief and revitalisation to the working day. Pihazzos should be located next to both external and internal thoroughfares, or in the natural meeting places on crossroads. In addition, the spaces should ”offer themselves” outwards enticing people to drop in or to make themselves at home.

A multiple use space is suitable for a variety of uses. This can mean both diversity in one way focusing, or then a diverse range of uses. So that multiple use of the space is possible, the structural elements of the space should not limit the activity inside the space too much. Large and fixed structures need to be designed to be flexible. Surface solutions can be changed and updated easily and economically. A versatile and flexible space withstands time and is durable. The flexibility and convertibility of spaces is aimed for with space usability solutions. Furniture can also be chosen that is ”tuneable” or recyclable. A shift-based dining space moving from a closed kitchen space to a half-open dining room and an open area for being and working in should be the basis for the Pihazzo which melds the whole campus. The versatility of cafeterias and restaurants is increased by being able to close the kitchen and the serving area when the area is not providing restaurant services.

The services of the area, the transport connections and the customer segments define the space as a whole. Achieving synergy benefits with the services in the area benefits everyone. Increasing the number of different kinds of individual and group work spaces can impact work in the restaurant. For example, the changing nature of library services shows that the focus has shifted from metres upon metres of shelves laden with printed material to the offering of different kinds of work areas, teaching and diverse databases.

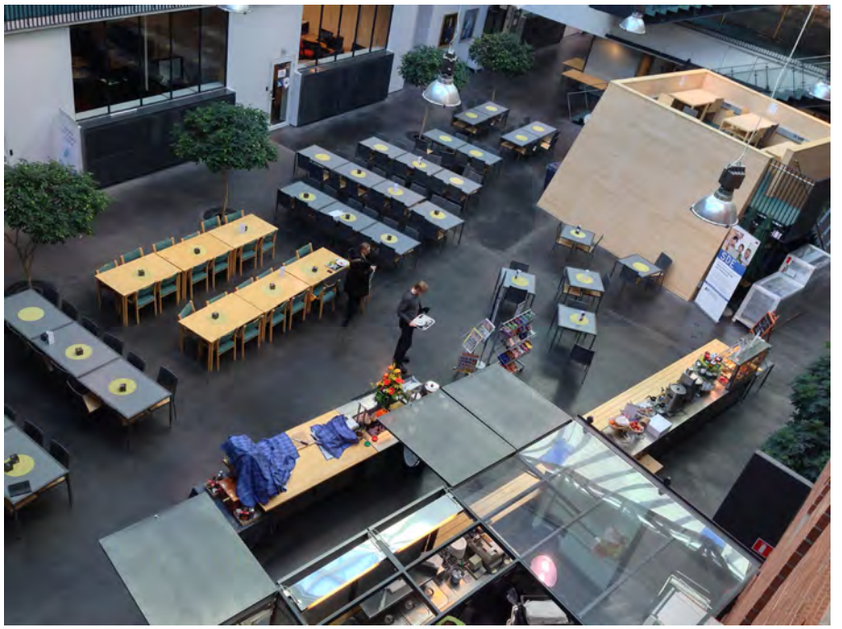

Figure 4. Versatile spaces at the proximity of the cafeteria.

Summary

In the manual made to support the development of Pihazzo four viewpoints important to the functionality and planning of multiple use restaurant, dining and cafeteria spaces are integrated: the customer's, the service provider's, the space and the planning viewpoints. The boundary conditions for functionality and planning are sustainable development, social responsibility and accessibility. The viewpoints have been investigated through different themes. (Table 2)

The manual is divided into three parts The Why part gives the reasons for the need for solutions, the What part gives suggestions on what to do and the Examples part gives concrete examples of suggested solutions. The manual ends with a checklist that can be used what different locations can offer against future design drivers.

The manual is primarily a tool for the joint development of Pihazzo and participation in it. The actors, service providers, staff, students, guests and companies of the campus have a part in the themes and they can bring their own know-how to the project. For example, from service providers we can obtain knowledge on the logistics, equipment and dimensions of kitchens. On the other hand, in the development of restaurants and cafeterias, we can use the know-how of students, which will reinforce the profiling of restaurants and creates a link to student activities.

The development of Pihazzos requires courage and new ways of thinking. In the development of new and supplementary service solutions it is necessary to have flexible agreement models and the will of the different parties. Experiments and learning from them demand risk taking, perseverance and creativity for trying out different solutions The Pihazzo ideology will be tested and further developed through developing the offering, spaces and services of Aalto's campus restaurants.

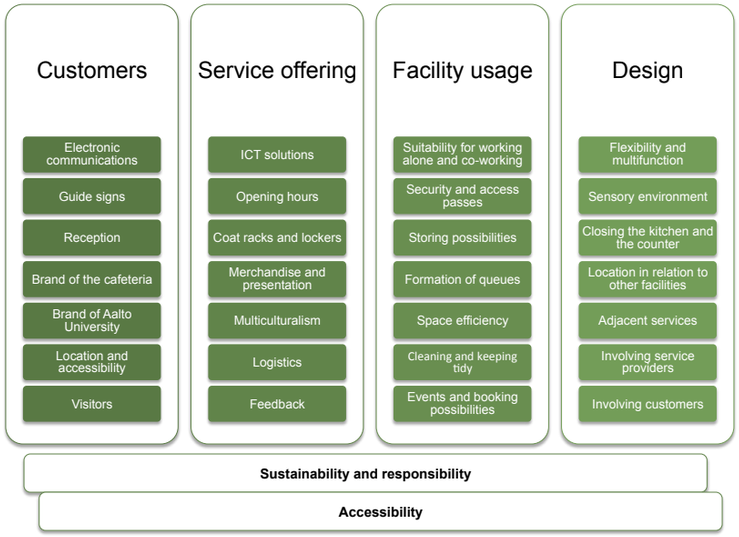

Table 2. The framework of the Use & Design manual.

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Ville Korpinen is an international-minded business model enthusiast. He holds a M.Sc. in business administration from the University of Tampere. In 2014 he co-founded a boutique consultancy business that helps clients design better services by utilizing business model innovation, lean startup and customer development principles. In his free time he is an avid traveller who enjoys cooking and recreational activities with his dachshund.

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Marjaana Lahtinen (PhD, Psychology) has been working at the Finnish Institute of Occupational Health since 1985 and has studied indoor environment issues for over 15 years. She also has a long career in organizational development.

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Kirsti Lonka is Professor of Educational Psychology Director of Research Group of Educational Psychology in University of Helsinki, Finland (2005-). She is a founding member of the Teachers' Academy of University of Helsinki since 2013 and was the first President of this Academy (2013-2014). She is also the Principal Investigator of the Project "Mind the Gap – between digital natives and educational practices" (Funded by the Mind Program of Academy of Finland (2013-2106), wiredminds.fi) as well as PI of WP4 Task 1.1. (Learning Environments) in RYM Indoor Environment project (2011-2015) rym.fi. Previously Kirsti Lonka was the Vice Dean of Faculty of Behavioural Sciences (2011-2013). She was Foreign Adjunct Professor at the Department of LIME, Karolinska Institutet, Sweden 2007-2011. She was also J.H. Bijtel Visiting Professor, University of Groningen, The Netherlands (2007-2008). Professor Lonka is active in Twitter and Instagram (@kirstilonka) and also in Facebook and LinkedIn. Kirsti Lonka is a popular keynote speaker around the world. She has published numerous refereed articles, conference papers and book chapters. She has also published plenty of text books and popular writings. www.kirstilonka.fi

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Tiina Mäkelä works as a researcher in the Innovative Learning Environments research field. Her internationally oriented research focuses on the design of 21st century learning spaces, on one hand, and on the globalization and localization of technological learning solutions, on the other. The case described in this book forms part of her work-in-progress doctoral thesis on participatory learning environment co-design with students.

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Marja Naaranoja is Adjunct Professor at the University of Vaasa. Marja has been analyzed construction project participant´s cooperation and decision-making.

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Suvi Nenonen, Ph.D, is a Research Manager at Aalto University School of Engineering, Finland. In addition, she is an adjunct professor at Tampere University of Technology. Her research area is workplace management. Her research interest is in physical, social and virtual workplaces and the usability of built environments.

Olli Niemi

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Dr. Niemi is responsible for the research and development of the company. He takes care about forming the R&D consortiums, building up the R&D -project plans, budgets and funding as well as managing on-going projects and programs. The strategy of the company is not to do itself its R&D projects but to subcontract its projects to its owning universities and strategic partners.

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Sanna Peltoniemi works as a project researcher in School of Architecture at Tampere University of Technology. Her research focuses on user involvement in architectural design processes and in particular, the viewpoints of communication and knowledge management.

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Noora Pihlajarinne is a doctoral student with a special research interest in the potential of the built environment to influence downright to mental human activities such as energy levels, learning and creativity.

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Architect, doctoral student Jenni Poutanen prepares her doctoral thesis on informal and social learning spaces in higher education in the School of Architecture at Tampere University of Technology. Poutanen teaches architectural design and in that position she has organized experimental courses on learning spaces and co-design. Poutanen received RYM Award 2013 honorable mention for developing as a part of her research work the "pop-up demonstrations" concept, which allows quick testing and refining of ideas with moderate resources.

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Janne has published over 20 conference papers and one journal during his ten-year R&D period. He is interested in elaborating new approaches to planning, including model based working, visualisation technologies and performance indicator frameworks. Read more: http://cic.vtt.fi/jporkka

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Katri-Liisa Pulkkinen (b. 1969) is an architect (M.Sc.) and doctoral candidate, currently working as a researcher in Aalto University in the Future Learning Environments Research Group at YTK - Land Use Planning and Urban Studies Group in the School of Engineering. She also teaches systems thinking at Aalto University, in the multi-disciplinary master program Creative Sustainability. In systems approach, her interests are in complex adaptive systems, especially systemic emergence and dynamics of change from the point of view of transition into more sustainable lifestyles. Her forthcoming dissertation studies urban pioneers and pioneering sustainability initiatives, with the dual aim of finding patterns that would help in designing future learning environments and more generally bridge transition to sustainability.

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Alpo Salmisto received the M.Sc. (Tech.) degree in Civil Engineering from the Tampere University of Technology, Finland in 2008. Since 2008, he has been a teaching associate and Ph.D. student at the Tampere University of Technology, Finland in the Department of Civil Engineering. His research interests include learning and future competencies of civil engineers and learning environments.

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Niclas Sandström (MA, M. Soc. Sci. Communication Studies, 2015), works as a PhD candidate at the University of Helsinki, Research Group of Educational Psychology. Recently, Sandström has been particularly interested in learning and physical and embedded learning environments. He has published on learning environments and learning and user experiences in interdisciplinary, innovative and intensive networked knowledge building. Sandström has also studied adaptive leadership and the semiotics of discourses and power focusing especially on leadership in the fields of learning and expert cultures.

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Aija Staffans D.Sc. (tech.), is Senior Research Fellow at YTK - Land Use Planning and Urban Studies Group YTK, Aalto University. She teaches urban planning and leads a research group which makes action research in urban planning & design processes, architectural competitions and neighbourhood development. Her research interest is in the interpretations and implementations of sustainability in planning practice, and in the digitization of planning in the context of smart cities. She is a pioneer in developing participative methods, digitally supported platforms and interactive environments for urban development and collaborative processes. Recently, she has been the initiator of the Aalto Built Environment Lab ABE, a new interactive modelling and visualisation space at Aalto University, School of Engineering. She holds several positions of trust and expertise in academic, professional and NGO organisations.
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Work and Organizational Psychologist Virpi Ruohomäki (PhD, Licenciate in Science, Master of Psychology), leads multidisciplinary research projects on work environments. She has over 15 years experience on studying knowledge work and new ways of working as well as participatory design and organizational development. She has published over one hundred articles.

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Eelis Rytkönen is interested in socio-technical phenomena and spatial design in organizational settings. Currently, he works as a researcher in Aalto University finishing his PhD dissertation on dynamics of campus management in spatial transformation. He holds a B. Sc. in Real Estate Economics and an interdisciplinary M. Sc. degree in International Design Business Management (IDBM). Eelis gets excited about friends, extreme sports, music, travelling and people who do stuff.

Pekka Tuominen

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Pekka Tuominen is a research scientist at the VTT Technical Research Centre of Finland, where his work has concentrated on the eco-efficiency of buildings and communities. His previous work has included the development of tools and indicators for assessing energy consumption in the built environment. He has also studied the profitability of energy efficiency investments and their economic impacts.

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Sari Tähtinen is an architect M.Sc and D.Sc. (Tech). She is currently working in Aalto University as a Post Doctoral researcher. At the moment she is primarily working in the ABE project and the campus development processes taking place in Aalto University. Her special interest is the use of image and different image practices in the context of architecture and urban planning.

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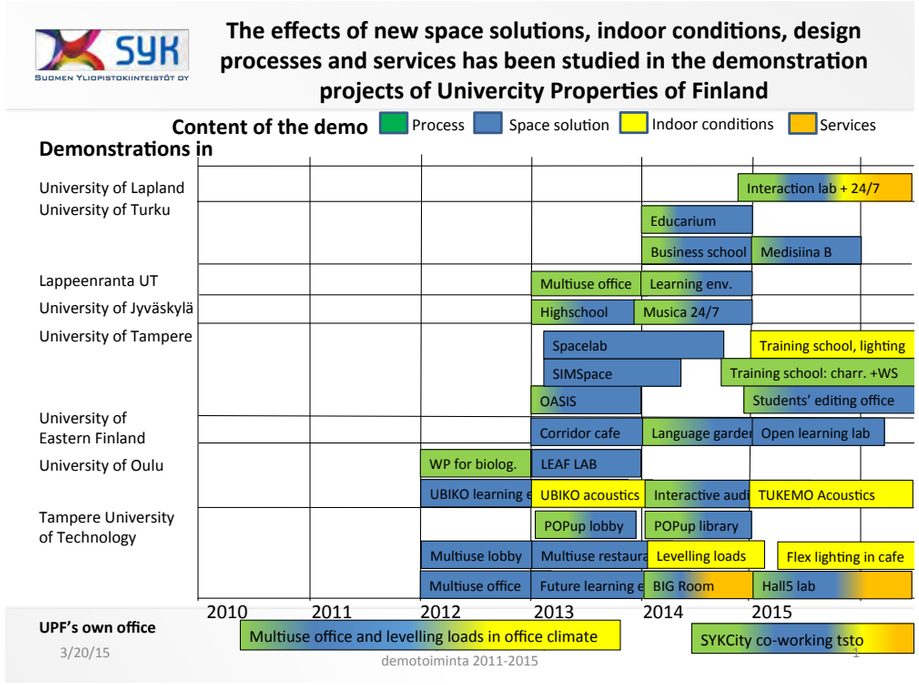
Lauri Vaara, M.A., works as a PhD student at the University of Helsinki in the Research Group of Educational Psychology. He has participated in the RYM Indoor Environment project aktively since 2011. In his work at the university Vaara has focused comprehensive in the design of engaging learning environments.

The Indoor Environment

The Indoor Environment Program of the Strategic Centre for Science, Technology and Innovation of built environment was realized in 2011–2015. The vision of the program, "to promote the productivity, satisfaction and health of space users in an ecologically sustainable manner", has been kept in sight also in its extensive Future Learning Environments working package.

University Properties of Finland has been the motor of the working package, and it plans to utilize the results of the multi-disciplinary research in investments of over a billion Euros, which it will make in the next 10 years. There have been researchers in the project from several research institutes and organizations in Finland. Also Aalto University Properties Ltd and Helsingin yliopistokiinteistöt Oy as well as other private sector actors took part in the project.



As an operating model, University Properties of Finland Ltd has developed so-called demonstration projects. They have taught how different solutions can be jointly developed with users and designers, what it is like to plan a learning environment that differs from the traditional, and what it is like to build them. Also new ways to use a space to support activity and what it is like to market new solutions have been the subjects of learning. Work based on demonstrations has implemented research into practice: informatIon is transferred from researchers to designers, builders and users in a very concrete way. Demonstrations have been made of processes, space solutions, conditions of indoor environment, and services on campuses. Similar demonstrations have been made in the University of Helsinki regarding, e.g., laboratories, and in Aalto University regarding, e.g., informal and multi-disciplinary learning environments.

"Learning Campus" is a collection of articles about the research and development of future learning environments in the Indoor Environment Program. It is a multi-disciplinary and diverse overview to support campus development and inspire everyone who is pondering where and how we learn, study and work.
What unites the chapters of "Learning Campus" is the desire to develop and learn together. Join in!

SYK
Suomen Yliopistokiinteistöt Oy