Master's thesis

NTNU
Norwegian University of Science and Technology
Faculty of Architecture and Fine Art
Department of Architectural Design and Management

James Michael Dodson

Teacher Workspaces 2030

An investigation of the future spatial and programmatic requirements for teacher workspaces outside of the classroom.

Master's thesis in Property Development and Facilities Management

Trondheim, June 2015

NTNU – Trondheim
Norwegian University of
Science and Technology

James Michael Dodson

Teacher Workspaces 2030

An investigation of the future spatial and programmatic requirements for teacher workspaces outside of the classroom.

Master's thesis in Property Development and Facilities Management
Trondheim, June 2015

Norwegian University of Science and Technology
Faculty of Architecture and Fine Art
Department of Architectural Design and Management

NTNU – Trondheim
Norwegian University of
Science and Technology

NORGES TEKNISK-
NATURVITENSKAPELIGE UNIVERSITET
INSTITUTT FOR BYGGEKUNST, PROSJEKTERING OG FORVALTNING

Oppgavens tittel:	Dato: June 2015				
Teacher Workspaces 2030	Antall sider (inkl. bilag): 133				
An Investigation of the future spatial and programmatic requirements for teacher workspaces outside of the classroom	Masteroppgave	**X**	Prosjektoppgave		

Navn: Stud.techn.
James Michael Dodson

Faglærer/veileder:
Geir Karsten Hansen / Nils Olsson

Eventuelle eksterne faglige kontakter/veiledere:

Ekstrakt:

The goal of this thesis is to set a greater focus and priority to teacher workspaces outside of the classroom today. In order to do this, scenario planning has been used to explore possible futures of teacher workspaces in order to examine how future needs can be planned for and implemented today. To this end quantitative research was done on teacher workspaces today, and qualitative research was done in the form of literature review, interviews and scenario planning.

The scope of the thesis is limited to Norwegian primary and secondary public schools. The focus of this thesis is teacher workspaces and support spaces used for pre- and post teaching activities outside of the classroom.

The thesis concludes that teacher workspaces of the future will require a greater variety of flexible spaces where teachers can perform the various tasks outside of the classroom that support their core operation, teaching. There should be spaces for both collaborative team-work and quiet concentrated work. A greater variety of workspace can be provided for teachers without a significant increase in total area by providing more shared-use spaces for students and teachers, such as group rooms nearby teacher workspaces that can be used as meeting rooms and collaborative spaces for teachers outside of class time. New Ways of Working or Activity Based Working are two workplace theories that could be implemented for teacher workspaces.

1. Space Planning
2. Scenario Planning
3. School Design
4. Teacher Workplace

Preface

This masters thesis is the final examination for the master's degree program in Real Estate and Facilities Management at the Norwegian University of Science and Technology (NTNU) in Trondheim. This report represents 30 credits of total 90 credits earned for this master's degree.

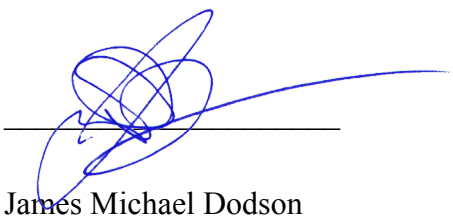
Work with thesis was carried out in parallel to my work as partner and architect at SPINN Arkitekter AS, an Oslo based architecture office that specializes in the design of schools and public buildings. The work done for this thesis was carried out from August 2014 to June 2015.

The choice of topic for this was based upon previous experiences in school design at SPINN Arkitekter. The current focus on the size of teacher workspaces instead of the quality or variety of spaces provided is a point of frustration for many architects working with schools. Because of this I felt that teacher workspaces would be an interesting area for further investigative study. The teacher's strike of 2014 placed the changing teaching profession in the spotlight in Norway, making the topic even more relevant. In depth research related to schools and how teachers work seemed like a good opportunity to make the work done on this thesis relate directly to my role as an architect and school designer.

Researching the teaching profession, its history and changing role has given valuable new insights into the programming and design of schools and will be of great influence in the design of new schools at SPINN Arkitekter in the years to come.

I declare that this is an independent piece of work according to the regulations at the Norwegian University of Science and Technology

Oslo, June 2015



James Michael Dodson

Acknowledgements

There are many people who I would like to thank for their help and support during my studies over the last 3 years, and during this last year in particular.

Firstly I would lie to thank my wife and family for their patience and understanding. Starting a new architecture office and studying for a masters degree are both time consuming activities. Thank you for supporting me in this pursuit. Special thanks to my wife Marianne for her proof-reading of various assignments in Norwegian underway. Thanks to my mother Jane Evans for her continuing support, encouragement and proof-reading of this thesis in English.

I would also like to thank my partner Leif Houck at SPINN Arkitekter for his academic inspiration, support, and good advice. Thanks also go out to my employees and co-workers who have stepped up and taken on responsibility during my absences to Trondheim and abroad while studying and writing.

Thanks also to Geir K. Hansen and Nils Olsson for their help and support as my supervisors on this thesis, and to Elin Røsok for all of her help in general at NTNU.

Finally, an extra special thanks to my fellow students in the Oslo group: Preben, Atle and Laurense without whom this study would have been a lot less interesting and fun.

Summary and conclusions

The goal of this thesis is to set a greater focus and priority to teacher workspaces outside of the classroom today. In order to do this, scenario planning has been used to explore possible futures of teacher workspaces in order to examine how future needs can be planned for and implemented today. To this end quantitative research was done on teacher workspaces today, and qualitative research was done in the form of literature review, interviews and scenario planning.

The scope of the thesis is limited to Norwegian primary and secondary public schools. The focus of this thesis is teacher workspaces and support spaces used for pre- and post teaching activities outside of the classroom.

The thesis concludes that teacher workspaces of the future will require a greater variety of flexible spaces where teachers can perform the various tasks outside of the classroom that support their core operation, teaching. There should be spaces for both collaborative team-work and quiet concentrated work. A greater variety of workspace can be provided for teachers without a significant increase in total area by providing more shared-use spaces for students and teachers, such as group rooms nearby teacher workspaces that can be used as meeting rooms and collaborative spaces for teachers outside of class time. New Ways of Working or Activity Based Working are two workplace theories that could be implemented for teacher workspaces.

TABLE OF CONTENTS

Figures and Tables

Figures

Tables

1. Introduction

This thesis project will explore the programmatic and spatial requirements for teacher workspaces in the future and attempt to set a focus on teacher workspaces today.

There has been a great deal of experimentation and development in school design over the last 20-30 years. The focus of this has often been on the development of flexible teaching spaces to match ever changing pedagogical principles and trends as they gain notoriety or show proven results. Meanwhile, teacher workspaces outside the classroom have not developed as quickly. Teacher workspaces today look and function much as those that were built 30 years ago despite the fact that the teaching profession has also developed and changed along with pedagogy and politics. This thesis will attempt to better understand the work teachers do outside the classroom, and how architecture and design can play an active supporting role. The ultimate goal of this study is to design and plan better, more functional and more attractive working conditions for primary and secondary school teachers.

> *«If we believe that school design is important for the teaching environment, and that the teaching environment is important for the formation and education we can give students, then the discussion of school design is a question that relates to the quality of the society of the future.»*
>
> *- Ketil Kiran, former president of Norske Arkitekter's Landsforbund (NAL)*

1.1 Background

The design of corporate office spaces is a topic which has generated a great deal of research over the past 20-30 years. There are yearly international conferences that discuss all aspects of workplace design, and competing trends that claim to reduce costs and increase performance in the workplace (Blakstad, 2001). There is also a great deal of international research and conferences on school design and education. These tend to focuses mainly on the pedagogic models for teaching, school organization, pedagogic models for teaching, or the design and arrangement of the classroom itself. Surprisingly, there seems to be little research into workplace design for teachers and the functions they perform outside of the classroom.

There are a many studies that explore teacher efficacy and how to improve it (Tschannen-Moran and Hoy, 2001), but most of these are related to the social and political environment of teaching, and not necessarily the physical aspects of a teacher's work environment and how they support their function. The classroom remains the main working environment of teachers and there has been significant developments in classroom design and pedagogical theory that have changed the physical learning environment of schools (Kuuskorpi, 2011).

Recent changes in the teaching profession are requiring teachers to spend more and more time at school where they are expected to perform a greater number of tasks (Kunnskapsdepartementet, 2014). Are the current designs of teacher workspaces optimized for the job at hand, or do changing demands require new or different spaces? This paper hopes to shed some light on the different spaces where teachers work, in and outside the classroom, as a contribution to the study of schools as complex social and functional entities.

This thesis will study historical and current trends in teacher workplaces, as well as current trends in workplace design in general. Technology has played a major role in the history of workplace design and area planning, so it will be necessary to look at how it can effect the future of teacher workspaces as well. Scenario planning will be used to explore how the adaptation of new technologies could change the requirements for teacher workspaces and other factors that will effect the changing workplace landscape in general.

A report from 2012 has estimated that there will be 27,200 too few teachers in Norway in 2035 (Roksvaag, 2012). This means that schools will have to fight harder to recruit and keep the best teachers on staff. This thesis postulates that an attractive workplace that supports a teacher's development and learning will be an important tool for schools to attract the best teachers. In 2020 an unprecedented 5-generation workforce will demand new and more individual solutions and a workplace that allows for more «collaboration, authenticity, personalization, innovation and social connection» (Meister and Willyerd, 2010).

A review of teachers' workspaces in Norwegian schools over the last 20 years shows that they are often under-prioritized or «leftover» spaces. Client demands for a greater degree of space efficiency and building regulations that focus on energy efficiency have resulted in new school forms with more compact and deeper plans. This school type creates large areas without direct daylight or views that subsequently needs to be filled with «secondary» functions. Teacher's workspaces and group rooms have in recent times been relegated to these dark and unattractive corners. Previously this was accepted due to the fact that teachers spent most of their day in well-lit classrooms. However, as teachers are required to spend more and more of their time at school and the kinds of tasks they are expected to perform become more diverse these secondary spaces do not optimally support the work at hand. Unfortunately, much of the debate about teacher workspaces has been limited to a focus on square meters per teacher (Grande, 2014) and not the qualities of the space.

Considering the time it takes to develop a new school from planning to conception, new schools today should already be thinking strategically and should implement and invest in the areas necessary to create the optimal teacher workplace of the future (Bølviken, 2013). Existing schools should also consider and plan for how they can accommodate the changing needs of their teachers. This study will look at historical context, current solutions and future scenarios to examine the future of teacher workspaces.

1.2 Purpose

The purpose of this thesis is to evaluate how current developments in teaching and workplace theory may effect the programmatic and spatial requirements of teacher workspaces in the future. The main focus will be on teachers' offices and support spaces outside of the classroom where pre- and post teaching preparatory work is performed.

Teacher offices today are often under-prioritized and designed upon workplace ideals that are outdated in relation to the wide variety of tasks teachers are expected to perform. Looking 15 years into the future, this thesis will examine how teacher workspaces can evolve to meet today's needs and those of the future. Placing teacher workspaces in the spotlight here will hopefully contribute positively to the design and planning of teacher workspaces today, improving workplace satisfaction, teacher efficacy, and ultimately school performance well beyond the next 15 years.

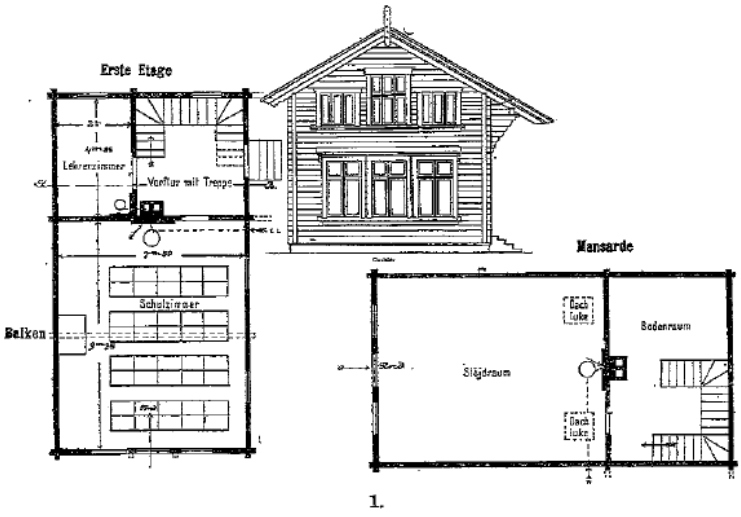


Figure 1.1 - One room schoolhouse in rural Norway ca. 1890. (Håkonson-Hansen, 1901)

1.3 Problem Definition

With a predicted teacher shortage of 27.000 teachers in 2025 schools will need to think differently than today in order to attract and keep the best teachers on staff in the future. Increased professionalization in teaching is changing the role of teachers and the expectations and requirements they must fulfill to do their job. Recent developments have resulted in teachers being required to spend more of their time on-campus and more time on non-teaching tasks performed outside of the classroom. Teaching has developed from an activity based upon individual sole practitioners to a team-based task. This requires teachers to spend more time collaborating and planning, when at the same time they also need spaces for quiet and concentrated work. Typical teacher workspaces today are poorly suited to a teacher's new workday.

In most other sectors of office-based work developments like New Ways of Working (NWW) (Blakstad, 2001) and concepts like Activity Based Workplace (ABW) (Lhoest, 2012) are being implemented to increase productivity and provide greater flexibility for office workers. While developments in technology and pedagogy have brought about major changes in the classroom and classroom design, teacher workspaces remain much as they were during the last 60 years. To compound this problem, new building regulations and energy-efficiency requirements have brought about new, more compact, school typologies (Houck, 2013b). These new buildings often feature deeper plans and less window area (Pedersen, 2014) resulting in new schools where teacher workspaces have little or no daylight.

Teacher workspaces today are under-prioritized and bound by the traditional teacher's office of the past. Most are not suited to the variety of activities teachers are required to perform outside of the classroom today. Exploring the idea of a teacher's workspace of the future will give valuable insight into future spatial and functional needs, allowing us to create more flexible and better working environments today that will function in the future.

Developments in the teaching profession, changing working requirements for teachers, and new technologies will effect teachers' needs for work space outside the classroom. New workplace solutions and area needs that support a combination of concentrated work and collaborative work will be different from historical teacher workspaces and new solutions

will need to be developed. If teachers are required to spend more of their time at school, there will be a greater need for a variety of spaces that support different working tasks. This includes spaces for collaboration, workplace learning, and spaces for quiet concentrated work. In addition a significant shortage of qualified teachers in the future will lead to the need for new technological and organizational solutions that allow for a sharing of teacher resources across schools and geographic boundaries.

1.4 Research Questions

In order to imagine new kinds of teacher workspaces in the future the year 2030, 15 years from now, has been chosen. This span of time will allow us to speculate about their programmatic and spatial requirements outside of current day politics and the baggage of traditional working habits. Interviews and discussions with teachers and administrators show that hold conservative opinions about what a workspace can and should be, especially among the older generations. Looking 15 years into the future also makes it easier to imagine a workforce that is willing to embrace new ways of working and alternatives to existing solutions. The research questions in this thesis are based upon the three dimensions of work: physical, virtual, and social (Nenonen et al., 2009).

- Physical: What combination of rooms and facilities will provide functional workplaces for both individual concentrated work and collaborative teamwork among teachers?
- Virtual: How will new classroom and office technologies change teacher workspaces?
- Social: How can new workplace concepts be applied to better serve the teaching profession’s needs and changing working habits?

1.5 Limitations

Schools are large and complex organizations that differ greatly in design and implementation of pedagogical practice from place to place. This study is focused on Norwegian public primary and secondary schools. These have a somewhat homogeneous structure and common background for teaching practice as defined by the Ministry of Education and Research (Kunnskapsdepartementet). There are some references to high-schools or international schools to add perspective, but these were not the focus of this report.

When defining a teacher's «workplace» and «workspace» the focus of this thesis will mainly be on spaces outside of the classroom where preparation, collaboration, grading, planning and other work is done. This includes, but is not limited to, the teachers' office, group rooms, grading rooms and associated spaces that are prioritized for teachers. The classroom remains the space where teachers spend the majority of their day engaging in their core activity, teaching. There are many studies on the classroom, so this thesis will focus on what other kinds of spaces are needed outside the classroom. To do this it will look more closely as what teachers do, where they do them and what future scenarios might effect these.

Studies have shown that having optimal workplace will have a positive effect on teacher efficacy or student performance (Schneider, 2003) (Perie and Baker, 1997) (Rosenholtz, 1989). There are also a plethora of studies that link workplace satisfaction with performance in office environments (Becker and Steele, 1995) (Becker, 2005) (Blakstad and Andersen, 2013). From these we will make a general assumption that an improvement in teacher workspaces will have a positive effect and influence on both the teachers and their students.

2. Methodology

2.1 Approach

The main focus of this thesis is to set a greater focus on teacher workspaces outside of the classroom today. Examination of historical and current workspaces, combined with speculation about future scenarios allows us to make assumptions about how teachers may work in the future. Several methods of study have been applied to form a basis for postulation. An explorative research approach was used to give a clearer picture of the problem at hand. Within this both qualitative and quantitative methods have been used to process and discover data.

Quantitative methods relate to variables or data that can be quantified. Qualitative analysis of 47 school plans and school statistics give concrete data that can be used to find patterns or relationships within the data.

Qualitative methods relate to information that can't be quantified. In this case, interviews with teachers, a principal, and a school planner have given insight into their experiences with current working conditions. The interview subjects have also been challenged to posit future possibilities.

Scenario Planning is a method allows one to make predictions based upon a set of key variables that are known, and a set of important unknown variables. When attempting to foresee what future teacher workspaces might be like scenario planning makes it possible to evaluate a set of possible outcomes and then generalize about how they could effect the present. The scenarios predicted combine a study of the situation today, combined with a set of hypothesis that point to a certain path of development. Even though predictions may not be accurate, they can still serve as a way of exploring possibilities that would be difficult to explore in the context of the present.

> *«Good scenarios challenge tunnel vision by instilling a deeper appreciation for the myriad factors that shape the future» (Schoemaker, 1995)*

2.2 Description of methods

The following methods have been utilized in this study:

- Literature review
- In-depth personal interviews
- Data collection and analysis of 50 schools from the last 20 years.
- Scenario Planning

Method triangulation is used to increase the reliability and usability of the data that has been gathered using the various methods above. Background information collected from interviews, analysis of current schools, and theory from literature review form a solid base of information. The triangulation of these three basic methods has functioned as a launchpad for the speculative work of scenario planning.

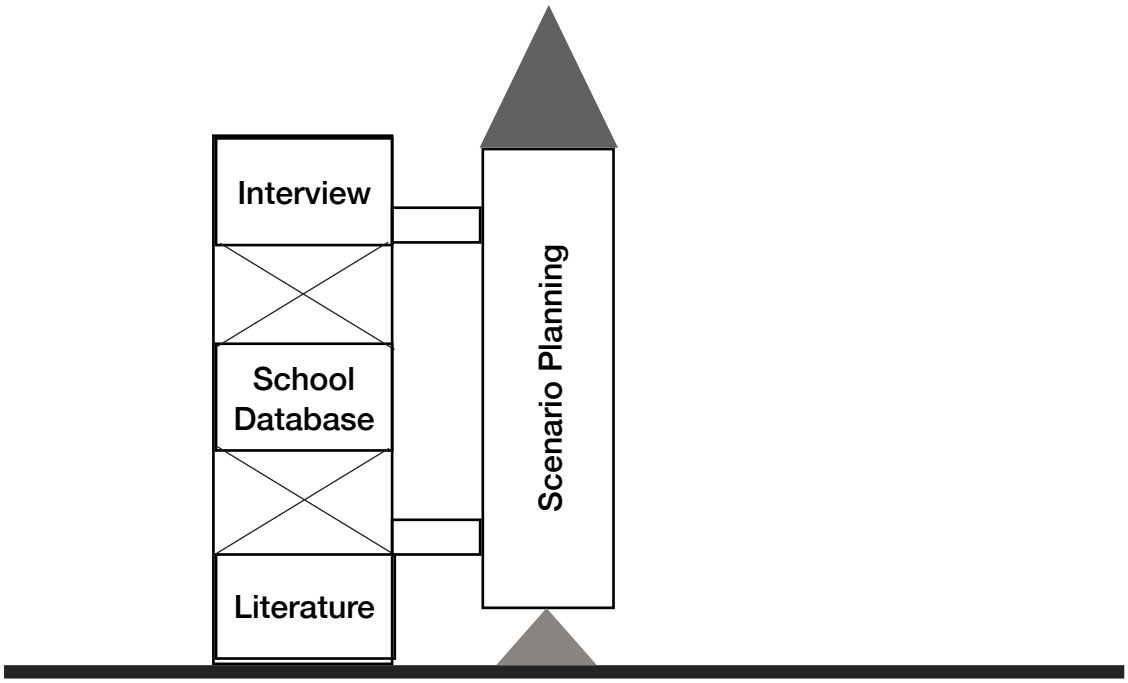


Figure 2.1 - Method triangulation as a launchpad for scenario planning

2.2.1 Literature Review

An extensive literature review was carried out that ranged over a variety of topics and resulted in a list of over 150 books, texts, journal articles, and web presentations. Initial searches were carried out online via the BIBSYS system at NTNU to find relevant material in the NTNU Architecture Library.

There were a number of good sources of information to be found in the NTNU library at NTNU including general books on school design, records of the School Building Prize from 1998-2002 (Skolebyggprisen), and pamphlets on school design published by the department of education . Google Scholar has been the source of the majority of the literature which has been used. Searches on Google have ranged from historical texts about school buildings in Norway, to political tracts on the importance of democracy in education, quantitive studies of teacher efficacy in USA, to doctor and masters thesis studying Norwegian schools and building practice. Search-words included «teacher workplace», «teacher workspace», «new ways of working», «teacher performance», «future of education», «workplace innovation». As relevant articles were found, they led to new and more relevant articles by following the references in their bibliographies.

When relevant books or periodicals were not available online they have been ordered from amazon.co.uk and added to the office reference library.

2.2.2 Data collection and analysis

Quantitative data of high quality about school architecture proved difficult to come by. For the purpose of this study a spreadsheet database was been created to gather quantitative information about schools from a number of different sources. This allowed for a limited form of quantitative data analysis about existing school projects and teacher workspaces. The level of information available varied from project to project depending on the source. A critical amount of data was available for 47 different schools that made their way into the database.

Initial searches for school information were done through back issues of Arkitektur N (formerly Byggekunst) the official Norwegian architectural magazine produced by the Norwegian Architecture League (NAL). This, however, only yielded a list of seven schools with basic project information and diagrammatic plans which was not enough.

Further information was provided by the webpage «Advisory services for kindergarten and school facilities» (Utdanningsdirektoratet, 2015a). This site contains a list of some 50 schools presented as examples for school owners to help in the planning of new schools. The web articles on the website varied greatly in the amount and kinds of information that was listed for each project, but there were a good number of projects that provided links to complete plan drawings. Some the most recent articles also contained photos of teacher workspaces. References to and descriptions of teacher workspaces were available for most of the newer projects, which shows that this is an area which has received increased attention in the last few years.

The Norwegian Directorate for Education and Training (Utdanningsdirektoratet) publishes updated information about the number of students and number of teachers at Norwegian schools on the website Skoleporten (Utdanningsdirektoratet, 2015b). Updated student numbers were obtained for all of the schools in the database in order to have a current and correct picture of teacher density and number of teachers per student. The current numbers were used for all projects instead of the number of teachers the school was designed for with the exception of one new school which currently had only 1/4 of the amount of students it was designed for as it was not fully in use yet, here the planned numbers were used.

The database is limited to built schools or projects under construction. Competition projects or preliminary designs were not used because they have not been through the developmental process that ensures that the final solutions are approved by the school users and administration. Reference projects and further information about schools have also been supplied from completed projects at SPINN Arkitekter and from other colleagues who provided supplementary information about projects for the purpose of this study. Where possible the location of teacher workspaces has been highlighted in the plans to simplify identification and analysis.

Figure 2.2 - Example of the school database spreadsheet

The school database contains factual information about the schools such as school type, name, building year, renovation year, size in m2, # of students, # classes per year, # home room teachers, # teachers, Teacher workspace organization, # teachers per room, daylight, layout, text description of teacher workspaces. There is also room for plans, photos or diagrams where available. In total, 47 schools are listed in the database at the conclusion of this thesis.

The data in the table was sorted by different factors in order to extract information. For example, when looking at daylight the data was categorized by three ages which correspond roughly to dates of pedagogical reform in Norway. The projects were then sorted in the sheet by age and the number of projects with, or without sufficient daylight were tallied. The results of this tally were then placed into a graphical form for interpretation. By sorting the list according to the desired variables it was possible to do a quantitave comparison of a number of factors that shed light upon organization and qualities of teacher workspaces.

2.2.3 Interviews

In order to get a sense of a teacher's workday and the spaces needed to support their work a number of structured interviews were performed. The subjects of these interviews were chosen based upon their roles related to schools and from a variety of ages to be representative of the multi-generational workplace. The interviews were initially carried out to inform the creation of future scenarios, and are by no means to be exhaustive. However, the individuals chosen for interview all report that they are fairly «typical» of their generation and that their opinions and work-habits are generally representative. An interview guide was distributed before the interview and included the following main areas for discussion.

Facts: Personal information about the interviewee, including their age, educational background, current position related to teaching, previous experience, and which generational category they belong to.

Central questions: The subjects were asked to describe a typical workday or workweek for a teacher today with a focus on which rooms and facilities they use on a daily basis.

Collaboration: How does their current workspace support or inhibit collaboration among colleagues, and what improvements could be made to allow for better collaboration.

Changes in the teaching profession: A discussion about current and past trends in teaching as a profession. This included a discussion about the binding of a teacher's time, teacher training, the projected lack of teachers in 2025, and the generational workplace.

Technology: Changes driven by technology were discussed historically and looking forward. The role of 1:1 computer coverage in classrooms and the effects that technology will have on their workday and workspace. The subjects were also asked to imagine their workday in 2025 and what that might be like.

The interviews were concluded with a general discussion about the current state and future of teacher workspaces. The interviews were recorded digitally, and transcribed as summaries. As the conversation was somewhat free flowing, their responses were later matched with the questions that were most relevant in the interview summaries in the appendix.

2.2.4 Scenario Planning

Scenario planning is a method used in strategic planning «to discover or intent, examine and evaluate, and propose possible, probable, and preferable futures». (Bell and Olick, 1989) A scenario is often defined as a description of how one can imagine a plan, action or a future development. Scenario planning can be considered a quantitative practice based upon a firm belief in the planners ability to predict the future. (Møller, 2012)

In this thesis scenario planning is used to describe three possible futures set in 2030 where we can freely imagine implementing new ways of working to tackle changes brought about by the invention and implementation of new technologies. The scenario planning was performed based upon methods described by Shoemaker. His 10 step process has been simplified and combined with an selection of variables to create three short descriptions of possible futures, a combination of procedural and intuitive scenario planning (Schoemaker, 1995). Defining three scenarios that involve two extreme variables has created three very different futures from which we can speculate about the future requirements of teacher workspaces.

2.3 Reliability of Data / Data Validity

Good reliability of data can be shown if a measurement is repeated several times and the results obtained are the same. (Larsen, 2007) Reliability and validity generally relate better to quantitative research than they do to qualitative data. This is largely due to the fact that quantitative research has decided what factors it will measure ahead of time. To ensure validity in qualitative research it is important that the researcher be unbiased. Data gathered with qualitative methods should be handled in a way that gives the same treatment to all who are interviewed or questioned and that their responses be related back to theory. (Halvorsen, 1987)

The quality of the quantitative data in the school database is difficult to test. The data is taken primarily from a governmental website that showcases schools as good examples. One can question if the data is representative of all Norwegian schools as these are the «good» ones. However, the relevance of these schools as models for good school design should say something about them as interesting objects. Data related to student and teacher numbers is

based upon actual enrollment and employment in 2014, which gives an accurate picture of that point in time. However these numbers must vary somewhat from year to year. Physical data of area and number of teachers per room are based upon interpretations of plan drawings or photographs, and can as such be incorrect. The number of desks drawn in an architectural plan may not necessarily reflect the number of teachers that actually share the space. Photographs may also not reflect which desks are actively in use. That said, the results of the quantitative analysis here are mainly to give a general idea of the current situation in order to create scenarios of possible future situations.

The sources in the literature study of this thesis are based upon reliable academic sources with references that can be checked. Where possible the original source was tracked down and read using the bibliography. At the conclusion of this thesis there are 182 sources gathered in an Endnote library, of which some 80 are actively used as source material in this thesis.

The qualitative data gathered through the interviews was used to give a direction to postulations of future scenarios. The limited number of interviews are not enough to make any conclusions about how the different generations imagine future workspaces. But they did serve the purpose of giving a clearer idea about a «typical» teacher's workday. In that all of the respondents painted a very similar picture with a high degree of overlapping information.

2.4 Procedural Outline

Work on this master's thesis was began based upon the author's background and personal experience from the design of schools and teacher workspaces. Having visited a good number of schools and studied many school designs there was a general impression that teacher workspaces were under-prioritized and treated as secondary spaces.

The teacher's strike of 2014 brought the question of how teachers spend their time at school to the public's attention again. One of the main points of disagreement in the teacher's strike was the demand to bind a larger portion of a teacher's time to on-campus time, while the teachers desired a greater degree of freedom and choice as to where and when they can do

their work. The quality of teachers workspaces was directly related to the debate as it was pointed out that the facilities at many schools were not good enough for the tasks at hand if teachers are expected to be there for a longer period each day.

This sparked the idea of researching teacher workspaces to find out how to improve them. A more functional and attractive workspace should be considered an important selling point when schools recruit teachers in the future. This was also an opportunity to ensure that research done for this masters thesis could positively influence the design of school buildings at SPINN Arkitekter.

The first phases of this study started with an exploratory search for relevant theory and background information in the form of a literature review. Searches were carried out on topics related to the teaching profession, workplace design and school design. Before choosing a method for the research it seemed important to have a greater understanding of the history of the teaching profession, and how it was developing here in Norway, so the search was expanded to include education history and development as well.

It quickly became obvious that there was a wealth of studies and information about pedagogy, educational trends, teaching methods, and what happens in the classroom. However, there was little or no information to be found that related directly to teacher workspaces outside the classroom. This made it necessary to research other aspects of workplace research and workplace trends to draw parallels. Research into NWW also led to information on ABW which presents itself as a further development or alternative methodology that combines physical space planning solutions and technological workflow solutions.

Structured interviews were carried out with a select group of teachers, a principal, and a pedagogic planner. The interviews were used as a way to get a better sense of a teacher's workday, and to discuss the role of technology in the classroom. The subjects chosen represent varied age groups in order to cover the spectrum of the generational workplace. The interviews were taped and a summary transcript was made after each interview. Future technologies and speculation into the future of teacher workspaces were also an important theme as a background for scenario planning.

The idea to use scenario planning as a way to examine future scenarios related back to a presentation from Eric Beltran Canepa who presented his masters thesis at an introductory course for the masters program at NTNU. Canepa's master has been a source of inspiration for theory and method related to his study of future work spaces for Statoil (Canepa, 2011)

In order to have some concrete data about teacher workspaces a search was carried out to find school plans and drawings. The idea was to gather a database of school plans of a quality that would make it possible to measure, examine and categorize some of the most important physical characteristics of teacher workplaces today. With complete architectural drawings it would be possible to recreate them in 3D to measure size and arrangement of teacher workspaces, the number of teachers per room, daylight and views, furnishing and ancillary rooms. Unfortunately it has been difficult to find enough high quality plans of school projects in magazines and books to allow for this to be practical. Plan drawings on the internet were often too small to measure with any reliability, and facades or sections were completely lacking. It was still possible to determine where teacher workspaces are placed relative to each other and student areas in general. The webpage «Advisory services for kindergarten and school facilities» contained a lot of useful data, but it was necessary to extract it from written text, diagrams, or supplement with google searches or links to architects web pages.

A database was created in a spreadsheet to gather as much information about schools as possible. Schools were divided into type and relevant data was entered as best as possible. Relevant information about teacher and student numbers were gathered as well. Once all of this data was gathered a simple analysis was carried out by sorting the data to look for trends or developments. Were there certain arrangements of teacher spaces that were more common in primary schools vs secondary, or according to school size? This data is gathered and explained in the results section.

Scenario planning was used to develop a set of possible conditions that may contribute to the design and planning of teacher workspaces in the future. The goal here is not to make «accurate» predictions, but to challenge the current paradigm and create possible situations that might otherwise be overlooked (Chermack et al., 2001). This was carried out by making a list of critical factors and evaluating their impact on teacher workspaces.

2.4 Thesis structure

This thesis is organized into the following chapters:

Chapter 1 - Introduction

Chapter 2 - Methodology, a presentation of the methods used

Chapter 3 - Theory and Literature study, a presentation of relevant theory and literature

Chapter 4 - Results, a presentation of data gathered using the methodologies described

Chapter 5 - Scenario Planning, 3 future scenarios

Chapter 6 - Discussion, results compared to theory as they relate to this thesis

Chapter 7 - Conclusions, answers to the research questions posed

Chapter 8 - Appendix

Chapter 9 - Bibliography

3. Theory and literature study

The theory and literature study in this thesis looks at the historical and theoretical aspects that effect teacher workspaces. This begins with a focus on schools and teachers. Starting with a brief history of the development of the Norwegian school system, the developing role of the teaching profession and school development. Workplace theory will be examined as it is applied to general offices and the trends that have evolved there. Current teacher workplaces will be examined through legal requirements and programmatic developments. Finally, scenario planning will be introduced as a method to test possible futures. Future trends will be discussed as a background for the scenarios used to develop teacher workspaces of the future.

> *«All other reforms are conditioned upon reform in the quality and character of those who engage in the teaching profession» (Dewey, 1916)*

3.1 History of the Norwegian school system

3.1.1 Origins of Norwegian Schools

Organized schools in Norway were created in the mid-1100's when Norway became an archdiocese and clerical schools were created. However, it was not until 1739 that Norway (then a part of Denmark) had it's first educational laws. Educational opportunities varied greatly depending on social status and location. Obligatory schooling was introduced in 1889 with the goal of creating a uniform, national culture. The first 7 year primary schools were introduced in school laws of 1935 and 1936, creating a school for the whole population and the roots of the school system today. (Grankvist, 2000)

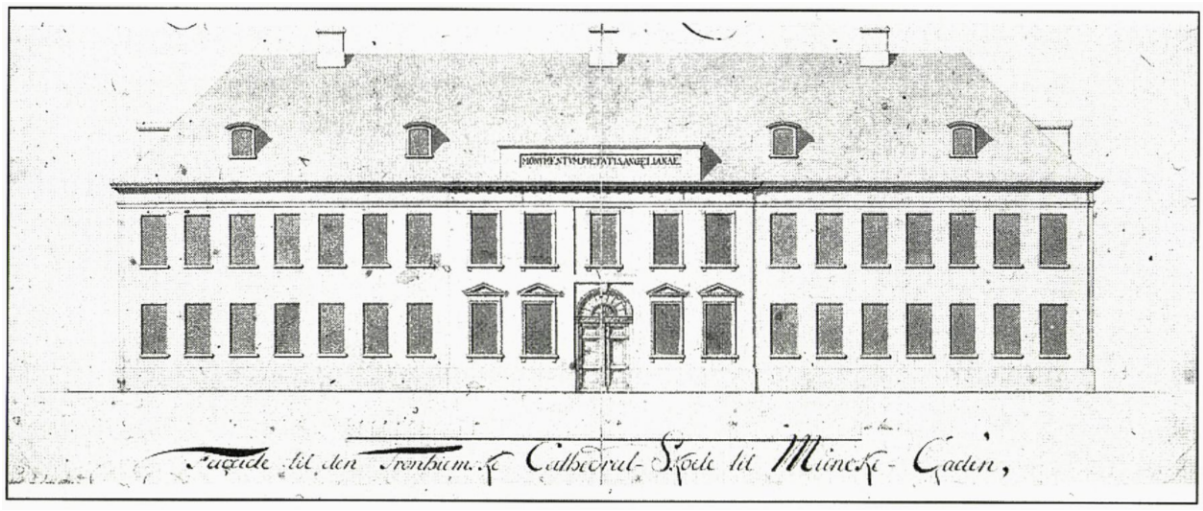


Figure 3.1 - Trondheim Cathedral School from 1787 (Grankvist, 2000)

3.1.2 After 1945

The post war period in Norway saw a new focus on education as a way to rebuild society. The idea of a «unified school» (enhetsskolen) was implemented with the goal of ensuring that all children would receive the same kind and quality of education regardless of where they live. (Mauseth, 2012) Norwegian schools also underwent radical change in the 60's and 70's as more people moved to cities, and industry began to give way to a service economy. The reforms of the 1990s (in particular '97) was the first time that education was considered as a continuous path from primary, secondary and upper secondary to higher education. (Baune, 2007)

3.1.3 2000 and beyond

Since 2000 a worldwide trend towards «life long learning» has brought about a paradigm shift in education and in Norwegian schools. Norway's participation in the PISA testing program showed surprisingly average results and spurred a new school reform based upon «Knowledge Promotion» to give a focus to core subjects and core knowledge. This should include basic skills and testable goals of competence in all school subjects. (Mauseth, 2012)

The most recent in a series of school reforms, «Teacher Lift 2014» (Lærerløftet) is intended to improve the level of education and raise the level of professionalism in teaching in Norway. According to the department of education, One of seven Norwegian teachers, and one of five math teachers in Norwegian schools lack specialized training in the subjects they are teaching. (Kunnskapsdepartementet, 2014) The Teacher Lift 2014 has a strong focus on teachers as the most important factor for good schools. «Nothing can replace a teachers professional weight and the contact they have with the individual student. Professionally strong and motivated teachers are the most important contribution for children learning more at school», (Kunnskapsdepartementet, 2014)

Recent developments in Norwegian schools include a trend towards energy savings, larger units, and varied pedagogical methods. Energy savings has led to school districts building newer, more compact and efficient buildings as well as rehabilitation and extension of existing schools. There is also a tendency to gather a number of existing schools together in one building or campus. In addition to reducing operating costs, larger units allow for more specialization among the teachers, a more professional administration, better facilities for sport, culture and other special teaching areas. Current pedagogical trends call for a specter of differentiated room sizes and facilities as part of the main teaching areas. This provides students and teachers with a wider choice of spaces for different types of work - individual work, group work, traditional teacher-led lectures, student-led presentations, and flipped classrooms.

3.2 The developing teaching profession

3.2.1 Professional development

The reforms and history above are closely tied to the development of teaching as a profession and a teacher's role within society and the school. The role of teachers has undergone a continuous development hand in hand with the school and educational system reform. The era of teacher as a private-practicing knowledge distributor from the early 1800s has been replaced by a teaching profession that is focused on teamwork and collaboration, the same trends that are developing in other professional occupations today (Wille and Svanberg, 2009).

3.2.2 Types of teachers

Teachers in Norway are divided into the following categories according to their education and specialization.

- General Teachers (Allmenlærere) - 4 year high-school education, (previously teachers' schools, or teacher's high-school).
- Subject Teacher (Faglærer) - Specialist in one or a series of subjects, usually practical or aesthetical. Qualified to teach subjects in primary school, high-school or adult education.
- Practical Pedagogic Education (PPU) - Educated in a group of subjects, such as sciences or humanities, with a supplementary one-year pedagogical education. Reform 94 included new practical learning and created a need for teachers with experiences in various working fields. Qualified to work in primary schools from 5th grade and up.
- Special Education - Education in special education requires additional coursework at a high-school or university. Usually, they will have had a background as a teacher.
- 5-year integrated teacher education - Newly created educational direction from 2003.

TEACHER TYPE	TOTAL	MEN	WOMEN
General Teachers	71657	22902	48755
Subject Teachers	16452	5155	11297
PPU - high school or university	32701	15407	17294
Special Education	1835	435	1400
PPU - vocational	14615	8478	6137

Table 3.1 - # of teachers aged 17-74 by type and sex (Roksvaag, 2012)

3.2.2 Changing profession

Contractual agreements between teachers, and their representative organizations also relate to the school reforms. In 2004 employer responsibility for teachers was transferred from the national government and a new agreement was made between the counties (KS) and the Union of Education (Utdanningsforbundet). A new central contract agreement was introduced with the goal of developing schools and education in Norway through pedagogical development processes at the school level. With individual customized teaching levels, teachers have taken on the role of «supervisors» instead of «lecturers». Teaching has become more of a combination of shorter lectures for larger groups together with problem solving and individual work with smaller groups. (Buvik, 2007)

With the 2004 school reform came new duties for teachers to support the following goals:

- increased teacher-student contact
- increased collaboration between teachers, parents, and school administration
- flexible organization of a teacher's time for teamwork
- varied working methods
- inclusion of students in planning, implementation and evaluation of their education
- flexible workloads
- predictable working environment for employees
- increased possibility for continuing education of teachers and staff
- increased space for school development
- simplifications that give more time to pedagogic leadership

-(Nicolaisen and Nyen, 2004)

3.2.3 Changing working hours

Working hours for teachers have always been unusual compared to a typical office-worker. Originally teachers were paid based upon classroom time without considering the total teaching load (leseplikt). Teachers had full autonomy over where and when they were to perform their necessary duties outside the classroom (Hagemann, 1992). The level of autonomy has been greatly reduced over the last 60 years while the definition of their duties has expanded.

In 1948 teachers were included in the national governmental regulated pay scale. This required a new definition of teaching load in order to be able to relate a teacher's full time equivalent (FTE) to other government employees. The government defined an average teaching load which included a total number of hours divided between classroom time and other related work outside of the classroom, and teachers were given more and new duties. (Hagemann, 1992)

The binding of a teacher's autonomy and free-time has been a central theme in contract negotiations about teachers working hours and salary. The freedom to correct student work or prepare for class from home or elsewhere is widely regarded as one of the main benefits of teaching, together with long vacations. In 1984 the teachers union (Lærerlaget) called for a working contract based upon FTE as an argument for higher wages. A yearly FTE of 1717,5 hours was agreed upon without a set number of hours of office time on campus. This was later reduced to 1687,5 in 2001 to incorporate vacation time. In 1994 a new agreement was made wherein 190 hours (five hours a week) were bound to on-campus work outside of the classroom. This was adjusted to 150 hours in 2002 to account for an increase in teaching load. (Nicolaisen and Nyen, 2004)

3.2.4 Division of time:

According to the central agreement (part A) a teachers FTE is 1687,5 hours. 38 school-weeks, plus one week for teacher development. A teachers time is split between on-campus (bound) time and flexible (personal) time. On-campus time includes classroom teaching, planning, collaboration, parent/teacher contact, self-education, and course preparation / grading.

> «Shopkeepers working time is tied to their opening hours, and it's difficult to have a home office. Industry workers have to be on the factory floor, whereas an engineer in the same company can do much of his work from home. For many employees it is the results that count more than where you do the work - or how long you spend doing it» - Bård Jordfald from FAFO (Tjeldflåt, 2014).

Flexible time includes coursework preparation and grading as well as time for self study of work related topics. There is nothing that prevents teachers from spending their «flexible time» on-campus, but the vast majority of them choose to do these tasks at home in the evening, or off-campus. This is mostly due to a lack of workspace suited for concentrated work. (Nicolaisen and Nyen, 2004)

	ON-CAMPUS HOURS	FLEXIBLE HOURS	SUM
Primary Education	1300	387,5	1687,5
Lower Secondary	1225	462,5	1687,5
Secondary	1150	537,5	1687,5

Table 3.2 - Teacher working hours, on-campus and flexible hours

3.2.5 Collaboration

Collaboration among teachers has existed prior to the latest contract reforms, but teaching has traditionally been characterized by an individual approach. Recent reforms have moved away from «my students» to «our students» and the focus on collaboration has become more important. (Løtveit, 2014) This change has effected the teacher's workday and the tasks which they perform on a daily basis.

FROM CLASSROOM FOCUS TO TEAM ORGANIZATION		
From the private practicing teacher	to	a professional and social community
From MY students	to	OUR students
From coordination	to	collaboration
From static student groups	to	a flexible organization of student groups

Table 3.3 - From traditional to team teaching. Presentation by (Løtveit, 2014)

Collaboration and organization of team teaching varies greatly depending on the size and type of school. Common grouping of teams is by year, by subject, or by homeroom or «base» area. There are also part-time teachers and other teachers who fall outside of these groups, creating groups that are not always directly connected to each other.

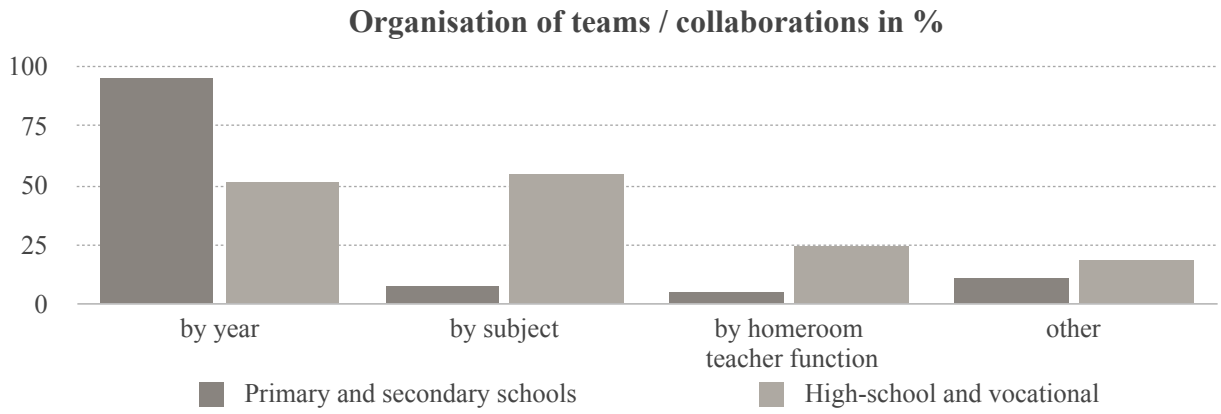


Figure 3.2 - Organization of teaching groups in primary and secondary schools (Nicolaisen and Nyen, 2004)

As an example of how the role of the teacher and inter-teacher relationships have changed, we can compare the following quote from the 1970s to the situation today.

> «It seems that teachers can work effectively without the active assistance of colleagues, since teacher-teacher interaction does not seem to play a critical part in the work life of our respondents.» (Lortie and Clement, 1975)

The idea of teacher as a sole-practitioner does not mesh well with the current pedagogies and guidelines of today. Newer studies have shown that inter-teacher social relationships have an important impact on teacher efficacy and their workplace. The teacher's lounge is often noted for being a center for teacher socialization, and an important part of a teacher's workday (Ben-Peretz et al., 2000).

> «Collegiality is the basis for group spirit and the bonds that hold a group together, allowing it to achieve extraordinary success. Once team spirit develops, the power of the team will work in almost any situation» (Cunningham and Gresso, 1993).

Studies have also shown that schools with higher levels of collaboration among staff (and administration) have a positive effect on student performance. A positive and collaborative school culture can be described as «schools where teacher development is facilitated through mutual support, joint work, and broad agreement on educational values» (Gruenert, 2005). This contributes positively to a school's «Ethos», which can be defined as a mix between its environment, atmosphere, and social relationships (Perie and Baker, 1997). The teacher's lounge is described as one of the simplest ways to test the ethos, by listening to the kinds of conversations which take place there. «Despair or exasperation covered by a sardonic humor… or you might overhear a discussion about how to help a pupil overcome a learning problem» (Ahrens-Hein and Eickmeyer, 2011).

3.3 School Development

> «Every school building houses a pedagogical theory, and the school building cannot be better than the theory it houses». Steen Larsen, Danish psychologist and pedagog (Buvik, 2009)

3.3.1 Physical teaching environment

There a number of ways to define what makes up the physical teaching environment. According to Kuuskorpi and Gonzales it refers to rooms, areas, equipment and tools (Kuuskorpi, 2011). Similarly Buvik et al. refer to this as the «physical surroundings» and include the school grounds, the school building itself, classrooms, fixed and loose furnishings (Bølviken, 2013). Bølviken points out the lack of focus on the physical environments of schools within pedagogical research noting that it «belongs to architects and architectural discussion» Hohr in (Bengtsson, 2011) or that «a belief that the physical environment is not important for learning» (Kampmann et al.), and «the physical environment is not among popular discourse among pedagogues» (Schratzenstaller, 2010).

On the other hand it is well documented that the most important single factor for teaching results are the school administration's and teacher's organization and teaching (Utdanningsetaten, 2008).

3.3.2 Physical context and operational culture

A study by Kuuskorpi et al. in 2011 set out to determine how school facilities can support the user. They have defined the physical learning environment as consisting of four learning contexts, that include the social, individual, formal teaching and informal learning processes. The combination of which greatly define the core of a school's operational culture. (Kuuskorpi, 2011). One important finding of this study was that the physical learning environment can greatly support educational institutions in changing their operational culture. Physical environments that supported new pedagogical methods and needs had a noticeable impact on students and staff.

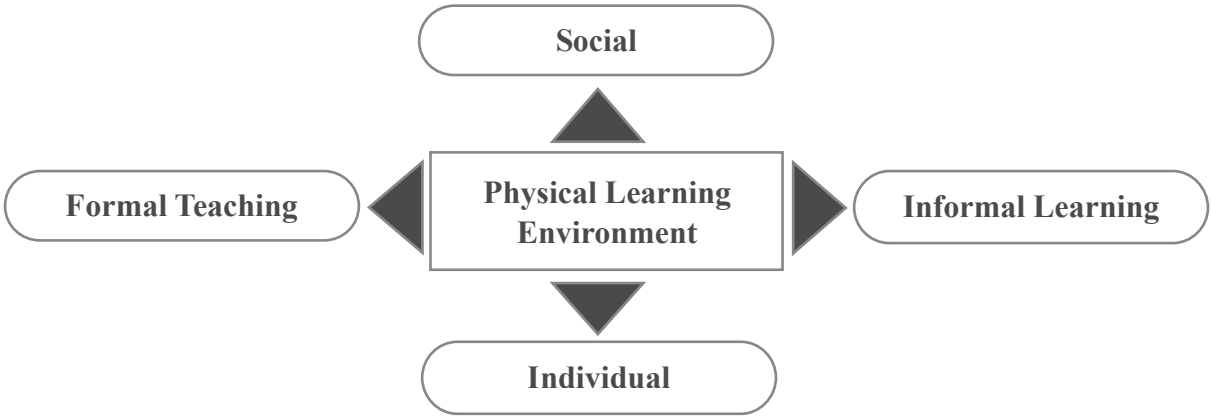


Figure 3.3 - Supportive learning contexts as shown in (Kuuskorpi, 2011)

3.3.3 Trends in Norwegian schools 2007

> «Varied work-forms and a greater emphasis on individually customized teaching dictate that schools should offer a greater variety of activities simultaneously without the students distracting each other. It is therefor desirable that student bases include rooms of varying sizes and equipment. Key words are project based work, teamwork, and taking responsibility for their own learning.» - SINTEF report on Nesna Skole (Buvik, 2005)

In 2007 Karin Buvik wrote «Trends in the physical design of primary schools» to summarize how pedagogical trends were changing school designs at that time. Project based work, individually customized learning, and mixed-age teaching are keywords in the introduction. Buvik points out that the new schools are more open and focused on social and cultural spaces. Aesthetic design of schools was prioritized, with daylight and acoustics highly prioritized. Many new schools were also seen as the «heart» of small communities where school facilities doubled as local cultural facilities after-hours. Transparency is mentioned as a trend with large areas of glass or internal glass walls allow for visibility between spaces. (Buvik, 2007)

COMMON MODELS FOR PEDAGOGICAL BASES	
Traditional Classroom	theoretical, individual or group work. Usually one form of activity at a time
Multifunction Classrooms	used for individual or group work, discussions or practical work. Most common in kindergartens, but also used in some high-schools
Large Classroom	a classroom large enough to contain two classes. Distribution or review of material with two classes at once
Flexible Areas / Landscape	used of multiple classes. Furnished for individual, group, or practical work
Mini-auditorium / Landscape	used by multiple classes for individual, group or practical work in an open landscape. Multimedia presentations in small closed rooms or mini-auditoriums that can be used by classes in turn
Student Offices	used for individual or group work, especially computer based work. Rooms for 5 to 10 students placed around a common forum where a larger group can gather

Table 3.4 - Common models for pedagogical bases in 2007 (Buvik, 2007)

3.3.4 Adaptability

School reforms from the ‘90s and ’00 have shown the need for school buildings to be adaptable. The fact that many municipalities focus on what they call «the school of the future» relates to the understanding that there will come reforms and innovation within pedagogy during the building’s lifetime. Generally one can say that new pedagogical theories are implemented every 10 or so years, whereas school buildings are built to last closer to 60 (Blyth and Worthington, 2010). This means that school buildings should be built with a high degree of adaptability in the form of generality, flexibility and elasticity at all levels. (Buvik, 2007)

3.3.5 Open Base Schools

Up until the early ‘00s open «base» schools were widely seen as the future of primary and secondary school buildings (Storstrand, 2014). Large flexible open areas replaced traditional classrooms. Base schools can be defined as schools with extensive use of open areas supplemented by group rooms (Vinje, 2011). This radical change was followed by a wave of criticism from teachers and parents, with noise problems and lack of structure in the classroom being the most frequent complaints.

According to Erlend Vinje, «Base schools are an architectural solution that is preferred by the school owners and administration, because the physical environment allows for lower running costs, flexibility to accommodate increased enrollment and the alternative pedagogical- and organizational forms which they prefer» (Vinje, 2013). The newspaper Bergens Tidene performed a national study in 2009 to compare student performance and well-being in base schools vs. traditional classroom schools. Using results from national testing and a student survey the study concluded that there wasn’t a significant difference in well-being or performance between the two school types (K. C Hoaas, 2010). This data is backed up by Vinje’s own study from 2011 in Oslo schools which concluded that teachers who taught in traditional classroom schools felt they had a better opportunity to utilize their classroom leadership and academic leadership for their students (Vinje, 2011).

Meanwhile, international studies can be found that give both weak-positive and weak-negative towards base-schools. School researcher John Hattie performed a meta-analysis of over 800 studies relating to achievement. The findings of this study are inconclusive, with «open classrooms» rated as number 133 of 138 possible measures to improve student performance. Hattie goes as far as to say that «open classrooms make little difference to student learning outcome» (Hattie, 2009).

3.3.6 Trends in 2014

In 2014 Espen Storstrand wrote a new article as a followup to Buvik's from 2007 to update on trends in classrooms in primary schools. Classrooms are not on their way out, but they are being organized differently than traditional classrooms. Bases or «Base-rooms» are being connected to a common home area for the year (Storstrand, 2014). Oslo Kommune defines this home area in the following way:

> *«Home area is where the students have a sense of belonging and spend most of their time. The home area is a «school within the school» and contains a set of rooms of different sizes and for different situations; group rooms, teacher workspaces, toilets and wardrobes. Each year can have its own home area, or they can share it with another. A home area should be equipped for a large variety of learning situations» - Standard room program for new primary schools (Oslo Bystyret, 2010)*

3.3.7 Shared- and multiple-use spaces.

To achieve area efficiency, new school buildings rely upon a high degree of multiple-use spaces. These can be flexible spaces that are shared between years, or spaces that have one use during the school day, and are rented out for another use outside of the school day (Storstrand, 2014). Whereas Buvik pointed out specialized rooms for kitchens, computer stations, or play areas in 2007, experience showed that these spaces were empty during large portions of the day. New trends are to give access to these kinds of functions and equipment in home areas or other common areas with a high degree of shared use.

3.3.8 Transparency

Storstrand writes that there is a typical trend towards a more transparent architecture leading up to 2014. Glass walls or large windows are used to give views in to various activities in order to give students and staff an overview of what is happening. Transparency is particularly prevalent in home areas where doors with glass windows, or glass areas allow a teacher to keep an eye on students who are working in different parts of the home area. Frosted glass or silkscreen are often used to selectively screen views or prevent «too much» transparency in areas where concentrated work take place.

3.3.9 Flexible or Mixed-size classroom schools

The current trend in 2014-15 sees classrooms as an important organizational tool for modern schools, with a focus on student «belonging» or «affiliation». The classroom or home area gives students a place where they know they belong, which is important to their well-being. However, the form and use of the classroom has changed. Classrooms and other teaching rooms are often of varying size and shape to build up under the different kinds of teaching and project work common today.

3.3.10 Effects of the physical environment on student performance

A schools physical design and pedagogical theory can be both positive and negative for student's results and well-being. The generalization shown by the studies in Schanke's literature study is the following, «If the physical environment is aligned with the school's pedagogic vision, then the environment can be said to be stimulating. If he physical environment is not aligned with the school's pedagogic vision, then it can be said to be inhibitory» (Schanke, 2008). Young et al. write «School buildings are only a piece of the education reform puzzle, but they may be a more important piece than we have understood in the past,». They go on to relate to the myth that «a great teacher can teach anywhere», but question to what extent they could do even better in optimal surroundings. There is no conclusive evidence, but a feeling that the physical school environment is generally underutilized as an active part of education (Young et al., 2003).

3.4 Workplace Theory

Trends in school design result in buildings with a lifetime of 50 years or more, whereas pedagogical trends can be said to change every 10 years. It is extremely important that new school buildings are flexible enough and general enough to adapt to new pedagogical trends. An indirect source of research on school buildings and the effects of their physical environment is the extensive research which has gone into study of the workplace and it's effects on production and well-being. Hines (1996) believed that this research can be related to school buildings (Schanke, 2008). Schanke goes on to conclude that further research that combined workplace theory and school buildings would be an interesting perspective for further research on school buildings.

3.4.1 Work and workplace

A workplace is considered to be more than just the place where work is done. Neonen, Vartiainen, et al. have divided the concept of workplace into three interrelated aspects, the Physical, virtual, and social (Nenonen et al., 2009). With this model work can take place in a combination of a physical setting and virtual space. Vartiainen refers to this as a «workscape» which includes the «layers of where we work» (Vartiainen, 2007).

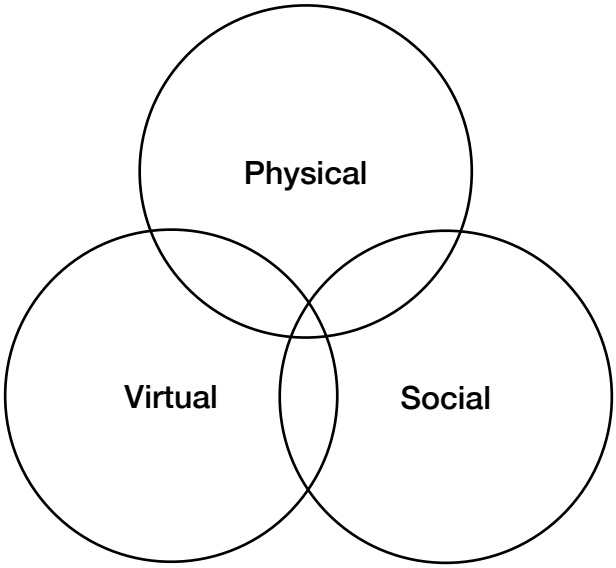


Figure 3.4 - The three dimensions of work, from (Vartiainen, 2007)

Physical space is an aspect of the tangible and built environment. This includes any facilities that are used for working and the equipment or furnishings that they contain. Examples of physical space in a school include the classroom, teachers offices, copy room, group rooms, etc. Equipment and furnishings may include copy machines, desks, teaching aids such as posters, computers or a whiteboard. Physical space can also be divided according to how it is used ranging from private to public, quiet to loud, etc.

Virtual space refers to an electronic construct where users interact or collaborate. This includes all forms of electronic communication, from email to instant messages, online communities like google+ or Facebook. Modern mobile technology gives users access to common virtual spaces almost irrespective of where they are (Nenonen et al., 2009). The technology used to access this could include computers, tablets, smart phones, or other devices that can communicate over the intranet or internet. The majority of Norwegian schools have implemented either «It's Learning» or «Fronter» as a platform for teacher-student-parent interaction, an example of the virtual dimension of a teacher's workscape.

Social space is created by collaboration and communication between employees in their exchange of thoughts, ideas, and opinions. A common belief system that is shared by colleagues who work and learn together. For teachers this includes interactions that range from team lesson planning, staff meetings, individual work, and interactions with administration, students, and parents. A study of the importance of the social interactions between teachers in the teacher's lounge have shown that social interactions and social environment at a school can greatly influence a teachers efficacy (Ben-Peretz et al., 2000).

3.4.2 Space Planning

Workplace Management and Space Management are important terms related to workplace theory. The idea that a workplace should support the core activities of a company is a key component of workplace theory. Workplace management can be defined as leadership or management of workplaces as a quantitative resource which include design processes, change, and the usage of workplaces (Nenonen et al., 2009). Space management and Space planning are discrete but related processes. Space planning involves optimizing a building

layout to suit a users needs. This should be related to the organizations strategic goals and FM plan. The result of space planning can be seen as a physical manifestation of an organizations space needs that takes into account employee, environmental, and organizational needs. (Best et al., 2003)

Within the space allocated to users of an organization, there are many different ways to organize and furnish the space. Becker's research and systematic analysis of workplace optimization shows that space planning can contribute positively or negatively on employee productivity. (Becker, 2005)

3.4.3 Flexibility, generality, elasticity and extendability

The ability of a space to adapt to new configurations in the future is defined with the concepts of flexibility, generality, elasticity and extendability. Flexibility refers to the ability for a building or space to meet new demands by changing properties. For example being able to easily move partition walls. Generality is a quality of a space to house a number of different functions or changing functions without having to change the space itself. An example of generality would be a rectangular room with good daylight that could be used as an office, a group room or a classroom without the need to make physical changes. Elasticity is the ability for a space or building to expand or contract based upon changing needs. In office buildings this would relate to the possibility to divide a larger space into several independently functioning units. Extendability is the ability to add on to a building or space, vertically or horizontally (Blakstad, 2001).

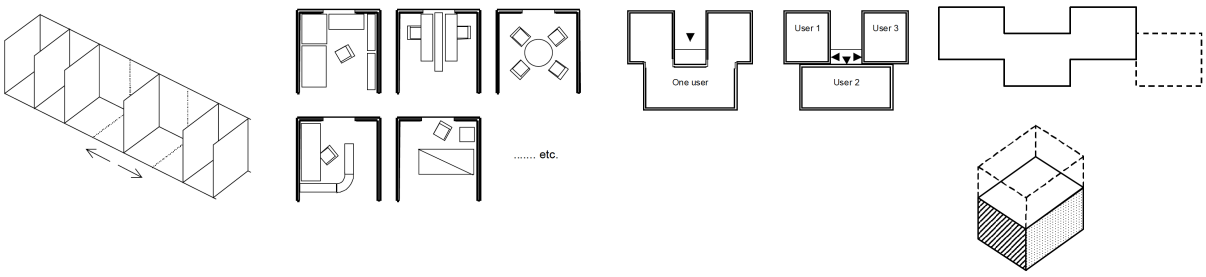


Figure 3.5 - Flexibility, generality, elasticity, and extendability. Taken from (Blakstad, 2001)

3.4.4 Area efficiency

Area and area use are the most important variables related to investments in new workplaces. This is also true of school buildings as area is not only related to the initial investment in building cost, but also upkeep and drift. Therefore area efficiency is always in focus in the development of new school buildings (Aspelund, 2008). Area efficiency can be achieved by joint use of areas, multiple uses of the same area and intensifying the use areas (NOU 22, 2004)

Nore and Aspelund define area efficiency into two aspects, Technical and Organizational. The technical physical aspect of area efficiency relies upon finding good physical solutions that allow for a reduction in area usage. This does not necessarily mean that the smallest area is the best solution. Investing in flexibility and the ability to adapt to future needs should also be seen as an investment in area effectiveness. Joint usage requires good planning and accessibility such that rooms can easily be used for multiple programs.

From an organizational standpoint, planning can greatly reduce area needs by reducing the number of redundant rooms. The occupancy rate of rooms can be greatly increased with joint and multiple use of the same area. Efficient area programming that plans for high occupancy rates contributes to reduced area. Organizational time-planning can also increase efficiency by ensuring that rooms are shared by different groups at different times of day. Another organizational factor that can increase efficiency would be an increase in the amount of hours that schools are open during the day (Aspelund, 2008).

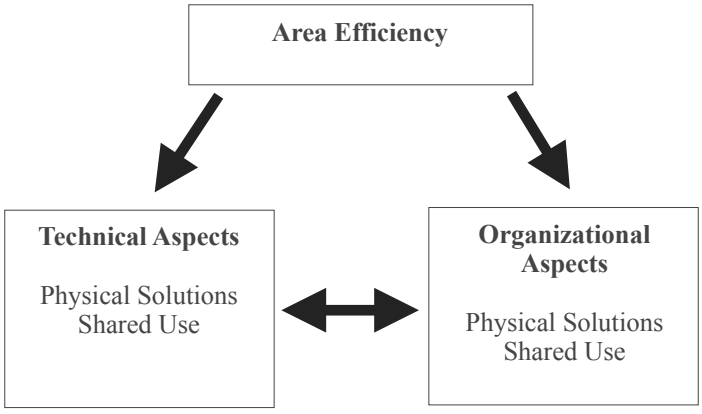


Figure 3.6 - Area efficiency according to Nore and Aspelund (Aspelund, 2008)

3.4.5 New Ways of Working

In office planning, the pressure to reduce area and at the same time increase productivity has led to the development new ways of thinking about the workplace and how it should function. Technological developments such mobile phones, email, and wireless networking have also allowed employees access to computer systems and communications anywhere that were once tied to a central office. The term «New Ways of Working» is often used to describe any kind of flexible working conditions where technology and interconnectedness is a key component (Pierik, 2011). Offices are no longer considered merely a space to work, but also an important social meeting place where collaboration and learning also take place. Work is no longer related to a place, but work and learning are instead considered interrelated activities that can happen anywhere. The diagram below illustrates typical activities in an office environment, but all of these activities also apply to a modern teacher's workday.

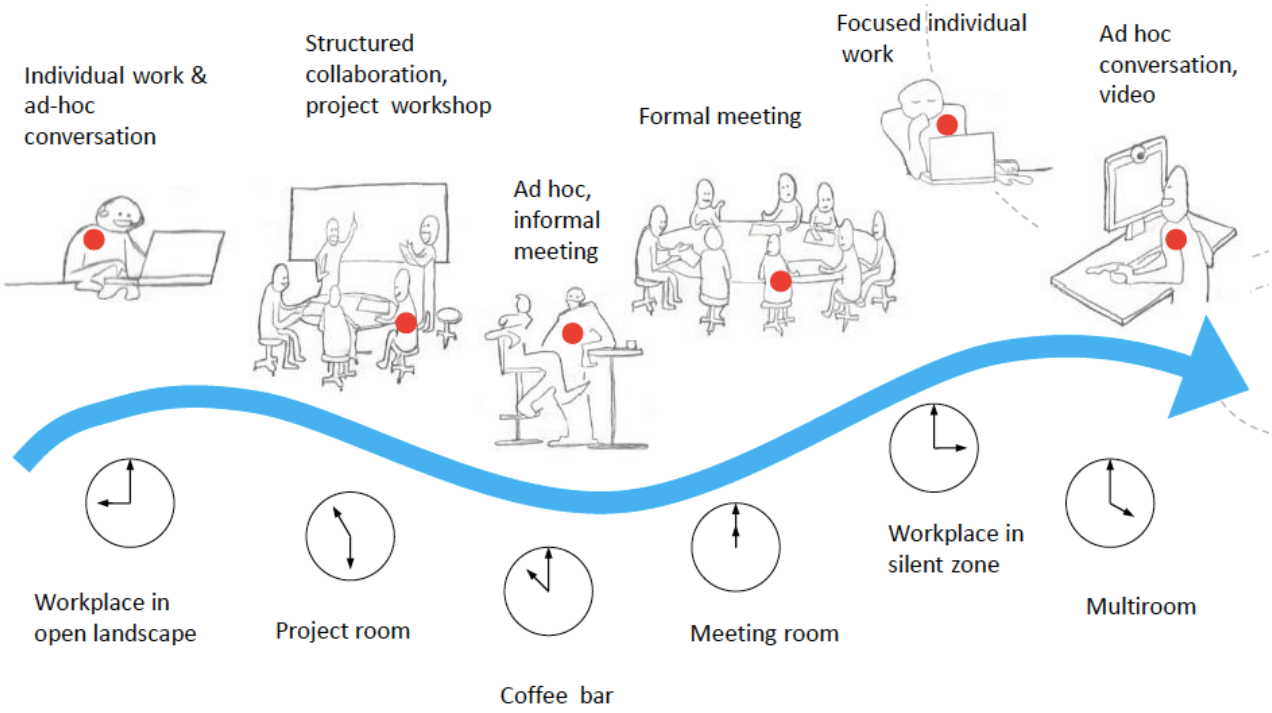


Figure 3.7 - User scenarios and work settings throughout the day, from (Blakstad, 2013).

3.4.6 Generational workplace

The workplace of the future will increasingly contain more generations simultaneously as people are healthier longer, and retire at a later age. The four current generations, Traditionalists, Baby Boomers, Generation X, and Millennial's all have their own workplace preferences and expectations from the workplace. Attracting and retaining the best workers will require an understanding the career desires, learning preferences, and expectations of these generations (Meister and Willyerd, 2010). When planing workspaces, it is important to understand the needs and desires of the users who will use them. Implementation of a future workplace should provide flexibility to provide for the differing needs of each generation of teachers. Because of this it may be difficult to find a "one size fits all" solution. An Australian study from 2006 lists among other things «flexible work practices that enable work-life balance» as a factor that will help attract and retain millennial teachers. These are not the same expectations as older generations (Mayer, 2006).

GENERATION	DATE OF BIRTH
Traditionals	before 1946
Baby Boomers	1946 - 1964
Generation X	1965 to 1976
Millennials	1977 to 1997
Generation 2020	after 1997

Table 3.5 - Generations in the workplace according to (Meister and Willyerd, 2010)

3.4.7 Hyperconnectivity

Hyperconnectivity refers to a state of near-constant online connection, made possible by multiple devices and technology. An IDC white paper in 2008 estimated hyperconnectivity in the workplace at 16%, and predicted 40% shortly thereafter. (Aducci et al., 2008) In 2013 more people accessed the internet daily from wireless devices, than desktop computers. (Adler, 2014). Teachers and teacher workplaces of the future will be hyperconnected, and their design and functionality will need to reflect this.

3.4.8 Productivity Paradox

The concept of a «productivity paradox» was coined in a widely cited article by Erik Brynjolfsen that studied growth in 572 businesses that had implemented new technology in the ‘80s and ‘90s. The findings pointed to the fact that computers were being used to replace pencil and paper functions directly, giving only a nominal gain. It was not untli the late ‘90s or ‘00s when businesses adapted entirely new strategies that were afforded by computers that true gain was visible. (Brynjolfsson and Hitt, 2003). An example of this is Dell Computer who used computer tracking and inventory to develop at just-in-time model for manufacturing. This allowed them to become a leader in computer sales and profits for a period of 10 years while the rest of the industry caught up (Zuboff, 1988). While this theory was originally related to productivity in companies related to the investment in computers, it has also been used to discuss how gains in learning attributed to technology are difficult to track. In education, the computer has been used to automate the pedagogy of direct instruction, basically using computers and tablets as digital flash cards. Finding new ways to use computers for things that they are good for, such as inquiry pedagogy and adaptive learning might be a way to further unlock the potential of mobile devices in the classroom (Norris, 2015).

3.5 Current Teacher Workspaces

In order to understand the needs of future teacher workspaces, an investigation has been made into the current status of the teacher workplace. This includes the legal requirements for workplaces and factors such as daylight and climate as well as current practice in programming of teacher workspaces.

3.5.1 Workplace Requirements

Workplace requirements for teachers have changed over the years to reflect the fact that teachers are spending more time at school and outside of the classroom. Prior to 2005 the Norwegian Office of Labor Inspection (Arbeidstilsynet) had a suggested average of 4 m2 per teacher in common workrooms. This was based upon the fact that teachers spent most of their time in the classroom, or elsewhere. Based upon the school reform of 2004 the Office of Labor Inspection wrote a letter that suggests increasing this guideline to 6 m2 in acknowledgement that teachers' needs have changed and that a larger portion of their time is spent at their workstation. The recommendation does not specify 6 m2 as a legal minimum, but it is often treated as such. This letter lists the following requirements for teacher workspaces:

- Workspace for planning, grading, and so on that is equipped with the required equipment and necessary space for storage.
- Meeting places for undisturbed conversations with students, parents and colleagues.
- Meeting rooms suitable for use.

There are no detailed standards set for solutions, but the following points are made:

- Workstations in common areas must be designed and used in a way that it is possible to work without disruption from unwelcome activities (group discussions, copying, etc).
- There must be space for confidential discussions.
- Rooms for discussion and meetings must not come into conflict with workspaces for individual work.

(Arbeidstilsynet, 2005)

3.5.2 Daylight and exterior view requirements

> «Daylight is necessary to control our biological clock, to keep us awake and refreshed. In practice, it cannot be replaced by artificial lighting.» (Bakke, 2013).

The Norwegian technical directive TEK10 states the following about Light and Views for offices.

§13-12 Light	(1) Rooms shall have adequate access to light without an annoying heat load.
	(2) Rooms designed for constant occupation shall have a window that provides adequate access to daylight, unless the activity indicates otherwise.
§13-13 Views	Rooms designed for constant occupation shall have a window that provides an adequate view, unless the activity indicates otherwise.

Figure 3.6 - requirements for lights and views in TEK10 - (TEK10, 2010)

An analytical study by Leif Houck has shown how daylight in classrooms is under-prioritized in recent architecture competitions. Factors like area-effectiveness and perceived energy-effectiveness in compact plans have been proven to be the most important factors for winning architectural competitions for schools (Houck, 2013a). Teacher workspaces are generally considered lower priority than classrooms when it comes to placement in school plans, meaning that they also suffer when it comes to placement along the facade and daylight in newer schools. As an example Houck reviewed Nord-Østerdalen High-School in Arkitektur N and commented:

> «All the classrooms have ample daylight… but the areas which do not fare well are the teacher workspaces. These have windows towards a central atrium and are therefore fairly dark. There are not views to the common area from all of the teacher's workstations even though they get their daylight from there.» (HOUCK, 2014)

3.5.3 Workplace and facility satisfaction.

In a study funded by the Kunnskapsdepartement in 2004-2006, Nicolaysen and Nyen conducted a series of interviews to monitor the effects of the 2004 school reform. The 2004 reform bound a greater portion of the teacher's time to school, in buildings which were not necessarily designed with this in mind. Their findings were based upon qualitative case-studies of schools and a quantitative questionnaire and document study.

> «As more and more of a teacher's time is bound to the school, their working environment becomes even more important» (Nicolaisen and Nyen, 2004).

When teachers were asked if the facilities provided were satisfactory, or dissatisfactory the greatest source of dissatisfaction among teachers was «distractions and noise». This is in particular related to distractions and noise when attempting to do concentrated work, such as grading papers, in a workspace with several colleagues.

> «We are twelve or thirteen teachers per work room. It is loud and crowded. Almost everyone feels that it is difficult to grade there, particularly in languages. Almost everyone would prefer to grade at home and most do. It's meaningless to be bound to campus when you don't have anything to do there and there is a pile of papers at home that need to be graded» - anonymous teacher (Nicolaisen and Nyen, 2004)

Results from the questionnaire show that a teacher's time was divided into the following categories:

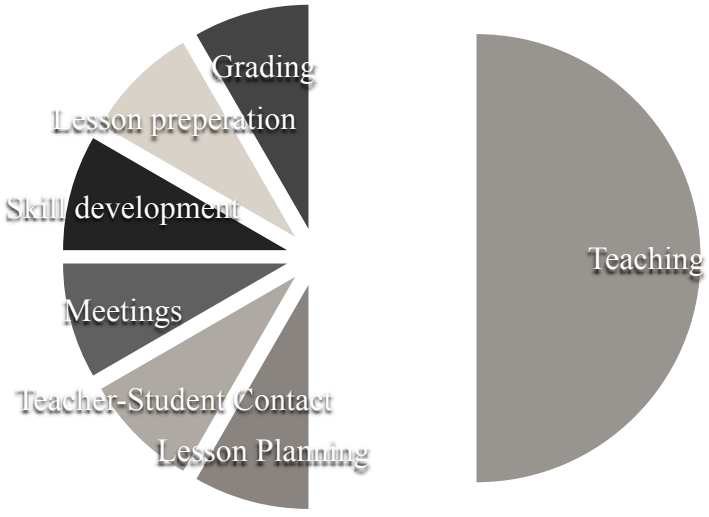


Figure 3.8 - Teacher activities in- and outside of the classroom. (Nicolaisen and Nyen, 2004)

The questionnaire asked teachers what they experienced as the main source of dissatisfaction with their current workplace. Unsuprisingly, distractions and noise were a problem for almost 60% of teachers. «Size» and «Meeting room availability» are the second largest source of dissatisfaction. Interestingly, «Computer Access», a major problem in 2004 can no longer be considered a problem in 2015 when nearly all teachers have their own laptop or desktop machine. A good example of how technology has changed the situation in the last 10 years.

> *«No, we don't have meeting rooms, so we use the classroom» - anonymous teacher (Nicolaisen and Nyen, 2004)*

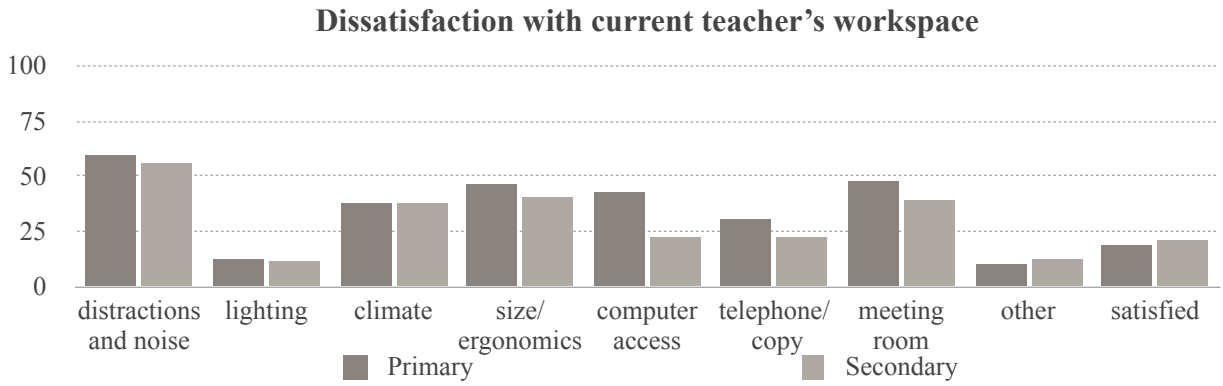


Figure 3.9 - Teacher dissatisfaction with their current workspace. (Nicolaisen and Nyen, 2004)

3.5.4 Example space requirements for teacher workspaces

Oslo City Council has developed a series of technical and functional requirements for it's public buildings. The latest version of these regulations, referred to as FKOK 2012, has a clear definition of what a teacher's workspace should be. The changing expectations for teachers and increased time required on campus are mentioned. «A teacher's preparatory and grading work consists of solo, group, and team work that is both theoretical and practical. It is important to create an attractive workplace where it is possible to perform individual concentrated, good meeting places and areas for common supplies» (Oslo Kommune, 2012).

For programming of area, FKOK gives the following formula: 1 teacher per 11 students and 6 m2 per workplace. Further they go one to define that these 6 m2 are to be divided among individual workplace (3.5 - 5 m2) and space for collaboration (1 - 2.5 m2).

Another example for situation would be Rygge County Council who was planning a new secondary school in 2012. They hired architect Astrid Reikvam from Arkitektformidling to consult on the development of a Room and Function Program for the new school. The document was placed on the Rygge County webpage for comments. Here the area is again calculated as 1 teacher per 11 students, and 6 m2 per teacher divided into 4 m2 for individual workplace, and 2 m2 for shared spaces. (Reikvam, 2012)

3.6 Scenario Planning

There are many different definitions of scenario planning as it relates to this thesis. Michael Porter defines scenarios as «an internally consistent view of what the future might turn out to be - not a forecast, but one possible future outcome» (Chermack et al., 2001) Scenario planning is as such, not a way to predict the future, but a useful tool that allows the author to tell multiple stories examining plausible futures.

3.6.1 History of scenario planning

First developed for military purposes at the RAND corporation by Herman Kahn, scenario planning was used as a management tool. At the time it was called «Future-now» and was a technique that combined storytelling and analysis to create fictional reports as if they had been written by people in the future. This kind of report was later called scenario planning, and the individual stories called «scenarios». (Canepa, 2011) As a method scenario planning has been adopted by the business world and applied to a wide range of issues.

3.6.2 Approaches to scenario building

There are three main approaches to scenario building; intuitive, quantitative and procedural. Kahn was a champion of the intuitive approach, which can also be seen as related to futurology or «future studies».

Intuitive scenario planning aims to find major themes that effect the central elements and create a story around them. Pierre Wack has said «In scenario planning, if you frustrate people for a few days, the subconscious takes over and you awake to find the scenario is there. The subconscious is more powerful than the conscious mind, however it will not intervene until it has been frustrated». (Wack, 2004).

The quantitive approach uses computers and complex modeling to manage a plethora of variables and extract scenarios. Quantitive scenarios combine a multiplicity of possible outcomes into consistent story lines (Schoemaker, 1995).

A procedural or processual approach attempts to combine the intuitive and the quantitative in order to provide a middle ground between the two extremes. Here the scenario planner can intuitively determine the most important factors, and graph them in a matrix from which different scenarios can be extrapolated (Van der Heijden, 2011).

Kees van der Heijden is an acknowledged scenario planners in the business world. Van der Heijden was responsible for Dutch Shell's scenario planning as head of their Business Environment Division. His book «Scenarios: the art of strategic conversation» presents the processes that were developed at Shell (Van der Heijden, 2011). An important part of the process were a series of workshops that created initial scenarios, in part to find the connections and links within the dataset. Brainstorming and creative thinking, mapping relationships, and ranking driving forces were also a part of the process. The «iceberg» metaphor in the figure over demonstrates the process of thinking through the scenario building process (Chermack et al., 2001).

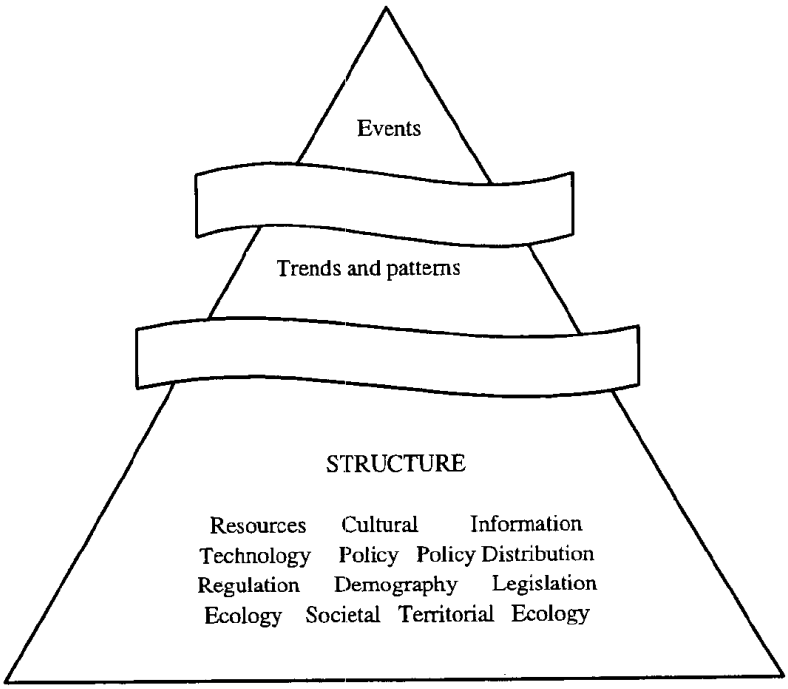


Figure 3.10 - The «iceberg» metaphor of the scenario building process from (Chermack et al., 2001)

Another well known scenario planner, Paul Schoemaker (1995), describes scenario planning as an attempt «to capture the richness and range of possibilities, stimulating decision makers to consider changes they would otherwise ignore. At the same time it organizes those possibilities into narratives that are easier to grasp and use than great volumes of data» (Schoemaker, 1995). Schoemaker published an article that demonstrates scenario planning as a step-by-step process based upon case studies of an advertising agency and Anglo-American Corporation in South Africa.

In his exposition Schoemaker defines three classes of knowledge related to the future.

- Things we know we know
- Things we know we don't know
- Things we don't know we don't know.

According to Shoemaker (1995), an increased focus on the second two will improve the overall quality of the scenario.

3.6.4 Scenario planning guide

Schoemaker lists the following 10 steps to creating scenarios:

10 STEPS TO CREATING SCENARIOS	
1. Define the scope	set the time frame and scope of analysis
2. Identify major stakeholders	who are the affected parties and who can influence them
3. Identify basic trends	political, economic, societal, technological, legal and industrial trends
4. Identify key uncertainties	what events with uncertain outcome can significantly affect the main issues of the scenario
5. Construct initial scenario themes	identify positive and negative extremes and test them against each other
6. Check for consistency and plausibility	look for internal inconsistencies in the scenarios
7. Develop learning scenarios	identify themes that are strategically relevant and organize the scenarios around them
8. Identify research needs	determine if any research needs to be done to further the scenarios at hand
9. Develop quantitative models	to help quantify the consequences of various scenarios
10. Evolve toward decision scenarios	iteratively converge toward the final scenarios that will test strategies and generate new ideas

Table 3.7 - The 10 steps to creating scenarios accordingg to (Schoemaker, 1995)

3.6.5 Scenario planning in Norway

In Norway, Erik Øverland has utilized scenario planning as an alternative to social-economic planning. «Norge 2030» relates scenario development to the Norwegian public sector as a non-linear process. The use of multiple scenarios allows for the possibility of multiple futures, resulting in a more robust decision making basis. Øverland coined the term «cluster of realities» to describe a present and future that are not logically connected, but interrelated. Øverland uses two classes of knowledge instead of Schoemaker's three. (Overland, 2000)

- Things people believe they know something about
- Elements people consider uncertain or unknowable

4. Results

This chapter will present the results from the methods described previously. Firstly the results of interviews related to teacher workspaces and developments in technology that may effect teaching and teacher workspaces. Secondly the results of an analysis of existing schools, with data about teacher workspaces. Finally scenario planning will be used to map out a number of possible futures for teacher workspaces, and the consequences which this may contain.

4.1 Analysis of Existing Teacher Workspaces

In order to imagine what teacher workspaces may look like in the future, it is important to first examine the current situation in present day schools. To analyze current workplaces school plans and photographs have been assembled from several sources and gathered into an spreadsheet database. In addition to the published projects Mesterfjellet School in Larvik has also been included as a new school completed in 2014. The majority of schools published in Arkitektur N are High Schools, and not primary or secondary schools, which is the focus of this thesis. Nord-Østerdalen High School has been included as an example of teacher workspaces towards an interior courtyard.

Of all the magazine articles published, there are no references or text passages that mention or describe the architectural qualities of the teacher workspaces. There are also no photographs of teacher workspaces to be found. This is also the case in countless other books and reference materials for international school projects. Typically the only mention is the coded text to identify the space on the plan drawings. In many cases it was not even possible to identify or find the teacher workspaces in the plans. Then again, there were few enough photographs of the classrooms themselves, with most focus being on images of the common spaces and exteriors. There is a clear change in the projects presented on the advisory service webpage, in that they have begun to mention and describe teacher workspaces in the last few years. This is due to the fact that teacher workspaces were more in focus related to school reform and the binding of teachers time to the school. So there were a number of images to be found there.

The plan diagrams printed in the magazine are usually fairly small, and include only a short numerical index to indicate function. In several cases the plans did not include any notation for teacher workspace at all. Not all projects on the advisory service webpage included plans, but a number of them did. Web searches and examination of the architect's webpages also yielded some additional plans.

The diagrammatic plans give a general idea of the placement and size of teacher workspaces in a variety of schools and school types. The chosen schools vary greatly in plan from «finger» or «comb» schemes with a lot of facade area and daylight, to more compact and area-efficient schemes. Schools that are the result of transformation of existing buildings are also represented. Organization varies from centralized placement of teachers together with administration, to decentralized schemes where the teachers are close to their home area. Room sizes vary according to the school size and the internal organization of teachers-groups into teams.

By analyzing the data collected we can identify some trends. The data is analyzed for; organization: centralized vs. spread (decentralized), number of teacher per room, daylight, and office layouts.

Figure 4.1 - Image of school database showing an example of the varying amount of information per school.

4.1.1 Location: Centralized vs. Spread

There are two main organizational principles when it comes to the location of teacher workspaces in schools. These can be categorized as:

- Centralized, all of the teachers offices and support spaces are gathered into one area of the school, usually near the administration.
- Spread (decentralized), teachers offices and support spaces are placed within or nearby the teaching spaces they are responsible for. These can be spread on the same floor, or placed in different floors altogether.

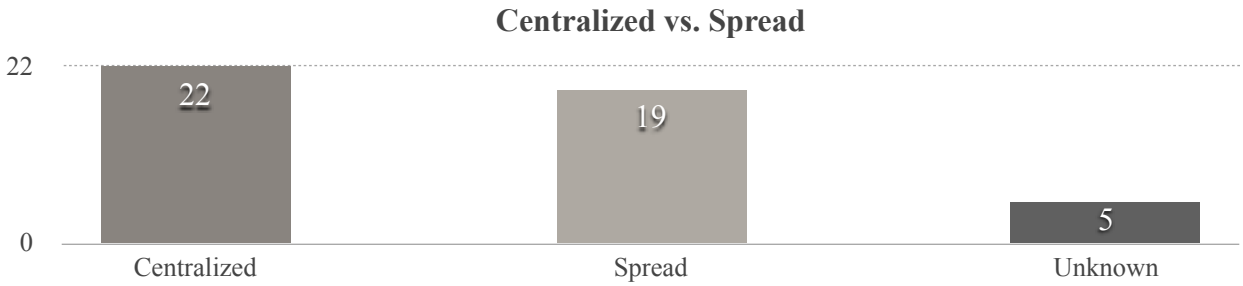


Figure 4.2 - Location: Centralized vs. Spread

Centralized schemes are often placed near the school's administration such that administration and staff are close to the teacher's lounge and have shared social spaces. Decentralized schemes are often arranged by year and close to the home area of that year. (Storstrand, 2014)

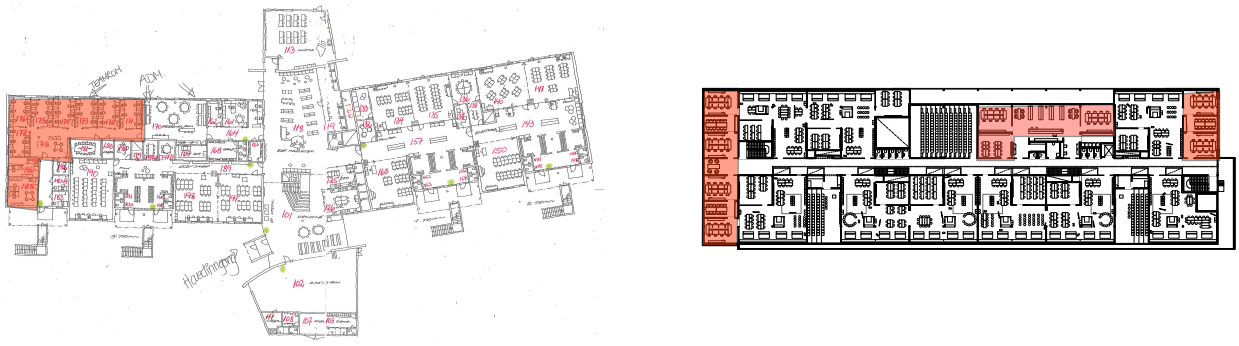


Figure 4.3 - Vestby Primary skole (left) with centralized location vs. Hundsund Secondary (right) with spread.

Analysis of the school database shows that there are roughly equal numbers of centralized (22) vs. spread (19) schemes. It was not possible to determine the organization in 5 of the schools due to lack of information. While the distribution is fairly even overall, further analysis by school type, school size, and school age shows some trends and preferences.

Divided by school type, there is a clear preference for centralized organization in primary schools with grades 1-7, whereas it is more evenly distributed between centralized and spread in secondary schools with grades 8-10 schools. For combined schools with 1-10 grades there is a slight preference for spread with 6 of 4 showing this organization.

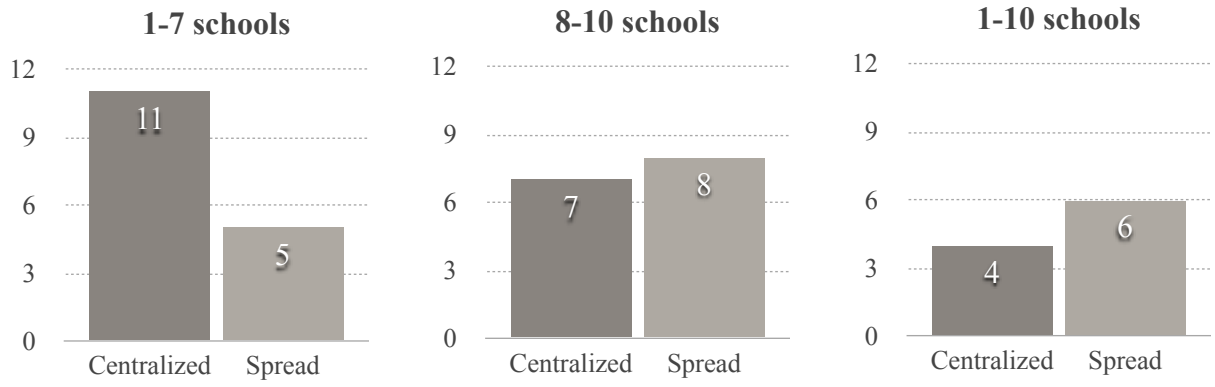


Figure 4.4 - Location by school type

Grouped by school size (<250, 250-450 and >450 students) there is also a clear differentiation between organizational types. For smaller schools of 250 or fewer students there are a majority with a centralized structure. Mid-sized schools ranging from 250-450 students are more evenly distributed. Large schools of 450 or more students show a clear preference for a spread organization.

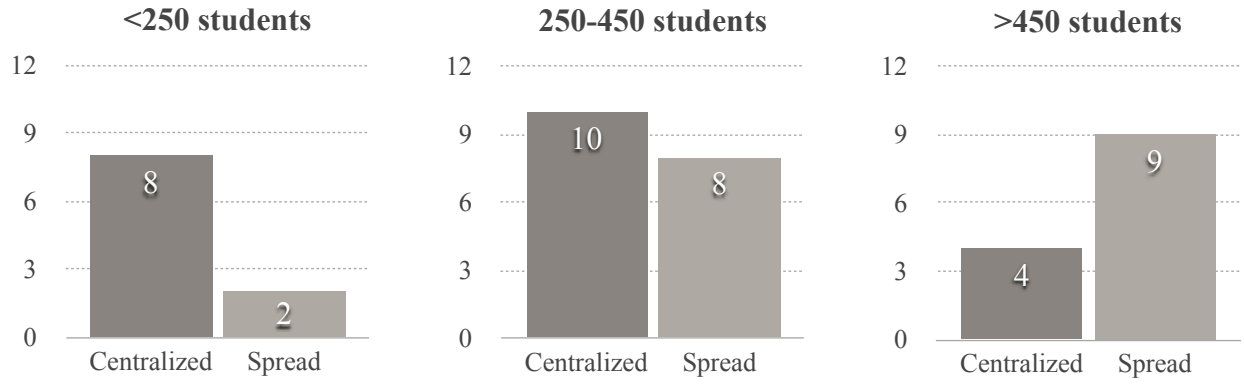


Figure 4.5 - Location by school size (# students)

Building types have changed over the years. Dividing the database by age also shows a trend in preference by year. Schools designed prior to 1970 have a clear preference for spread organization. Whereas schools built between 1970 and 2004 are almost entirely centralized. The exception to the rule is Hellerup School in Denmark, which was only included as an example of a compact and more radical school in Denmark. As a school that heavily influenced Norwegian schools after 2004 it could be said that it belongs in that category. This means that 100% of schools built between 1970 and 2004 in Norway were modeled on a centralized placement of teachers. Schools built after 2004 show a greater diversity and more even distribution between spread and centralized schemes.

Figure 4.6 - Organization by building age

The older schools on the list have all been renovated since 1970. Renovations can vary from complete gutting and rebuilding to repurposing and reusing the existing structure. If we divide the schools according to their renovation dates instead of initial building date we can see a more even distribution. Curiously, all 3 of the centralized schools built prior to 1970 were renovated after 2004, whereas the other 6 schools with a spread organization prior to 1970 are distributed in both groups.

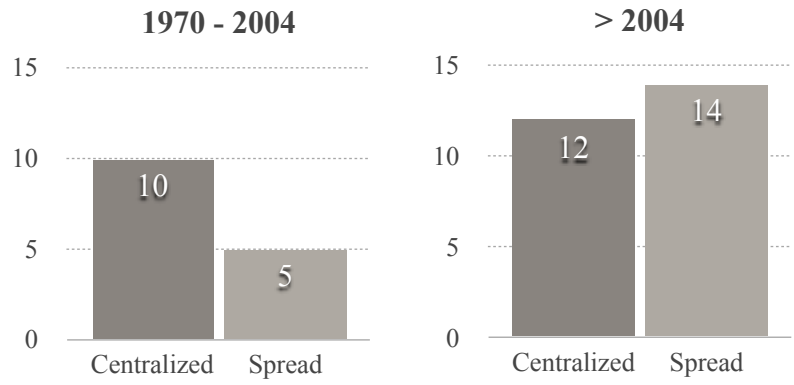


Figure 4.7 - Organization by date of renovation

4.1.2 Number of Teachers per room

It is possible to determine the number of teachers per room in the plans that are furnished. Personal experience is that the actual number of desks or teachers in reality may vary from the architects drawings. For plans without furniture the number of teachers per room is interpreted by counting the number of classrooms and using the standard factors of 2 teachers per class for primary and 2.5 teachers per class for secondary schools. (Aspelund, 2008). Some schools have rooms of varying sizes, they have been placed in the category of their average size.

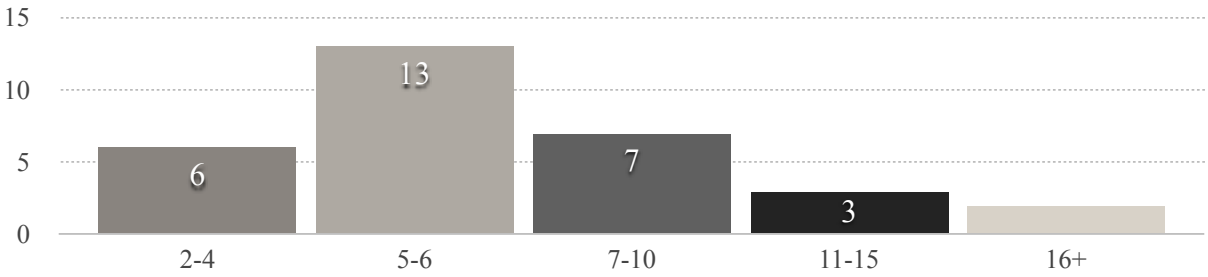


Figure 4.8 - Number of teachers per room overall.

TEACHERS / ROOM	1-7	8-10	1-10
2 - 4	3	3	0
5 - 6	8	4	1
7 - 10	4	2	1
11 - 15	1	3	0
16+	0	1	1

Table 4.1 - Number of teachers per room by school type

Size is fairly evenly distributed, with 5-6 teachers per room being the most common size. 6 teachers or less accounts for more than 50% of the possible configurations. Teacher rooms with less than 10 per room account for more than 80% of possible configurations.

TEACHERS / ROOM	<250 STUDENTS	250 - 450 STUDENTS	>450 STUDENTS
2 - 4	4	1	1
5 - 6	3	7	3
7 - 10	2	4	2
11 - 15	1	2	0
16+	0	1	1

Table 4.2 - Number of teachers per room by school size

The distribution of teachers per room by school size is also fairly evenly distributed with the most common variation being between 5-6 teachers per room in the 250-450 student range.

TEACHERS / ROOM	<1970	1970-2004	>2004
2 - 4	1	2	3
5 - 6	3	1	9
7 - 10	1	2	5
11 - 15	2	0	0
16+	2	0	0

Table 4.3 - Number of teachers per room by date of original construction

TEACHERS / ROOM	<1970	1970-2004	>2004
2 - 4		2	4
5 - 6		2	11
7 - 10		2	5
11 - 15		1	3
16+		0	1

Table 4.4 - Number of teachers per room based upon date of renovation or original construction.

4.1.3 Daylight in teacher workspaces

Workspaces are required to have sufficient daylight and views according to the current Norwegian building regulations (TEK10, 2010). The Labor Inspection office in Oslo has established practice that accepts workstations within 10 m from a facade with a window if furnishing and screens are placed such that there is a view to the windows. In addition, indirect daylight and views are accepted where there is a glass wall between a workspace and a window if the worker is there less than 50% of a work day. (Bakke, 2013).

The teacher workspaces in the database have been ranked as to having sufficient access to daylight, partial access, or no daylight whatsoever. The majority of teacher workspaces have access to daylight. This shouldn't come as a surprise considering the fact that it is a requirement by law. However, analysis of the plans show that there are 5 schools where the teacher workspaces have only partial daylight from an interior courtyard or similar, , and one project lacked daylight completely. Lack of plans or inability to determine where the teacher workspaces were placed leaves 7 projects as unknown.

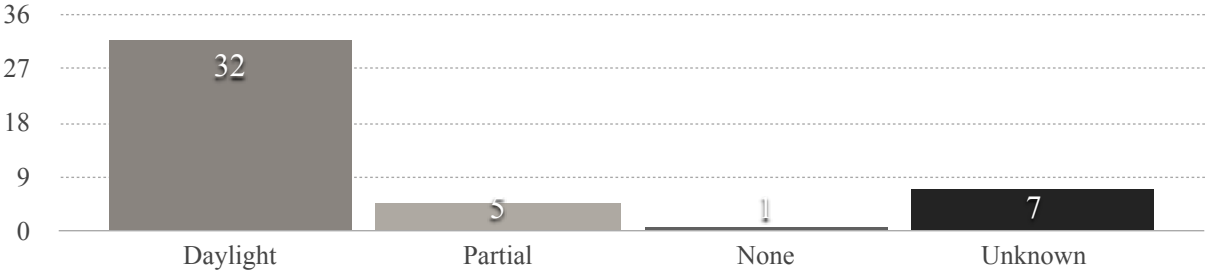


Figure 4.9 - Daylight in teacher workspaces

Arranged by school type, there is an obvious difference as to which category teacher workspaces with only partial daylight occur. All of the primary 1-7 schools have good daylight for their teacher workspaces. Only slightly over half of the workspaces for secondary (8-10th grade) schools have daylight with 6 of 11 with proper light.

DAYLIGHT	1-7	8-10	1-10
Daylight	16	6	4
Partial		4	1
None		1	

Table 4.5 - Daylight in workspaces by school type

Arranged by school size (number of students) smaller schools all have teacher workspaces with good daylight. The medium sized schools have the greatest number of workspaces with only partial daylight. The largest schools of 450 students and more have the highest percentage of workspaces partial or no daylight, but there are only 7 schools in this category.

DAYLIGHT	<250 STUDENTS	250 - 450 STUDENTS	>450 STUDENTS
Daylight	8	13	5
Partial		4	1
None			1

Table 4.6 - Daylight in workspaces by number of students

Looking at daylight in relation to building year, there is a clear trend that buildings prior to 2004 prioritized or provided daylight in teacher workspaces. Suddenly, almost 25% of new school buildings after 2004 have teacher workspaces with partial or no daylight. This is a clear change in prioritys or other factors that have led to this development. Hellerup school in Denmark is again the exception in the category 1970-2004. Meaning that prior to 2004 all norwegian schools prioritized daylight in teacher workspaces.

DAYLIGHT	<1970	1970-2004	>2004
Daylight	9	10	16
Partial		1	4
None			1

Table 4.7 - Daylight by building age

4.1.4 Teacher office layouts

There are three main categories of furniture layout in teacher offices. The chosen solution varies depending on room size and teacher preferences. These layouts have been defined with the following types:

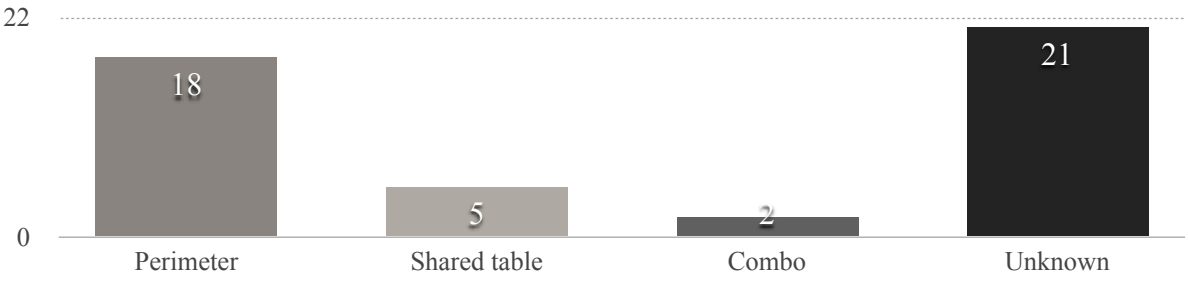


Figure 4.10 - Teacher office furniture layouts

- Perimeter - The desks are arranged facing outward in the room, typically with shelves over the desk. Storage either between, under, or behind worktables. In rooms where there is space there will often be a group table in the middle for collaboration.
- Facing desks - Teacher work-surfaces placed together in the middle of the room in the form of a shared table or collection of individual tables. Varying methods of screens on the tables divide the individual spaces. Storage between, under, or behind worktables.
- Combination «open landscape» - In particularly large or open landscapes there may be a combination of the two above.

The perimeter configuration is considered the most standard and traditional. There is not enough data here to warrant further division by type, size and age. But it is interesting to confirm that most teacher workspaces are arranged in the traditional manner.

Figure 4.11 - Furniture arrangement. Perimeter arrangement on left, combination on right.

4.2 Interviews

Four interviews were carried out with a variety of people connected to schools and teacher workspaces; two teachers, a principal (also formerly a teacher), and a pedagogical planner (also a former teacher). The interviews and discussion with interview subjects have given valuable insight into a typical teacher's workday, and the spaces which teachers use to get their work done. With their help it was possible to derive a good starting point for scenario planning.

	I1	I2	I3	I4
Title	Teacher	Principal	Pedagog	Teacher
Age	35	63	45	28
Generation	Millennial	Baby boomer	Gen. X	Millennial
School Type	1-10	1-10	n/a	7-10

Table 4.8 - Key information about the interview objects.

The interview guide was divided into facts about the interview object and central questions. The central questions included: Physical Solutions, Collaboration, Changes in the teaching profession and Technology. The interviews were carried out as informal conversations, and the discussion drifted through the questions below, without it being a direct question and answer session. The written transcripts of the interviews have been reorganized such that the answers that related to the different questions by each interview object have been categorized and summarized according to the central questions. The summarized and organized responses are collected in the format under in the appendix.

The discussions around the central questions have been summarized in the following sections. Quotations from the interview objects and graphs have been added where appropriate to illustrate the data.

4.2.1 Teacher activities

The interview objects were asked to describe their, or a typical teacher's, workday. A list of main activities for teachers was extracted from the interview transcripts. Teaching was clearly the main activity listed by everyone, with a number of other activities that may vary from day to day or week to week. The main activities listed are as follows (in no particular order):

Teaching, course preparation, team meetings, all-staff meetings, lunch break, recess duty, grading or correcting tests or papers, informal meetings, private meetings with students, private meetings with parents, meetings with other support functions (psychological services, nurse, admin), phone calls, communication with students or parents by email, layout of teaching material, socialization and discussions, internal courses or learning, external coursework and collaborating with colleagues outside of the school.

4.2.2 Typical workspaces or rooms available

The interview objects were asked to describe which spaces or areas they used when performing their duties. When describing the rooms available for the activities over a list of spaces was created from the interview transcripts. The spaces that were mentioned directly, or inferred used are listed below. Cyberspace is also listed as a place to represent the virtual world space used when collaborating over the internet. Shared teacher's office, classroom, group room, telephone room, copy room, auditorium, teacher's lounge, principal's office, student cafeteria, outdoors (playground), hallway / corridor, meeting room, «At home», external location, «Cyberspace».

4.2.3 Where activities are carried out.

The activities from the lists above are matched with the rooms in which they are most often carried out in the table below.

	Teachers office	Classroom	Group Room	Telephone room	Copy room	Auditorium	Teacher's lounge	Principal's office	Student cafeteria	Outdoors	Hallway / corridor	Meeting room	At home	External location	«Cyberspace»
Teaching		X	X			X				X					X
Course prep	X	X			X								X		X
Team meeting	X	X	X									X			
Staff meeting		X				X	X								
Lunch break	X						X		X	X					
Recess duty									X	X	X				
Grading	X	X		X									X		
Informal meeting	X	X	X				X					X			
Student meeting	X	X	X					X				X			
Parent meeting	X	X	X					X				X			
Other meeting	X	X	X				X	X				X			
Phone call	X		X	X								X	X		
Email	X	X	X	X								X	X	X	X
Layout / copy	X	X	X		X										
Socialization	X						X			X	X			X	
Internal course		X	X			X	X		X			X			X
External course													X	X	X
External collaboration										X				X	X

Table 4.9 - Activity vs place matrix

From the interviews, the teacher's office is clearly where the most time is spent and the largest variety of activities carried out. For those who had a classroom available, it is also a place for many different activities. The secondary spaces available varied, and thus the amount of activities carried out there also varies. Meeting rooms and group rooms are both flexible rooms with the main difference between them being usage.

4.2.4 Typical teacher workday

The interview objects were all asked to describe a typical workday for themselves or a typical teacher. There was a high degree of overlap in the four descriptions and all agreed upon the most crucial moments of the day. Depending on the day of the week and the duties of the teacher some days will be different from others. Some days are primarily spent in the classroom, whereas others may have longer periods of the day dedicated to planning or meetings. Different facilities and age of students meant that there were some differences, but the general picture was clear enough to summarize as follows. Bound on-campus time is generally 30.5 hours a week. There is some flexibility as to when it is used, but generally between 08:00 and 15:00. Most reported being «spent» or «worn out» by the end of the day, finding it difficult to do concentrated work directly after the end of classes.

TIME	PLACE	ACTIVITY
08:00 - 08:30	Teacher's office	Arrive at school, do some preparatory work in the teacher's office before class. Check email or SMS from parents about absence
08:30 - 11:30	Classroom, group room, auditorium	Teaching activity
11:30 - 12:30	Teacher's lounge, playground, cafeteria with students	Lunch with colleagues in the teacher's lounge. Rotating recess duty requires teacher to be where the students are, in the cafeteria or outside.
12:30 - 14:00	Classroom, group room, auditorium	Teaching activity
14:00 - 16:00 3 days / week	Teachers office, meeting room, grading room	general follow-up work or grading, mainly in the teacher's office. Informal meetings with co-teachers or team members. Telephone to students or parents. Grading or planning, depending on what needs to be done.
14:00 - 16:00 2 days / week	Meeting room, teachers office, auditorium	team or staff meetings from 14:30 - 16:00. Team meetings either in the teacher's office, or a meeting room. All-staff meetings in a larger space, such as auditorium or teacher's lounge. Breakaway work in meeting rooms or a classroom if available.
16:00 -	Home, generally kitchen table or couch	Catch up on grading or preparation.

Table 4.10 - Typical teacher workday according to interview subjects

4.2.5 - Physical Workspace

In order to understand the teacher's workspace of the future, it was important to get a better understanding of the physical solutions that exist today and how they work. There are many different solutions across the primary and secondary schools in Norway, but they generally consist of the same kinds of rooms and teachers generally perform the same kinds of tasks there. The questions in this section were meant to map what spaces are considered most important, and to determine how they are used.

The classroom was clearly considered the main workspace for teachers. Outside of the classroom there was also a clear answer that the teacher's office is the primary workspace and the place where they spend the majority of their time. The teacher's office is where they start their day, prepare for class, do lesson planning, grading and other preparatory work. Several commented that the office should be a quiet space where they can work without distraction, or that they work in the office, but would prefer to do much of the work that is done there at home.

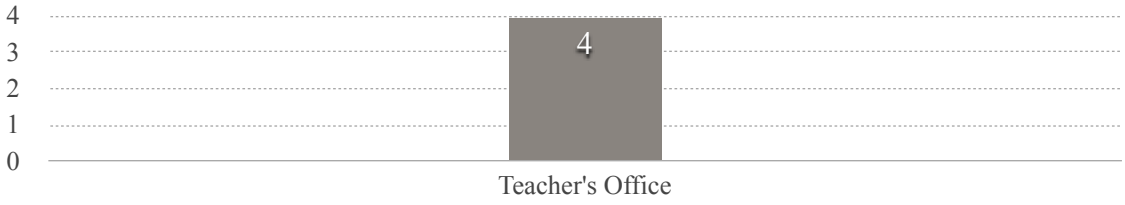


Figure 4.12 - Question: What do you consider your primary workspace (outside the classroom)?

The teacher's lounge is an important space for social interaction, while noting that it wasn't generally used for «work». Group rooms or other rooms where it is possible to be alone for concentrated work was otherwise the main focus. Some referred to these as grading rooms or «conversation» rooms, but the idea was to have a quiet place for concentrated work. Home room teachers who have access to an empty classroom prefer to go there if it is available.

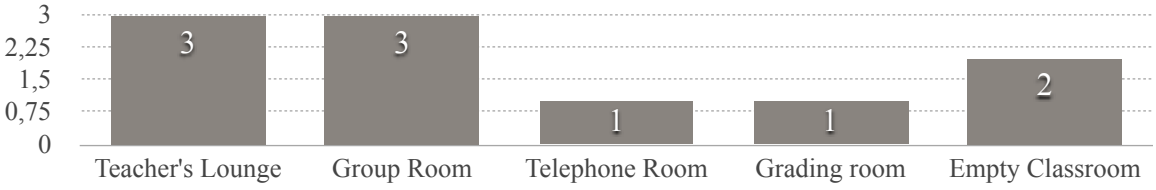


Figure 4.13 - Question: What are some other important support spaces to your work?

Generally the interview objects report being happy with the teacher's office as the main place to work, and in general there was a feeling that the spaces they had functioned fairly well. I1 and I2 are working in a new school building which is a major step up from their previous facilities. I4 felt somewhat lucky to have an office that was only half full, commenting that the other teachers who were 6 to an office felt a lack of space.

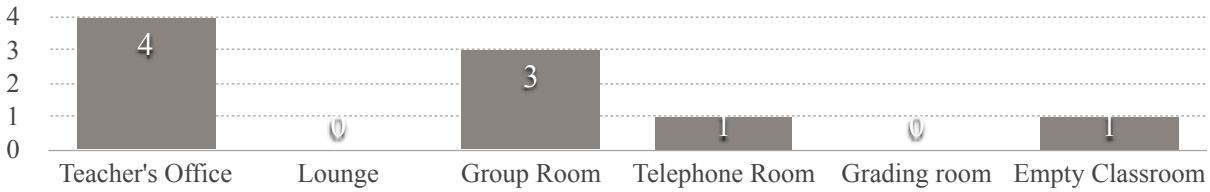


Figure 4.14 - Question: Which of these, if any, work particularly well?

The shortcomings of the teacher's office were also mentioned. Generally there seems to be a problem with distraction and sound, regardless of the solutions or number of people in the office. I4 shares a room with only 3 other people, but also commented that it is difficult to work in a concentrated manner there because she is always «available» when in her office. The fact that colleagues and students could come in and disturb seemed to be as much of a problem as anything else. Group rooms without windows or daylight were mentioned negatively.

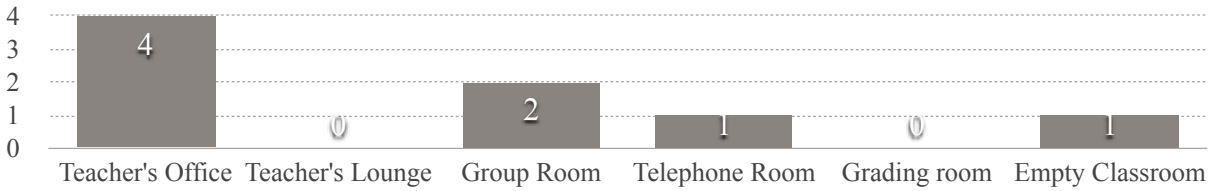


Figure 4.15 - Question: Which ones don't work so well, and why?

Working in the classroom is a natural solution for teachers who have a home-room space to use, not an option for all. I1 mentioned that teaching in the classroom worked well for the teachers in grades 1-4 at his school, but that teachers in 8-10 couldn't do the same because there were longer school hours and the rooms were usually in use in the afternoons. E2 said «teachers should be working in their classroom. They can organize and work together there, do practical things and prepare for the next day. Team meetings can also happen in a classroom so it doesn't disturb others in the teacher's office space».

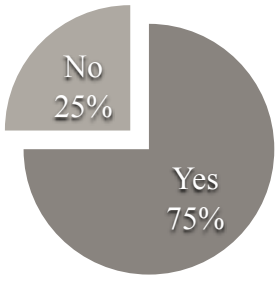


Figure 4.16 - Q: Do you use the classroom as a workspace after hours or when there are no students there?

«The most important learning is in the daily collaboration with colleagues and those I work closely with» - I1. The responses refer mostly to the school organization and not the facilities themselves, but all respond that workplace learning is closely related to being with colleagues.

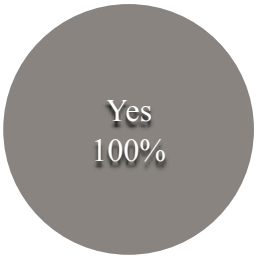


Figure 4.17 - Question: Does your current workplace support/inhibit your opportunity to learn new skills?

When asked if they would prefer a larger and more varied array of spaces, or a larger «personal» workspace, there was a lot of discussion, but no clear answer. The teachers are generally happy with their offices, even though they mention the noise and concentration problem. Space for «concentration» or «focused work» were frequently mentioned, but not with a clear preference to having more quiet rooms vs. space in the teachers offices. The answers were also often conflicting. I1 says «Requirement of more space is not necessarily larger desks, but more space to also have quiet workspace.». I3 states «Optimal solution would be to have more, smaller teacher offices to avoid distraction. It's simpler to ask one person to be quiet in a small office than having to ask many in a larger office, repeatedly over a longer time. I would have a preference for more and smaller rooms, vs. larger open office space.». I2 had the most concrete suggestion «today's solution, but with one more conversation room per floor».

The next question asked «How different are teacher workspaces from other office workers, or creative/collaborative workers?». Responses here went along the lines that a teacher's workday is very intense with very many kinds of work to be done during the day divided into pre-teaching, teaching, and post-teaching. The work that is done outside of the classroom is generally done by all of the teachers at the same time, giving a high degree of simultaneity and high-intensity use of the space available. I3 says « Teachers have a short period of time outside the classroom each day where a lot has to happen. Both individual work, and collaborative work. Requires more communication and collaboration to get the job done than a typical office job would.»

What aspects of workplace theory (generally applied to offices) and «new ways of working» be applied to teacher workspaces? Response from all here was that teachers are a very conservative group, and that it was difficult for them to imagine implementing NWW. However as the conversation circled around the topic they did open to the possibility of working «differently» if it was accepted. «Far out to think about sitting in a sofa and doing my job» - I1. « Perhaps it will change as the teachers also learn to use the new building. They may over time change the way they work - especially if they are required to be at the office for a larger part of the day. A new, young principal could maybe work from a sofa, but not me.» - I2. « Teachers like to have their own desk where they know their things are waiting on them to come back.» - I3

4.2.6 - Collaboration

Collaboration is an important aspect of current pedagogical theory and trends in Norway. Greater collaboration is required of teachers according to the latest school reforms. Do the current configurations of workspaces support collaboration, and what are the consequences of even more collaboration in the future?

Collaboration is described as very important by all of the interview objects. «Collaboration and co-planning are key for team-teaching which is prevalent today» - I3. «Collaboration and a team feeling is important for a good school environment. We try to get all to come to the teachers lounge to eat or take a break. This helps create a ´we´ feeling for the whole school» - I2.

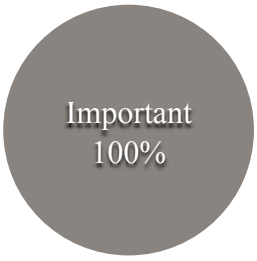


Figure 4.18 - Question: How important do you consider collaboration with your colleagues?

The need to facilitate simple collaboration by being in the same room with the other teachers in a team is made clear by everyone at the same time as the noise and concentration problem is also brought up. I2 states clearly «When collaborating, they should not do it in the teacher workspace. That should be a quiet roåom, but in practice there is a lot of discussion happening there. Some teachers have bought earphones or earplugs to be able to

concentrate». The size of the group has an effect on how much of a disturbance quick informal discussions are, with larger groups experiencing more of a distraction. « The size of the school and organization of the school has a lot to say for the optimal size of the teachers workspaces. Can have consequences for flexibility if the school changes size at some point in the future.» - I3.

How does your current workspace support/inhibit collaboration?	
Support	Team in one room makes quick conversations easy, easy to give information to all, classroom can be used for team discussions
Inhibit	Disturbing for others, not always an available group room or classroom, takes too much time to leave the room for short conversations, size and group composition effect how many people may be disturbed.

Table 4.11 - How does your current workspace support/inhibit collaboration?

There was broad agreement that a teacher's workspace was important to their ability to perform as a teacher. I3 said, «It's very important. It's a deciding factor for teachers to feel like they have a good working conditions. Especially now that a teachers time is bound to the school… You are supposed to work at the school regardless of too much noise, bad ventilation, too crowded. This can quickly cause unhappiness». All of the respondents answered that having a good workspace and good environment is important. I2 notes that the working climate is as important as the physical environment, and that it is possible to have a well functioning school even in poor conditions, but that good conditions and a well managed or new school certainly contributes. « There is something to be said about pride or ownership in the place, both for teachers and for students.» - I4. « A great school building does not make a great school, but it can contribute! Pride about what you have around you and what you do is important, a new building generates pride, and creates pride for what the teachers are doing.» - I2.

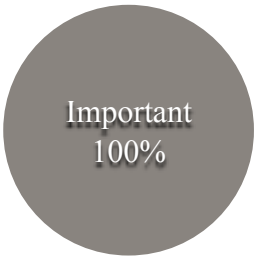


Figure 4.19 - Question: Is the teacher's workspace important to your ability to perform as a teacher?

4.2.7 - Changes in the teaching profession

The questions about changes in the teaching profession focus on political and professional changes that have taken place over the last 10 years and that are ongoing. In particular the recent trend that teachers should spend more of their time on-campus. Also the fact that there has been predicted a teacher shortage of up to 35,000 trained teachers in the next 10-15 years.

When asked about the consequences of teachers being forced to spend more time at school, teachers and administration had different perspectives here. Teacher I1's reply focused on the problems more time on campus would cause, «If all the teachers are required to be (at school) more, then there would be problems due to lack of classrooms or group rooms». All agreed that with more hours at school, there would have to be more and more suitable spaces for grading and concentrated work. The current conditions and solutions would not be acceptable with more hours bound to school, or «full-time school». The principal I2 says that staff would need «a little more space, a little more screen or private space, and perhaps better standards. More space in order to show that they are appreciated.».

When asked about the importance of attractive and well functioning workspaces, all of the interviewees here responded first that it is the school's reputation or status / organization that is the most important factor for recruiting and keeping teachers. The overall work-environment is the most important factor, with physical solutions providing added value. I3 responded that it is a school's status, reputation, location (near home), and good leadership / pedagogic. «If these things are in place, then the physical design of the school generally, and teacher's workspaces will also be important». This is echoed by I2 who says «It's the overall work-environment that is most important, A clear plus with a new building and good facilities».

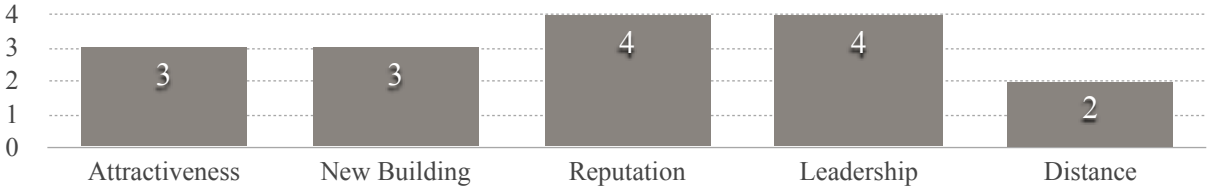


Figure 4.20 - How will attractiveness of effectiveness of teacher workspaces effect recruiting new teachers?

The ability for traditionals to embrace new technologies was one problem of having a generational workplace according to I1. The older generations lack of ability to effectively use and teach using new technologies creates problems for integrating them into the technological classroom. I3 states that «Today's students will be adults soon too, and they will expect a different way of working, because their learning experience was also different».

4.2.8 - Current and future technology

Technology has been a driver for change in the classroom since the days of classroom radio. With technological changing at an ever-increasing rate, one can assume that its influence on pedagogy and ultimately the design of schools and teacher workspaces will increase in the years to come. What do we know about technological change today, and how it will influence the future?

Technology has been more naturally integrated into the classroom. Smart boards or projectors that can stream video wirelessly allow for instant access to information. Computers have become a tool for daily use instead of a «room» that needs to be booked. Access to information at school and at home has allowed new concepts like the «flipped classroom» where students can access instruction at their own level, learn anywhere, and receive guidance in the classroom. Greatly reduced price and capable tablets mean that schools can afford more devices which allows them to be further integrated. «Touch» technology was mentioned as creating a new level of interactivity and direct connection to the interface and content. I1 relates that iPads have fundamentally changed the way students can interact with the net because they are on-line «instantly». Compared to sitting in a computer lab where it took almost the entire class period to get everyone on-line and working effectively.

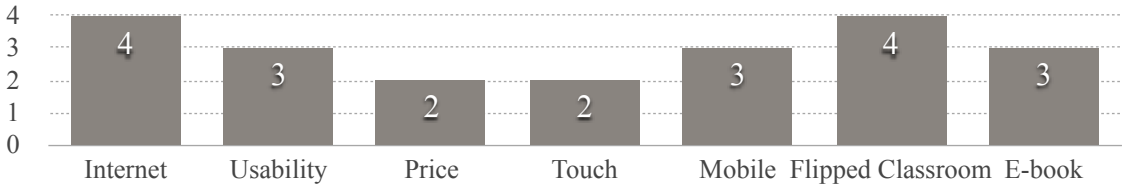


Figure 4.21 - What are the most significant changes to teacher workplaces in the last 10 years that have been driven by technology?

When asked about the «paperless classroom», lack of 1:1 device:student integration, and teacher «habits» that prefer grading on paper are the biggest obstacles to the paperless classroom thus far. I1 reports that there is a lot of double-up of information today, where information is placed both on the school's webpage, and printed out and sent home with the students. I4's students submit their english papers digitally, but she prefers to print them for grading and comments.

> *«If the paperless office ever becomes a reality, the classroom will be the last place it happens» according to I1.*

Technology changes so rapidly, that it was difficult for the subjects to come to any clear conclusion about what future technologies would have the greatest effect on a teacher's work environment. Digital collaboration and collaborative technologies, such as google+, google groups or the variety of apps that allow for information sharing and co-writing were mentioned by several. The idea being that better information sharing and ability to collaborate across schools or geographical areas could have an important impact on a teachers workday.

The interview subjects who were questioned did not have a clear answer to question, «How do you think teacher workspaces will differ from your current workspace in 2025?». The general thinking was that things in the future would be much as today. «The new school we have is top-modern, so it is difficult to imagine that a workplace in 2025 would be different» according to I1. I3 had the most radical vision «Ideally in the future the difference between the adults' workspace and the students' workspace would be wiped out. There could be different zones, zones for teaching, zones for conversation, quiet work, working with computers, creating things». I4 expects buildings to be more environmentally responsive, less paper, and schools with a greater degree of individualization for the students.

5. Scenario Planning

In order to imagine the future of teacher workspaces, scenario planning is used to create a narrative that allows us to explore options that are different from today's current solutions. Simply designing workable and flexible teacher workspaces based upon today's needs is an architects job, and one that is being practiced on many levels already in Norway. The interview objects who were working in a brand new school were generally very pleased with their work arrangements and layout. Taking into account their comments would only bring about a minor improvement in the situation. By looking 15 years into the future certain extremes can be brought into play to see how they might effect the decisions that are being made. This is the goal of scenario planning in this study.

5.1 Planning procedure

Schoemaker developed a 10 step process for scenario planning at Dutch Shell (Schoemaker, 1995). This was a detailed and involved process used by international companies to plan for the future. For this thesis uses a slightly simpler version of this process that combines the procedural and intuitive approaches. This process was useful in identifying the key trends that may effect the future of teacher workspaces, and applying variables of uncertainty to create 3 future scenarios. The steps of the procedure used are outlined below:

1. Define the scope
2. Identify major stakeholders
3. Identify basic trends
4. Identify key uncertainties
5. Construct initial scenario themes

5.1.1 Define the scope

A future that is 15 years from now has been chosen as the timeframe for scenario planning. The year 2030 is close enough to be imaginable, and yet far enough away that one can imagine dramatic changes in schools and teaching. Looking back 15 years to 2000 we find a world without iPods or iPhones where music was purchased in record stores and

videocassettes were rented at a video store. 15 short years have completely changed the way most of the world consumes music, television, and movies. With the historical increase in technology, 2030 should be different enough from today to allow for freedom of thought in scenario planning.

We will assume that no catastrophic natural or man-made disasters will take place in the next 15 years. It will also be assumed that the geopolitical situation will remain stable enough that international politics will not play a significant factor in the study. 5.1.2 Identify major stakeholders

For the purpose of this study, the major stakeholders are identified as those who are closely related to a teacher's workday:

SCHOOL - INTERNAL	SCHOOL - EXTERNAL
Teachers	Local politicians
Students	National politicians
Administration	Labor Office
Staff	Parents

Table 5.1 - Identification of stakeholders, internal and external

5.1.3 Identify basic trends

A selection of trends relating to schools and technology have been identified in a brainstorming process as starting points for scenarios. These can be used singularly or in combination to create scenarios ranging from «status quo» to extreme.

IDENTIFY TRENDS
Teacher flexibility more bound to on-campus time
A variety of different sized and proportioned spaces for teaching
Increased use of technology in the classroom
Open university, distributed learning, video classrooms, flipped classroom
Increased collaboration and networking, both professional and social
Professional specialization and workplace learning
Internet of things, the connection between analog and digital worlds

Table 5.2 - Trends related to teacher workspaces

5.1.4 Identify key uncertainties

Events with uncertain outcomes that may influence future teacher workspaces include:

KEY UNCERTAINTIES
Critical lack of teachers, currently estimated 27,000 to few teachers in 20 years
Teacher flexibility, to what extent will the current trend of bound time extend
Technological development, ubiquitous computing, wearables, embedded tech
Political push for better «results» on national tests, and how they think this can be achieved

Table 5.3 - Key Uncertainties

5.1.5 Construct initial scenario themes

Looking at a combination of trends and uncertainties we can postulate future extremes for some of the options. Of many possible combinations, the following have been chosen as interesting and having a significant impact on the stakeholders at hand, in particular teachers.

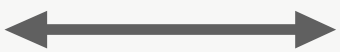
Today's solutions / Traditional		Future / Extreme
Teacher time increasingly bound to campus.		Complete flexibility to choose when and where to work.
«One size fits all» office space with few support spaces.		Flexible and varied workspaces for varied uses.
Standard technology, laptops and smart boards are «high tech» today.		1:1 devices and integrated technologies in the classroom. Mobile technology, wearable computers, 24 / 7 connectedness.
Enough teachers, workspaces under-prioritized.		Teacher shortage, recruitment and retainment of staff crucial.
Traditional schools, utilize and plan according to resources at hand.		Decentralized schools, networked resources of teachers and shared resources.
Teacher as a jack-of-all-trades, responsible for all administrative tasks		Teacher as specialist, with support resources such as secretarial staff or others to allow greater focus on teaching
Individually customized learning based upon monthly or yearly testing		Adaptive learning devices guide students along at the optimum pace for their ability, maximizing learning.

Table 5.4 - Initial scenario themes

5.2 Chosen scenarios

The following three scenarios have been chosen based upon taking a combination of two of the variables listed above to the future extreme.

SCENARIO	VARIABLE 1	VARIABLE 2
1. Status Quo Evolved	flexible workspaces	1:1 technology
2. The flexible future	adaptive learning	complete flexibility
3. The distributed future	teacher shortage	distributed learning

Table 5.5 - Scenarios and variables

The three scenarios each create a future vision based upon two extreme variables each. The futures which these predict will each have different effects and manifestations in the form of teacher workspaces in the three dimensions of work, the physical, virtual, and social (Vartiainen, 2007).

	PHYSICAL	VIRTUAL	SOCIAL
1. Status Quo Evolved	Teacher workday bound to campus 7,5 hrs. Teacher workspace consists of flexible workspaces and a variety of rooms for varying functions. Implementation of NWW / ABW.	1:1 integration with mobile computing means that students are always connected. Computers and internet a natural «tool» in the teachers arsenal. Collaboration and	Collaboration and close team working based upon class or year. Democratic and flat structure among teachers.
2. The flexible future	Completely flexible, teachers can «work" or «school» anywhere. School building helps facilitate learning, use of specialized equipment, social destination.	1:1 mobile technology Adaptive learning technology leads and guides individual learning for students. Teachers have instant feedback of students progress and can schedule meetings to discuss or guide a students progress.	Collaboration and close teamwork between teachers and students. Traditional student / teacher lines are weakened.
3. The distributed future	Centralized production of educational content. Schools contain «production facilities» for creating content. Learning anywhere, but production and tele-communication tied to physical locations.	1:1 mobile technology and distributed learning classrooms. Virtual classrooms and discussions.	Collaboration and teamwork across schools or regions. A vertical striation of teacher status and pay scale. «Super-teachers», local teachers, helpers.

Table 5.6 - Scenarios and the three dimensions of work

5.2.1 Scenario 1: Status quo evolved.

Key factors: Flexible workspaces, 1:1 technology

This is the least extreme scenario which sees technologies and trends from other environments such as NWW and ABW finally make it into schools as younger generations and new ways of working replace older more traditional workspaces.

Teaching continues to evolve to include new tools and technological advances. Classrooms remain an important social construct for student «belonging». Classrooms are flexible teaching spaces that come in a variety of sizes with a focus on different kinds of activities or tasks. A teacher's workday is 7,5 hours at school with the possibility to work flexibly outside of class time. Teacher workspaces of 6-8 people today are replaced with a series of flexible open landscapes that are used for general work with a clean desk policy. Personal items are stored in movable trolleys that can be taken anywhere. Adaptive learning and digital textbooks have removed the need for paper storage completely. All student work is delivered digitally and feedback from a students progress is available instantly for teachers on their mobile device of choice. A series of flexible supporting rooms in varying sizes are available for collaboration or concentrated work. These can be used for teaching during the day or reserved by teachers for concentrated work. Multiple-use of the spaces ensures that there are few «empty» spaces during the day. Planning and reserving of space is integrated in the teachers weekly lesson planning to ensure that there are also always spaces available for teachers who need to do concentrated work.

As cities build new schools to replace older less efficient buildings, they will combine several smaller schools into new larger buildings for more rational management. The new school buildings will increasingly also feature a combination of other municipal functions ranging from healthcare, administration, culture or sport. Urban schools may also include a housing component to maximize site potential and revenue.

5.2.2 Scenario 2: The flexible future

Key factors: complete flexibility, adaptive learning

Ubiquitous computing and mobile technology have created a state of hyperconnectivity where everyone is online 24/7 with access to the complete internet anytime and anywhere.

Work, school, and free time are highly interconnected with school serving as the most important social gathering space for students and staff alike. School is not a place where students go, but a mode of being. School buildings open from morning to evening with a variety of activities taking place across the day. Study can take place equally at home, in the classroom, or outdoors. A school is no longer a physical institution where teachers distribute knowledge, it is a place where students gather to socialize and receive guidance from their teachers and peers. School buildings provide specialized facilities and equipment for sports, experiments, crafts, music, etc while theoretical learning can take place anywhere.

Students learning is completely individualized based upon adaptive learning and responsive digital technology. The grouping of «classes» is still based upon age and social maturity, but coursework at a certain level may contain students of many different ages who gather to discuss level appropriate work. Students «school» and teachers «work» together in a variety of settings that are suited to the tasks. Lesson planning is a collaborative effort between students and teachers, and tasks are delegated to both groups to prepare for the week or month. Holistic learning projects encourage students to use all of the school's special facilities for projects.

School buildings include cultural and sporting facilities in mixed-use hybrid buildings. School facilities are open until late at night allowing students and other citizens to use them for project work or maker-space type work. Social areas with cafe and other services form an important social space for the neighborhood or rural area. Instead of one large school building, schools become hybrid campuses with multiple buildings and functions is interlinked.

5.2.3 Scenario3: The distributed future

Key factors: teacher shortage, decentralized schools

A dramatic increase in the number of students combined with a lack of trained teachers and resources leads to a distributed teaching model in order to better utilize teaching resources. Trained teachers are supplemented with support staff and student teachers. Local and national «super-teachers» who are experts in their subjects are responsible for producing and distributing teaching content for a group of schools in their subject of expertise. Teaching content is delivered to students in interactive classrooms or via mobile devices.

The lack of teachers leads to a new division of teacher types and a vertical striation in teaching according to both educational training and teaching results. The best teachers are sought out for «super-teacher» positions where they lead groups who create and distribute teaching content for a city, a county, or a rural region. Individual schools in big cities begin to specialize and differentiate in order to attract specialist knowledge within a chosen field such as mathematics, music or science for example. Expert lectures are delivered live at their school, and broadcast to interactive classrooms allowing one teacher to lead multiple classes. Content is also recorded or streamed to other connected institutions. Students can also watch the lectures at their own pace and level on mobile devices or together in smaller groups of the same level. Schoolwork and project work is done on-campus in student groups to encourage collaboration. Student groups that span between schools is common and project groups may only meet over social media or interactive video conferencing. «School» is an activity done anywhere, like work.

Teacher’s workloads become increasingly like television or video production today. Scripting and presentations replace much of the typical lesson planning. Teaching as a profession becomes vastly more specialized and striated. Teacher training may also take place in-house at schools with teachers starting as classroom helpers while they receive on the job training and apprentice under the school’s more experienced teachers. Some schools offer teacher apartments again to attract and maintain desirable staff.

6. Discussion

The purpose of this research is to examine teacher workspaces today and determine what factors will play an important role to meet the changing needs of teachers and schools in the future. A theoretical base for speculation has been formed through a literary study that looked at the history of teaching and the development of schools, as well as developments in the workplace outside of schools. Interviews with teachers, administration and a pedagogical planner have given an inside perspective on the workings of today's school and invited them to speculate on the future. Empirical analysis of existing schools has been done in an attempt to determine trends in the development of teacher workspaces. Finally, scenario planning has been used to create three different scenarios that might effect teacher workplaces in 2030. All of the above form the background for discussion in this chapter and will be related back to the research questions.

Research Questions:

- Physical: What combination of rooms and facilities will provide functional workplaces for both individual concentrated work and collaborative teamwork among teachers?
- Virtual: How will new classroom and office technologies change teacher workspaces?
- Social: How can new workplace concepts be applied to better serve the teaching profession's needs and changing working habits?

6.1 Discussion of Methods

A discussion of the reliability and validity of the methods utilized in this research. Strengths and weaknesses of the chosen methods are discussed and evaluated.

6.1.1 Literature study

The literature study section of this research was wide-ranging and personally enriching for the author. Initial searches for literature or studies about teacher workplaces drew a blank as there has been little research devoted to this topic. The lack of information about teacher workspaces was interesting in itself, and served as a confirmation that it was a worthwhile topic to explore. Expanding the search outward to teaching and school design led to a plethora of information from many different sources. Articles and research on teacher efficacy and studies of student achievement gave clues to what physical factors may impact on student and teacher performance. There was a great deal of research here that, while interesting, did not make it into the literature summary presented here.

There was quite a bit of literature about the development of teaching as a profession, ranging from historical documents to recent research. This included valuable background about why and how teaching differs from many other occupations. There were a number of Norwegian studies about recent school reforms that gave quantifiable data about the teaching profession. Historical documents gave a good idea about how teaching has developed in society and how it continues to do so. This information was expanded upon in the scenario planning studies.

Literature focused on school development gave an important theoretical background of how pedagogical trends are converted to physical schools. Studies and analysis of school trends were also extremely helpful as background information, even though they scarcely mention teacher workspaces outside the classroom.

Workplace theory was an obvious area of research to see what developments and ideas were being tested in other sectors. The broad-ranging idea of New Ways of Working (NWW) is a trend in workplace theory that has been widely implemented in the office and creative sectors, with generally positive results. I was unable to find any concrete examples of NWW

being implemented in schools for teacher workplaces, even though there were some examples of concept schools using NWW theories in the classroom. In reading workplace theory it also became obvious that generational trends in the workplace would effect teacher workplaces in the future as new generations of teachers are educated and join the workforce.

6.1.2 School database

Initially I had hoped to gather complete drawings and information from a number of schools that could be used as empirical data about teacher workspaces. However, it proved difficult to get access to detailed drawings of enough schools to perform the data as planned. Plan drawings that are published in magazines or online are typically greatly reduced and simplified. This makes it impossible to accurately re-create the spaces. After initial searches in Norwegian architecture magazines yielded a limited data set another approach was taken.

Instead of a detailed analysis of a few schools the idea formed to gather more general information about a greater number of schools. The discovery of the «national advisory service on kindergarten and schools» led to the creation of a database in a spreadsheet that gathered as much information as possible from public sources. The idea was to see if it was possible to spot trends in organization or placement of teacher workspaces based upon the data available. With a database of almost 50 schools with varying degrees of information it seemed possible to extract useful information from the data gathered.

Given the information that was gathered it was possible to use quantitative methods to determine trends in organization, number of teachers per room, daylight qualities, and layout of the offices. These factors were then analyzed by school type, size, and year. There were some clear trends in the data, which also provided an interesting and useful background for scenario planning of the future.

6.1.3 Interviews

At the start of this research it seemed important to get an inside perspective on what teachers do and how they used the spaces that they have available to them. What does a typical workday involve for a teacher in 2015? What spaces to they use for their work, and how? Personal interviews were chosen over a questionnaire in order to have an open dialog about how they use their spaces and what the future may hold.

The interview objects were chosen based upon generation and position. It was important to also get an administrative perspective in addition to that of a teacher. A pedagogical consultant who works directly with planning and programming of new schools also seemed like a natural choice in order to get a perspective of someone who works closely with schools, but is also outside the system.

The interviews were conducted as conversations, and varied widely in which topics there was the most focus on. This was important in order to get their personal interpretation of today's situation, and four different perspectives on the future. It would have been useful to have a conducted a greater number of interviews to achieve a truly representative spectrum of opinions and ideas, and this can be seen as a weakness with this section of the study. However, the responses worked well for giving a more nuanced understanding of a teacher's workday and the problems they have with existing teacher workspaces. As a supplement to the literature studies and previous research articles the interviews provided important personal insight.

Although the interviews were of a qualitative nature, it was also possible to extract some quantitative information by listing up the rooms that were discussed and cross-referencing what purposes they were used for from the tape and transcripts of the interviews.

6.1.4 Scenario planning

Scenario planning was seen as a way to look at the problems surrounding teacher workspaces in an entirely new way. Presenting a series of possible futures 15 years from now allows us to free ourselves from some of the political and technical issues in order to consider the big picture. The procedural approach to scenario building was chosen as it combined intuitive and creative thinking with a graphing of key variables. This method allowed the freedom to imagine new situations based upon identified possibilities and create an interesting narrative around it. Within that narrative it is possible to imagine the possible consequences of new working situations on teacher workspaces. Mapping and discussing the three chosen futures against the 3 aspects of work creates a matrix of possible consequences which can be used to examine general requirements that would be useful in any future.

Teacher workspaces built today will most definitely still be in use in 15 years. While the futures imagined in scenario planning range from the incremental to the extreme, all are plausible. With that in mind it seems clear that school planners and architects need to consider how school buildings can be planned with enough flexibility and generality to adapt to the changes that are to come. In many senses we are already living in the future, while most teacher workspaces today are designed for the past.

Scenario 1: As the least extreme of the three proposed futures, Scenario 1 reflects today's situation in many ways. The most radical aspect of this scenario is that teachers would be bound to school 9,5 hours a day, thus removing the 1,5 free hours teachers have today. Most teachers use this time for grading papers and concentrated work (I1). The lack of space for quiet and concentrated work is the reason that many teachers choose to work at home in the first place (Nicolaisen and Nyen, 2004). This is the dilemma that most teachers already face today, and which they also express a great deal of dissatisfaction over.

Scenario 2: Takes flexibility to another extreme, with both extreme flexibility in where «school» and «work» are to be done. Teachers in this scenario are completely free to determine where and when they will do their teaching. This does not mean that they would not have to come to the school. Teacher and student performance would be monitored constantly and reported almost instantaneously by the adaptive learning systems in use. This

«performance based» approach is common today among tech companies such as 37 Signals a web development company who have written about the benefits of extreme flexibility in their book «Remote: office not required» (Fried and Hansson, 2013).

Scenario 3: This scenario seems at fist to be the most potentially dystopian and far-out, however the fact of the upcoming teacher shortage and the basis for distributed learning that it is based upon are both very real. Examples of distributed learning institutions like Coursera (www.coursera.org) and the Khan Academy (www.khanacademy.org) offer online classes of high quality from professional teachers and universities. In a future situation where there was an extreme teacher shortage it would only make sense that teacher resources would have to be divided in another way, and that schools may choose to specialize in order to attract the best teachers and be able to brag about producing the best content. This scenario is likely best suited to secondary schools. Perhaps «live» teachers would be prioritized to primary schools where personal interaction with the smaller children and socialization are more important.

6.1.5 Summary

Primarily qualitative methods have been used for this study, with literature search, interviews and scenario planning being the three most important sources. Quantitative data from the school database shows some potential and interesting trends, but the number of samples and the varying quality of the data in the table, gathered from a number of sources, makes it somewhat less reliable. Good reliability requires that both the measurement parameters and methods are clear. (Olsson, 2011). Method triangulation of a number of different methods is used to make up for the weaknesses and unreliability of data. The triangulation of background information from the literature study, interviews, and data from the school database form a solid background from which to launch ideas of scenario planning in the future.

6.2 Research Question #1: Physical dimension of work

- Physical: What combination of rooms and facilities will provide functional workplaces for both individual concentrated work and collaborative teamwork among teachers?

6.2.1 Discussion of theory and results

A general desire to achieve area effectiveness in order to reduce both investment and management costs in municipal buildings has put a pressure on teacher workspaces. This is due to the fact that they are seen as an inefficient use of area since they are empty for a large portion of the day. Teacher workspaces are being built and used today much as they have for the last 50 years. We can see from the school database that instead of improving over time, some new schools have built teacher workspaces with little or no daylight, a basic requirement for office spaces and a healthy working environment. This is the result of many factors and other aspects of school design are being given a higher priority than teacher workspaces. In 2005 the labor office commented on the fact that teacher's workspaces should have the same qualities as other office-worker spaces (Arbeidstilsynet, 2005), and yet it is first in schools built after 2004 that we see teacher workspaces without daylight appear.

As teachers have been pressured to remain on-campus for a longer portion of the day, they have in turn focused on having more space. The 6 m2 per teacher guideline has become an unwritten rule with varying models of practice. The result of these factors been a slight increase in teacher workspace size, mainly focused in a traditional teachers' office with a few supporting rooms in addition. The fact that teachers are required to perform an increasing number of activities in this one general-purpose space has led to increased workplace frustration. Noise and distractions are the number one complaint of teachers in the literature study and interviews. Lack of meeting rooms and other spaces for quiet work is the second most common complaint. Clearly, there is room for improvement in the physical spaces where a teachers' work is done.

There has been a focus on «square meters» and not other qualities of the workspaces or how teachers are supposed to use them. The interviews performed for this thesis back up the data provided by Nicolaisen and Nyen's study from 2004, that the greatest frustration in today's teachers offices is sound and distraction (Nicolaisen and Nyen, 2004) and that there aren't

enough spaces for quiet concentrated work. Even in new schools where the teachers report that they have «top modern» solutions, they also complain of distractions and the inability to do their work at their desks. One can ask if this a physical problem, or a behavioral one. The principal who was interviewed (I2) stated clearly that teacher workspaces should be quiet spaces for concentrated work. If this was the case then everyone in the room would be happier and more able to concentrate.

> «The office space is often too loud for concentrated work. It's supposed to be a quiet space, but it's hard to stay totally quiet in a space with 8 people» - I1

> «When collaborating, they should NOT do it in the teacher workspace. That should be a quiet room, but in practice there is a lot of discussion happening there.» - I2

Are disturbing discussions in the teacher's office due to the fact that there aren't enough other rooms available, or a simple lack of discipline? Is this a problem in the physical or social dimension of work? It would seem that both are to blame, and that distractions are partly due to a lack of spaces for the task at hand, and partly due to sub-optimal grouping of individuals in a particular office. The most common current solutions according to the school database are teacher offices arranged in groups of 4-8 teachers that are divided by year or by subject depending upon the size of the school. The reality of the situation in these rooms is often different from what was planned over time due to fluctuating class sizes or the inclusion of others not related to the group. This leads to teacher groups where some team members have been placed in other rooms because the room is too small, or to small groups being put together in the same room. This makes collaboration at their desks a distraction to those sitting nearby who aren't involved. This also creates situations where information is shared with those in the room, while some on the team are forgotten according to interview subject I4. The solution to this problem is not a question of just providing «more» rooms, but also a question of how existing rooms are used and how conveniently a teacher can transition from quiet work to collaborative work. Placement and size of the rooms will depend upon school size and type.

The changing workplace in 2030 will contain an increasing number of generations working at the same time. Studies have shown that each generation has it's own set of needs when it

comes to workplace satisfaction. Any «one size fits all» solution will increasingly lead to a «one size fits none» situation. It would seem that there are many reasons for schools to provide a greater variety of spaces that provide the ability to organize teachers more flexibly and dynamically.

One important question is the distribution of the total amount of area. Do teachers in 2030 need more than 6 m2 each or less? A discussion about the future of teacher workspaces should not focus solely on size, and bigger is not necessarily better. Can the desired variety of workspaces be accommodated by implementing flexible solutions and a greater degree of multiple-use spaces? The current «norm» of 6 m2 per teacher, divided among a number of kinds of areas as practiced in Oslo is not necessarily accepted by the labor authority elsewhere. Implementing NWW or ABW would necessarily involve the labor authority and the teachers representatives to find a solution that works on all levels.

6.2.2 Discussion of Scenario Planning

PHYSICAL DIMENSION OF WORK IN SCENARIOS 1-3	
1. Status Quo Evolved	Teacher workday bound to campus 7,5 hrs. Teacher workspace consists of flexible workspaces and a variety of rooms for varying functions. Implementation of NWW / ABW.
2. The flexible future	Completely flexible, teachers can «work" or «school» anywhere. School building helps facilitate learning, use of specialized equipment, social destination.
3. The distributed future	Centralized production of educational content. Schools contain «production facilities» for creating content. Learning anywhere, but production and tele-communication tied to physical locations.

Table 6.1 - Physical dimension of work in scenarios 1-3

Scenario 1: Using workplace transformation and analysis methods such as NWW or ABW teacher workspaces could divided into a number of different types of rooms of varying sizes. Some larger flexible open workspaces are be provided. Rooms would be designed and suited to the tasks at hand to allow for a flexible division of time among them. With an extended school day teachers would need workspaces for collaborative team-work with their colleagues and the need of spaces for quiet concentrated work would increase. These quiet spaces should be as attractive to use as the office space and have access to daylight and

views. Experience shows that secondary spaces without daylight or views will not be utilized as often as spaces with them. Interview subject I4 confirmed this with her experiences at her own school where student teachers and others are subjected to «closet like» interior spaces with no windows or daylight. A greater degree of shared space with students would allow for more teacher usable spaces as well. Group rooms can double as grading rooms or conversation rooms.

Scenario 2: While the main focus is perhaps upon the virtual level of work in this scenario, it does not mean that the physical aspect is unimportant. The requirements for teacher workspaces in Scenario 2 may be different from scenario 1. The school itself is described as a social institution with specialized facilities and equipment that are used in learning activities and project based work. Given an attractive and social workplace with the support spaces and technologies they need to do their work, would teachers still prefer to grade at home? A combination of teacher offices and student offices would provide flexible spaces for both groups to work on project based work, and could be used flexibly with the help of mobile technology.

Scenario 3: New tasks in the form of production and recording would lead to new kinds of teacher workspaces. The recording of class lectures could take place in specially equipped classrooms, but the recording of screen-captured presentations and other production would need different kinds of spaces. It would seem natural to include editing facilities, or rooms for audio and video editing, even though the technology for this production may be portable. While very not Norwegian, the supposition that there would be a vertical striation of high-ranking «super-teachers» and content specialists could lead to a situation common in corporate offices. There may be a need for different kinds of offices, with larger more private offices for the executives and others working in an open landscape. In any case, there would still be the need for support rooms for different uses.

6.3 Research Question #2: Virtual dimension of work

- Virtual: How will new classroom and office technologies change teacher workspaces?

6.3.1 Discussion of theory and results

> *«The future is already here, it's just not very evenly distributed» - science fiction author William Gibson (The Economist, 2001)*

Technology has historically played an important role in the transformation of the classroom and there is no reason to think that this will not continue in the future. Some schools have already implemented 1:1 student to device ratios, others still have a «computer room» which is can be considered an anachronism. This is due to the fact that computers are now seen as tool to be used anywhere and everywhere, much like a pencil or a calculator. Tablet computers have transformed hallways and quiet corners into spaces where students can do creative work connected to the internet. They can make a stop-motion animation or learn algebra in a game-like app that makes it fun. Regardless of the current standards of many schools it is difficult to imagine classrooms in 2030 that aren't hyperconnected. Both teachers and students will be part of an interconnected network that supports collaboration and learning.

Grading papers is something that teachers already do «anywhere» to the extent that they are used to carrying around a stack of papers in their backpack to be graded at home. A digital workflow would make this simpler when provided with the right tools. A 1:1 student to device ratio will ensure that all students have access to the tools they need to perform and submit their work digitally. Teachers should also be able to access student submissions or tests anywhere and from any device. There is little doubt that hyperconnected classroom is upon us (Adler, 2014) and that both students and teachers will be increasingly connected by cheaper and more numerous devices. This change in the classroom should also have an effect on how, when and where teachers do their work.

A digital and paper-free workflow is key to the implementation of NWW. Removing paper from the equation allows for a reduction in the amount of space teachers would need for

personal storage at the same time as it frees them from their desk as «the place they have their papers stored». Teachers today produce a lot of learning materials that are colored and laminated, then hung on the walls of the classroom. Future technological solutions with digital ink or projector walls will potentially also remove the need for these laminated support materials. Solutions for this exist today, but they are not commonly used for this purpose. Teachers will have to adapt and embrace the technologies to fully utilize the classroom of the future. Routines and best-practice will have to be developed. One benefit of having digital educational material would be the fact that it could easily be shared with other teachers, locally, nationally or internationally.

6.3.2 Discussion of Scenario Planning

VIRTUAL DIMENSION OF WORK IN SCENARIOS 1-3	
1. Status Quo Evolved	1:1 integration with mobile computing means that students are always connected. Computers and internet a natural «tool» in the teachers arsenal. Collaboration and
2. The flexible future	1:1 mobile technology. Adaptive learning technology leads and guides individual learning for students. Teachers have instant feedback of students progress and can schedule meetings to discuss or guide a students progress.
3. The distributed future	1:1 mobile technology and distributed learning classrooms. Virtual classrooms and discussions.

Table 6.2 - Virtual dimension of work in scenarios 1-3

Scenario 1: Existing technologies already allow teachers to work anywhere within the school and continue that work seamlessly at home, or on a train for that matter if the school has the necessary infrastructure. Lightweight laptops or tablet computers and fast wireless networks to support this are already implemented in many new schools. Digital textbooks and homework would reduce the need for paper storage. Digital-ink posters and learning materials in the classroom would also reduce the need for analog materials that have to be stored. All of the school's rooms could be managed by a central integrated booking system that would ensure teachers have enough available quiet spaces for grading at the times of day when they need them. Scheduling and tracking of usage would be an important aspect of the central «software» that controlled the school. Wireless tracking technologies using RFID or

student and teacher mobile devices could be used to monitor and optimize room usage and reservation (Ranjbarrad, 2014).

Scenario 2: Adaptive learning is taken to an extreme in this scenario, with the thought being that a majority of the student's work would be individually adapted to their level. This does not mean that all of the results would be digital and automatically graded without the interaction with teachers. The software would suggest individual academic paths and levels for each student as determined by learning algorithms. Teachers would be able to see where their students were struggling with concepts and could devote their personal time to helping an individual or a group who were having the same problem. This would hopefully help teachers invest their time where it can make the most difference with their personal interaction.

Scenario 3: Integrated technologies would allow the students to receive content and view it anywhere. The focus on distributed classrooms and content might mean that more time was spent in a virtual classroom online than in a real classroom. Technologies like spatially immersive displays (Raskar et al., 1998), VR, and AR could drastically change the way teachers interact with their students and students interact with each other.

6.4 Research Question #3: Social dimension of work

- Social: How can new workplace concepts be applied to better serve the teaching profession's needs and changing working habits?

6.4.1 Discussion of theory and results

The teachers interviewed described themselves as «conservative» and «traditional», and somewhat unwilling to implement new solutions. This is one possible explanation as to why teacher workspaces have not evolved as much as workspaces in the offices elsewhere. The idea that teachers as a group need to act a certain way as part of their «reputation» seems widespread.

> «Teachers are very conformist - there are certain expectations to how a teacher will look be and react.» - I2

> « A new teacher that tried to implement new ways of working would quickly be an outcast» - I1

Potentially this conservatism is related to the generational workplace and the fact that teachers can and often do work all the way to retirement age. Implementing new ways of working would require re-learning how work is done, and changing ingrained habits that have been copied and reproduced for generations. With more generations in the workplace at the same time it will be increasingly difficult to find a «one size fits all» solution that everyone is equally comfortable with (Meister and Willyerd, 2010). Baby Boomers are not as likely to be comfortable in an open or flexible office as Millennials or Generation 2020. The provision of flexible rooms of varying sizes should also take this into account.

School organization and leadership have been sited in the literature study as the most important factors for a school's success. While the physical design of the school building itself may be secondary, school architecture should support and nurture a positive working environment. This means that school buildings should not introduce physical obstacles that prevent positive socialization or create boundaries that have a negative impact on the school's organization. A lack of flexibility or fixed solutions that work counter to a school's goals are both examples of how a building can have a negative impact on the social aspects of work.

The primary missing ingredient to implementation of more varied and flexible workspaces today is a willingness or interest to try. This must necessarily come from both the strategic level with city and national government support, and on an operational level with school administration and teacher support.

6.4.2 Discussion of Scenario Planning

SOCIAL DIMENSION OF WORK IN SCENARIOS 1-3	
1. Status Quo Evolved	Collaboration and close team working based upon class or year. Democratic and flat structure among teachers.
2. The flexible future	Collaboration and close teamwork between teachers and students. Traditional student / teacher lines are weakened.
3. The distributed future	Collaboration and teamwork across schools or regions. A vertical striation of teacher status and pay scale. «Super-teachers», local teachers, helpers.

Table 6.2 - Virtual dimension of work in scenarios 1-3

Scenario 1: The longer workday would also call for a different organization of a teacher's time. With students on campus for a longer period, teachers would be able to stagger their preparation and teaching times more throughout the day. The current situation where all teachers are in the workroom from 08:00-08:30 and again 14:00-16:00 would change with some teachers starting early, and others perhaps having their first hour in the classroom at 11:00. This, together with a variety of spaces to work in could reduce simultaneity in the teachers office space. Reduced simultaneity would open for the possibility of reducing the number of desks, while providing for more quiet rooms. The idea that «work has to take place in the teacher's office» could be replaced with more flexible, less formal attitudes. This will happen naturally in part with the millennial and generation 2020 entering the workplace in greater numbers.

Scenario 2: Flexible working hours and free time have long been one of the more attractive traits of teaching and a reason that many teachers got into the profession in the first place (I2). If technology and school organization could enhance this, instead of inhibiting it then hopefully teacher performance and satisfaction would increase. There is research to show that increased flexibility of this kind would allow for a better work-life balance (Lewis and Cooper, 2005).

Scenario 3: The mental jump from today's teacher to that of a producer of content or «online personality» would certainly be a change. Looking at dystopian future science-fiction one can

imagine teachers becoming more like a guild where the specialist schools are not only for teaching students, but also places where teachers to go complete specialist training.

6.5 Generalization of scenarios and theory

Given that any of the three chosen scenarios, a combination of them, or realities that are even more extreme due to external forces could come true in 15 years, it is possible to conclude that new schools should be planned with teacher workspaces with a high level of flexibility and generality in order to be able to adapt to new working situations in the future.

Scenario 1 could be implemented from a spatial and virtual standpoint today. There would be a greatly increased need to have quiet spaces for concentrated work, and a larger variety of spaces where work could be carried out throughout the day. Workplace theory NWW or ABW could be implemented along with supporting technologies to allow for seamless working.

Scenario 2 has a focus on technology and the potential flexibility that it can bring to schools and teachers workdays. The complete implementation of adaptive technology in this scenario has the potential to be so disruptive that the teaching profession would need to undergo a radical change as well.

Scenario 3 may seem the most far-out, but it is still a useful exercise in extremes. In a future situation where teacher workspaces share more with television production facilities, it would clearly be necessary to create a new kind of workspace. Could existing workspaces be converted to work in this way, and what might it look like if one was to design a school with this scenario as a given? In this extreme, schools have to work very hard to keep the best teachers, and thus teacher workspaces should be highly prioritized, attractive and flexible.

In all of the scenarios generated it is difficult to imagine that a traditional teacher workspace with 4-8 desks in a room arranged along the outer wall will be the optimal and most accommodating solution. Greater flexibility in the form of varied workspaces and a greater level of multiple-use space between teacher spaces and student spaces has the potential to work in all of the scenarios above.

7. Conclusion

This thesis was started based upon the intuition that teacher workspaces outside of the classroom today do not provide the support that teachers need to perform their jobs properly. There is an implicit hope that by drawing attention to this problem that it will be possible to improve teacher workspaces which will in turn improve teacher and performance and ultimately student performance as well. When planning teacher workspaces today, we can ask ourselves What will teacher workspaces in 2030 be like?

Teacher workspaces of the future will require a variety of flexible spaces that allow teachers to perform the various tasks that support their core operation, teaching. This will require new kinds of spaces, the adaptation of new technologies and changes in school organization and teacher work habits.

Using the research questions which are related to the three dimensions of work it is possible to draw further conclusions and explore areas which will require further investigation to answer.

- Physical: What combination of rooms and facilities will provide functional workplaces for both individual concentrated work and collaborative teamwork among teachers?

The main issue here is to provide a variety of spaces that allow teachers the flexibility to work in teams, to have private conversations, and to work on concentrated individual work. Just as classrooms and teaching environments have developed into a series of rooms of different size and character in order to support different teaching activities, so too should teacher workspaces develop into new areas that allow them to work optimally.

There may not be one definitive answer here as individual schools have different working methods and environments, so there is a danger that solutions that work well for one school type and organization may not work well for another. However, flexibility and generality must be key features to ensure that schools can develop and evolve over time without the need for expensive renovations and physical changes. There is no reason that teacher workspaces should not receive as much attention and care as other types of workspaces.

Daylight, a good interior climate, and features that make for an attractive workspace are equally important as energy-efficency and area effectiveness.

There are many ways to solve the physical layout of teacher workspaces. Further exploration and ultimately full scale testing would be necessary to find a definitive answer.

- Virtual: How will new classroom and office technologies change teacher workspaces?

There is no doubt that technology is changing the classroom much as it has the workplace in general. The performance paradox tells us that true increases in learning performance will only take place when technology is truly used to it's full potential instead of being a digital version of analog tools. As we approach 1:1 device saturation and hyperconnectedness new technologies such as adaptive learning will have a huge influence and potential to change the requirements for teacher workspaces.

Schools should invest in the infrastructure and tools that are necessary to support a teachers workflow. Technology should be an enabler that allows teachers to collaborate and work together better. It may well be that schools will be one of the last places to implement a paperless workflow, and there is much to be said for analog tools, but there is clearly a huge potential for improvement when it comes to the implementation and use of technology for teachers in and outside of the classroom.

- Social: How can new workplace concepts be applied to better serve the teaching profession's needs and changing working habits?

Teachers are no longer lone-practitioners who sit on a platform at the front of the room dispensing knowledge to «their» students who are expected to sit quietly. Today's teachers are a part of a teaching team that works together across academic subjects to guide and interact with students to help them seek out knowledge that is individually suited to their level and skills. A workplace that supports teacher collaboration, workplace learning, and a good work-life balance seems necessary for the further development of both teachers and teaching as a profession. A predicted teacher shortage in the next 15-20 years will mean that schools will have to work harder to recruit well trained teachers. Attractive and functional

teacher workspaces have the potential to contribute positively to teacher recuitment and retention.

The quantitative and qualitative research done during this thesis has shown how the teaching profession has changed over the last 20 years, greatly broadening the number of tasks that teachers are expected to perform outside the classroom. Education and pedagogic theories are in a constant state of development. School buildings are also being developed to embrace new pedagogic trends and meet new political and statutory requirements. It is surprising how little teacher workspaces have changed, resulting in a situation today where typical teacher workspaces are not optimal for the tasks at hand. An increased focus on this issue will hopefully bring about a change in attitudes and priorities. The adaptation of developments in workplace theory that have been tried and tested elsewhere would most likely benefit teachers and teacher workspaces. However, this would also require teachers to learn new skills and new ways of thinking about work.

7.1 Topics for further research

There are many areas and directions where this research could be carried further:

1. An in-depth case study of a suitable school that led to concrete suggestions or guidelines for implementing NWW or ABW for teacher workspaces.

2. Development of a space planning tool that could suggest what kind of rooms and how many a particular school would need depending on school type, size, and chosen organization.

3. A closer study of the positive and negative aspects of centralized vs. decentralized teacher workspaces and how these aspects can be strengthened or weakened by workplace design.

4. An in-depth case study of a recent school that contains more flexible workspaces for teachers.

8. Appendix

8.1 Guidelines for school design in Norway

8.1.1 Regulations and laws

Arbeidsmiljøloven (2005). Law regulating health and safety in the workplace.
From Arbeidsdepartementet
http://www.lovdata.no/all/nl-20050617-062.html

Building regulations TEK10, Regulations and technical requirements for buildings.
From kommunal- og regionaldepartementet
http://www.lovdata.no/ltavd1/filer/sf-20100326-0489.html

Regulation for health and safety at kindergarten and schools (1995).
From Helse- og omsorgsdepartementet
http://www.lovdata.no/for/sf/ho/xo-19951201-0928.html

Teacher Regulative, Knowledge lift 32 (Kunnskapsløftet 32)
From http://www.udir.no/Lareplaner/Kunnskapsloftet/

8.1.2 Room program, FKOK Schools 2012

FKOK 2012 - 3.4.13 Teacher Workspaces

New curriculum and teaching methods require close cooperation among staff, between staff and students, and between employees and homes. Schools must organize teaching in groups as needed and in such a way that education is secured in the best possible way. This means that the adults who have responsibility for a student group will work in close cooperation on planning and implementation of teaching.

Working expectations for teachers have been and are under change. The new contracts require more on-campus time for teachers and staff. A teacher's preparatory and grading work consists of solo, groups and team work that is both theoretical and practical. It is important to create an attractive workplace where it is possible to perform individual concentrated work, good meeting places and areas for common supplies. It is important that the areas that make up teacher workspaces are seen as a whole.

There should be one teacher workplace per 11 students. There should be 6 m2 per teacher workplace.

- 3,5 - 5 m2 per person for individual workplace
- 1 - 2,5 m2 for collaboration, formal or informal meetings (team meetings, interdisciplinary meetings, guidance counseling), telephone room and quiet rooms or study cells for work that requires extra concentration.
- Work-desks should be between 120 - 160 cm wide.

Total 6 m2 per person for all functions, with multipurpose and simultaneity taken into consideration. For each building, the division of workplace area between individual and group rooms must be described based upon the workplace culture one wishes to support, related to each of the following points:

- Teachers need an individual workplace for pre- and post work related to teaching
- Teacers need access to a larger worktable
- Teachers need access to screened off areas for confidential telephone calls
- Teachers need access to screened off areas for confidential meetings or student consultations
- Teachers need access to an area for academic discussions
- Teachers need space to store private and common teaching materials
- Teachers need to be available for students

Figure 8.1 - Example room program FKOK 2012 (Oslo Kommune, 2012)

8.1.3 Room program Teacher Workspaces, Rygge Skole

«Teacher Workspaces:
New teaching plans and work reforms demand a close collaboration among the staff, between the staff and students, and between the school and student's homes. The school should organize teaching in groups as needed in a way that customized teaching can be safeguarded in the best possible way. This means that teaching staff has a common responsibility for a larger group of students. Close collaboration on planning and implementation of teaching is necessary.

The teacher's contracts demand a that teachers are on-campus in a greater degree than before. It is therefore important to make an attractive workplace which provides for individual concentrated work as well as good meeting places and areas for teaching materials. Area is calculated with one teacher per 11 students, and 6 m2 is provided per teacher.
4 m2 for individual workspaces
2 m2 for common spaces for formal or informal meetings

Each class is dimensioned for up to 24 workspaces, collected in one area, but organized in two units which corresponds to the student's homerooms. A common meeting room for up to 12 teachers is placed near the teachers workspaces. It should be possible to open this area to the adjacent corridor or screened area near the teacher workspaces such that all 24 teachers in the class can meet. Two small telephone rooms / quiet rooms are provided for work that requires concentration or for telephone calls. Further meeting rooms can be combined with group rooms for students.

Teacher workspaces:

- Closely connected to student home room areas
- Individual workplaces for pre- and post-preparation related to teaching
- Access to a larger worktable
- Screened area for confidential conversations and meetings
- Arena for academic discussions
- Storage of personal and common teaching materials

Individual lockers for belongings and confidential documents. There should be wallspace for shoe-racks and hooks for jackets and rain gear near the workspaces as the teachers are not expected to use the common wardrobe as their primary wardrobe.» (Reikvam, 2012)

Figure 8.2 - Example room program, Rygge (Reikvam, 2012)

8.2 Interview guide

«Teacher Workplace of the Future»

Introduction:

This interview is a part of a thesis project, the final assignment in a Masters Degree in Property Development and Management at NTNU in Trondheim. The title of this thesis is «Teacher Workplace of the Future» and it is focused on the future requirements for teacher workspaces outside of the classroom. This thesis project will explore the design of teacher workspaces in the future based upon scenario planning, trends in workplace design, new technology and the changing landscape of the teaching profession. The goal of this thesis is to suggest possibilities for planning better, more functional, and more attractive working conditions for teachers through space planning and design.

This personal interview is one of several that will ask for informed input from teaching professionals of different ages, experience levels, and roles within their respective schools. The goal of these interviews is to gain insight into a number of different aspects of a teacher's workspace today and to discuss possible scenarios for the future. The form of the interview will be an in-depth personal interview based loosely on this interview guide.

As the masters thesis will be written in english, this interview guide is also prepared in english. However, the interview itself can be conducted in english or Norwegian at the interviewee's preference.

The interview will be recorded in order to document the discussion and make note taking and transcription easier. Upon transcription, all personal information will be anonymized. At the end of the report the recording will be destroyed to ensure anonymity. It is possible for you to stop the interview or to decline participation at any point during or after the interview. A digital copy of the completed thesis will be presented to interview participants upon completion.

Interview guide

1. **Facts**:

School name and type?

What is your current position?

At what institution?

How long have you held your current position?

Do you have any other roles or responsibilities that relate to the school or your position?

What, if any, other positions or roles have you had previously?

Where did you receive your education?

Degrees earned?

Graduation year?

What is your Current age and year of birth?

Which «generation» do you feel describes you best:

Traditionals (born before 1946), Baby Boomers (1946 to 1964), Generation X (1965 to 1976), Millennials (1977 to 1997), Generation 2020 (after 1997).

2. Central Questions:

Physical solutions:

Can you give an example of a typical workday, and what workspaces and facilities you use during the day?

What do you consider your primary work space (outside the classroom)?

What are 3-4 most important support spaces to your work?

Which of these, if any, work particularly well?

Which ones don't work so well, and why?

Would you say that any particular solution helps you to be a better teacher?

How does your current workplace support/inhibit your opportunity to learn new skills?

Given the choice between a larger and more varied array of spaces (break-away, meeting rooms, telephone rooms), or a larger «personal» workspace, which would you choose? Why?

Do you use the classroom as a workspace after hours or when there are no students there?

Interview guide

How different are teacher workspaces from other office workers, or creative/collaborative workers?
What aspects of workplace theory (generally applied to offices) and «new ways of working» be applied to teacher workspaces?

Collaboration:

How important do you consider collaboration with your colleagues?
How does your current workspace support/inhibit collaboration?
How would you improve your current workspace to improve collaboration?
How important do your consider your workspace to your ability to perform as a teacher?

Historical / Future Changes in the teaching profession:

The Lærerløftet 2014 says «academically strong and motivated teachers are the best contribution to help children learn more at school». How do you think that a teacher's physical workspace can contribute to motivate teachers?
What, if any, consequences do you foresee for teacher workspaces in relation to Lærerløftet 2014?
The binding of a teacher's autonomy and free-time has been a central theme in the development and negotiation of teacher's working time and salary. If teachers are required to spend more time «at school», what kinds of changes, if any, will this require in teacher workspaces?
There will be an estimated 27.000 too few trained teachers in Norway in the near future. How do you see this effecting the general workplace for teachers?
What role do you think the «attractiveness» or «effectiveness» of teacher workspaces will play in recruiting the «best possible» staff in future?
What effects do you expect when the workplace in 2025 contains 4 or 5 generations, each with their own values and needs?
How do you see changes in pedagogical development changing the requirements on teacher workspaces outside the classroom?

Interview guide

Technology

What are the most significant changes to teacher workplaces in the last 10 years that have been driven by technology?

How do you see technology changing the requirements of teacher workspaces in the future?

How do you see the role of 1:1 tablet computers or laptops changing the requirements for teacher workspaces?

If technology allowed for a truly «paperless classroom», how would this effect the needs of teacher workspaces?

What current or future technologies do you think will have the greatest effect on a teacher's physical working environment outside the classroom?

How do you think teacher workspaces will differ from your current workspace in 2025?

3. Summary:

Are there any aspects that we have touched on which you would like to comment further?

8.3 Interview Summary

8.3.1 Interview Summary - Central Question 1: Physical Workspace

What do you consider your primary workspace (outside the classroom)?	
I1	Teacher's office, or the classroom to be alone if it is empty
I2	Teacher workspace, should be a quiet space where they can work without being bothered
I3	Teachers office, but teachers are mostly in the classroom
I4	Office, but prefer to do grading work at home

What are other important support spaces to your work?	
I1	Teacher's lounge is important for socializing, group rooms for teaching or phone calls.
I2	Conversation rooms or smaller workspaces for team meetings or meetings with parents. Classroom after school hours if they are available. Would be good to have a telephone room, or more group rooms per floor.
I3	Teacher's lounge (for breaks, or social interaction). A place to relax right after teaching time is over. (Lounge a place for relaxing, not necessarily work talk). Exception would be personnel meetings or internal classes or seminars. Depends on the furniture in the lounge. Deep sofas are not well suited for coursework, but tall «cafe tables» where everyone can see everyone work well.
I4	There is one grading room shared among the teachers. Should be a quiet space for concentration, but is often not.

Which of these, if any, work particularly well?	
I1	Teacher's office is much better than at my old school. Plugs for laptop easily accessible and easier to connect. Previously the plug was under the table which made it more difficult. Simple small things like that are much better.
I2	Generally pleased with the layout and arrangement of the rooms. The Teacher workspaces function very well, and the teachers are happy. Could perhaps have one more conversation or quiet room per floor. Teachers are furnishing and using all the «corners» of the school. Areas outside the classroom where it's possible for groups to sit and work. Its great to see these areas taken into use, they function well as a supplement to group rooms and other such.
I3	Its possible to use both classrooms and group rooms for meetings, collaboration, and individual work when they are available.
I4	Teacher's office works well, because there are only 3 people in it. But even then it can be distracting to work there at times.

Which ones don't work so well, and why?	
I1	The office space is often too loud for concentrated work. It's supposed to be a quiet space, but it's hard to stay totally quiet in a space with 8 people. Sometimes you turn to ask a colleague a quick question and it turns into a conversation. People generally will go somewhere else to have a conversation or discuss things, but it is easy to forget. It's easy to get irritated with others when they are talking in the office.
I2	The sliding doors in the teacher offices are not optimal. Could perhaps have been better with smaller offices and fewer teachers per office.
I3	The classroom is perhaps a bit lonely, better to sit with the other adults. The classroom is also often in use for other things. Classes are not necessarily finished when teacher has their break, or SFO (after school program) may be using the space.
I4	Meeting rooms without windows or lights are not very attractive. Feels like working in a closet.

Do you use the classroom as a workspace after hours or when there are no students there?	
I1	Yes, for concentrated work. Feels like «my» space. Can also do other things while in the classroom, like arranging, tidying up, or laying out materials for the next day. It seems natural to use the classroom when it's available. Teachers in general are creatures of habit, so once they have started doing something one way and it works, then they continue to do it the same way.
I2	Teachers «should» be working in their classroom. They can organize and work together there, do practical things and prepare for the next day. Team meetings can also happen in a classroom, so it doesn't disturb others in the teacher's office space.
I3	The classroom is perhaps a bit lonely, probably better to sit with the other adults. The classroom is also often in use for other things. Classes are not necessarily finished when that teacher has their break, or SFO (after school program) may be using the space.
I4	As an english teacher, I move from classroom to classroom and don't have a home room. Moving between rooms you don't have the same feeling of «ownership» to a classroom. I have access, but it would be unusual to use a classroom as an office for me. The small desk in the classroom is full, no space to do work. Only set up as a space to do while teaching, but you would have to clear it off, not very practical.

How does your current workplace support/inhibit your opportunity to learn new skills?	
I1	Most important learning is in the daily collaboration with colleagues and those I work closely with. Internal teaching from administration takes place in the auditorium, break away into groups in group rooms or a classroom, and then meet again in auditorium. There is an iPad group that has responsibility to do research and find good solutions, then spread that on to the other teachers, a form of internal teaching and resource sharing.
I2	Workplace learning is something that takes place at the all-staff meetings which take place in the auditorium to start, then groups break away for discussion and group work in an empty classroom or group room.
I3	-
I4	School has a focus on developing teachers and looking toward the future. New ideas and things to try out. Off-campus courses are arranged for classroom-leadership and other skills. The all staff meetings involve planning and implementing these extra curricular activities. An important part of learning at the workplace. One of the main challenges with development as a teacher is time. When can one find time to do development, as the school day is already quite busy.

Given the choice between a larger and more varied array of spaces (break-away, meeting rooms, telephone rooms), or a larger «personal» workspace, which would you choose? Why?	
I1	Generally happy with the space I have. New workplace is much better than our previous offices. The biggest problem was that all of the teachers brought a lot of material with them from the previous school. It took some time to get rid of excess teaching materials. Requirement of «more space» is not necessarily larger desks, but more space to also have quiet workspace.
I2	The teachers are happy because the new offices are much nicer than the previous ones, but I would like them to have a little more space. This is a 2 parallel school, so there is room for this. In a larger, say 5-parallel school it would be different. Then it would perhaps be better with offices that open to a common area where they can gather around a large table. Then it would be more natural that each year had its own area, with larger teams you would need to collaborate with more people. Telephone rooms for confidential discussions, or to avoid disturbing the others would be useful. Today's solution, but with one more conversation room per floor would also be good.
I3	Optimal solution would be to have more, smaller teacher offices to avoid distraction. It's simpler to ask one person to be quiet in a small office than having to ask many in a larger office, repeatedly over a longer time. I would have a preference for more and smaller rooms, vs. larger open office space. A work day changes quickly between individual work, and the need to discuss with others nearby. The ability to just «turn to your neighbor» to ask a question is very important.
I4	Some combination of both maybe… If I was sitting in the room with 6 people then I would definitely want more space. There is supposedly some kind of requirement for 6 m2. There is a need for more specialized rooms, such as a grading room (retterom). Many of the rooms today are used for so many different purposes, like students taking a test, parents visiting for a meeting, student teachers who need a space. It is difficult to find a space to do focused work or have a meeting.

How different are teacher workspaces from other office workers, or creative/collaborative workers?	
I1	Workday is very differentiated with many different kinds of work to be done. Very intense in the classroom where a teacher «gives a lot of yourself». By the end of the day one is «empty in the head» afterwards. Difficult to start on mentally heavy work after 14:00.
I2	-
I3	Typical office work involves longer periods of individual work, with clear times for «meetings». You might work individually for 3 days and then have a meeting at a pre-arranged time. Meet for an hour or two, and then go back to individual work. Or if you are working together in front of a computer for 1-2 hours you would be more likely to do it in a meeting room. Teachers work routines require them to interact more often and in short periods. Makes it more difficult to define the need to go to a meeting room. Teachers have a short period of time outside the classroom each day where a lot has to happen. Both individual work, and collaborative work. Requires more communication and collaboration to get the job done than a typical office job would. The short amount of time teachers are in the office, and all there together, makes a teachers workspace different from a typical office. A teachers workday is characterized by a high simultaneity in the office. The order of a teachers work-tasks are very similar. All start at the same time of day, and end at more or less the same time of day. So they are all in the office at the same time, very compressed.
I4	Haven't worked in another office type job, so I don't have anything to compare it to. One difference would be that in a private sector job, you could make more demands on how your workspace should be. Also, there would be competition to make the workspace attractive and modern. For teachers, you could maybe go to NAV and get a special chair or standing desk, but teacher workspaces are not prioritized. My principal says that she wants to spend the money in her budget on people as much as possible, but office space is not prioritized.

What aspects of workplace theory (generally applied to offices) and «new ways of working» be applied to teacher workspaces?	
I1	The concept of «hot desking» would be very strange for teachers. Sitting on a shared table would be okay, but people would want to sit in the same place every day and have a fixed place for their computer. Teachers are very conservative and it would be difficult to implement new ideas and ways of working. Would feel strange to sit in a sofa. «Far out» to think about sitting in a sofa and doing my job. Fear that the other teachers would look strangely if someone sat in a sofa and worked as it «doesn't look like working». Would rather go home than sit in a sofa at the office. Stereotype and expectations of a teacher do not include working in sofas, so it's difficult to imagine. A new teacher that tried to implement new ways of working would quickly be an outcast «especially if they tried to wear a cap inside at the same time». Discussion has brought me onto new thoughts. Maybe I could sit in the library and be comfortable while working, why not?
I2	Teachers are very conformist - there are certain expectations to how a teacher will look be and react. I've noticed that the teachers have started to use the new school differently because they have areas they didn't have in the previous school. The furnished areas of the corridors are being taken in to use. It's also easy to see that the students are using the building differently because there are new options. The kids can do more in more places when they have an iPad around in the school. Teachers can also sit where they want, but they don't. It's mostly due to tradition. Perhaps it will change as the teachers also learn to use the new building. They may over time change the way they work - especially if they are required to be at the office for a larger part of the day. A new, young principal could maybe work from a sofa, but not me. This is partly due to the role and reputation that one creates and the expectations you have for yourself and from others.
I3	If we one day have «whole day school» where the students are at school all day, changing between physical activity, free-time, school and meals. Then maybe a teacher's work day will also be very different. Some might not start teaching until 12:00, or have classes at different periods during the day. Then it might be more natural to choose an available table, or sit in a lounge or sofa. Work somewhere else with a laptop in your lap. But this will likely meet a lot of resistance. Teachers like to have their own desk where they know their things are waiting on them to come back.
I4	

8.3.2 Interview Summary - Central Question 2: Collaboration

How important do you consider collaboration with your colleagues?	
I1	Important. Two classrooms are connected together. There are 3 teachers per «year» in a «team». Home-Room teacher has responsibility for students in their own classroom. Third teacher has some students in each room. Teacher offices arranged for 8 teachers. In the teacher office they are generally 3 that work together, plus another teacher that perhaps has art, or music.
I2	Collaboration and a team feeling is important for a good school environment. We try to get all to come to the teachers lounge to eat or take a break. This helps create a «we» feeling for the whole school. Some of the teacher groups work in the teachers lounge. It is empty during a lot of the day. The Music teachers use the lounge for their meetings, and prefer to be there instead of in the music room, they sit and plan around one of the tall tables. But generally the teachers lounge is a place to be social and relax. Should also be possible to talk about other things there than work.
I3	Collaboration and co-planning are key for team-teaching which is prevalent today.
I4	My school has a focus on developing teachers and looking toward the future. New ideas and things to try out. This is why the co-teaching model currently being tested. There are also a number of requirements that come from «above».
How does your current workspace support/inhibit collaboration?	
I1	When collaborating we will often go to the classroom to have a group discussion. That's where there is space, and we aren't disturbing anyone. At previous workplace they had more room in the teacher's office, and could turn around and collaborate around a table.
I2	When collaborating, they should NOT do it in the teacher workspace. That should be a quiet room, but in practice there is a lot of discussion happening there. Some teachers have bought earphones or earplugs to be able to concentrate. Teachers «should» be working in their classroom. They can organize and work together there. Do practical things and prepare for the next day. Common meetings in the auditorium, with break-away to classrooms. Workspaces should be quiet, if each year had better doors between them then they could sit there and work collaboratively in smaller groups without disturbing the others.
I3	A typical team will vary from school to school depending on size. Typically 4 (max 6) persons. If the school is large enough, then a team would be teachers from the same year. At smaller schools then a team may be composed of 2 years at a time (1-2 year), or even 1-4 years together. The size of the school and organization of the school has a lot to say for the optimal size of the teachers workspaces. Can have consequences for flexibility if the school changes size at some point in the future. One often plans for 6 m2 per teacher, but end up jamming more into the space in the end. Not an optimal situation.
I4	If all my co-teachers were in the same room, it would be convenient to turn and talk. Easier when there are only a couple of people in the room. But can't really discuss with others in the room, too disturbing. Miss out on some information by not being in the same room as the rest of the team. Not the best informed.

How important do your consider your workspace to your ability to perform as a teacher?	
I1	New workspace is much better than the old one. The new office is not a lot different from the old one, but it was a lot older and worn down, not enough plugs, bad internet. Air quality, light and so on are much better in the new school, particularly air quality.
I2	There should be flexibility, room for individual work, room for collaboration. Should also be room for creativity and ability to develop an individual way of working. The working climate is as important as the environment around you. This can be great in an old worn-down school, as well as in a new one. A great school building does not make a great school, but it can contribute! Pride about what you have around you and what you do is important, a new building generates pride, and creates pride for what the teachers are doing. The teachers can relax because of the aesthetics around them. Good natural light and good acoustics give a calm good feeling to the whole school.
I3	It's very important. It's a deciding factor for teachers to feel like they have a good working conditions. Especially now that a teachers time is bound to the school. Previously you could go work at home if you didn't feel comfortable in the office, or were distracted. But now a teachers time is bound to a larger degree. You are supposed to work at the school regardless of too much noise, bad ventilation, too crowded. This can quickly cause unhappiness.
I4	When you think about which school you want to work at one of your first impressions is the building, feeling or atmosphere when you walk in. When some extra thought or care is put into a building, you feel more proud to be a part of it. Many elements which make a workspace positive to be in or a place you enjoy. There is something to be said about pride or ownership in the place, both for teachers and for students.

8.3.3 Interview Summary - Central Question 3: Changes in the teaching profession

If teachers are required to spend more time at school, how will this effect teacher workspaces?	
I1	Want to have both the possibility to work quietly at school, and the freedom to do it at home. Important to be able to collaborate with the other teachers, and have space to meet with them. If all the teachers are required to be there more, then there would be problems because there are not enough classrooms or group rooms. In the future I can imagine having more flexible type rooms. Rooms for collaboration, rooms more like a reading room at the university, rooms of different functions.
I2	Teachers are relationship-builders, and work with people. Have to be where the people are in order to influence each other positively. You can take a computer with you wherever you go, but to influence each other positively you have to be in the same place. Must be able to observe each other in an academic group and give each other feedback on their performance. In order to feel confident in each other, we have to spend time together. Consequence of being at school more : a little more space, a little more screened or private space, and perhaps better standards. More space in order to show that they are appreciated. Also important that they have functioning infrastructure (copy, internet, etc).
I3	I think that «Whole day school» will come. This will mean more changes between learning, free time, physical activity. From 8-4 with more flexibility at each end. Students need to be more active in their own learning process. Not just tactically and motion wise, but mentally as well. Collaboration and working together with other people, and putting words on what you understand, didn't understand, learning together are important. I hope that the teaching arenas in 10-15 years will look very different from today's classrooms. More fatboys, standing tables, cafe furniture, bar, collaboration tables, project tables. A lot greater variation in teaching environment and teaching activities. Variation between working together with other students, alone, with an adult. PC, iPad, digital chalkboards. That the roles, Previously it was the teacher that spoke, and students who should sit quietly and receive information. Today we can see that students are the ones who are presenting, to the other students and teachers. There is a lot of powerpoint, which you can really get sick of, but there is something happening. Students get an assignment to prepare arguments for - or against something, debate cafe. This kind of teaching will become more and more common. Differentiated learning arenas, and differentiated learning.
I4	Being required to be at school for longer hours, you would have to create spaces for grading. Would have to have quiet spaces for undisturbed concentrated work and grading.

How will attractiveness of effectiveness of teacher workspaces effect recruiting new teachers, or keeping existing ones?	
I1	There was a group of teachers who came to the new school, and they all said «wow, I would like to work here». New building, new facilities are attractive. As long as teachers have space, they will adapt. The «teacher's call» is something that teachers have very strongly, it's more important to meet the students and be inspired by the job. Difficult to say how space effects teachers.
I2	It's the overall work-environment that is most important. A clear plus with a new building and good facilities.
I3	I think primarily a school's status / reputation, location (near home), and if the school has good leadership, pedagogic, osv is the most important. If these things are in place, then the physical design of the school generally, teacher's workspaces, will also be important. You would rather drive 2 km to work at a new school than freeze at an old school. «New» or «Old» are the main characteristics of schools. Harder to separate between «new». Among all the things one would consider, a teacher's workspace's physical workspace would come quite low down on the list. Perhaps because today there is very little difference between them.
I4	What I looks for in a school is the type of culture, what tone the administration sets, what expectations they have to the student body. Information about the school should come from talking to another teacher. A principal is a salesperson. I can see how a building or an office that was a welcoming or inviting place to be could be a first impression that would make it more attractive.
Consequences of a generational workplace?	
I1	Traditionals struggle to adapt to the new technologies. They are not able to keep up with current technology, and are not able to help the kids with their skills. They can't / don't want to adapt to technology or take into active use. This makes it difficult for the older teachers to participate equally, this is only likely to increase.
I2	-
I3	As students change their environments, shouldn't teachers also change the way they work? Today's students will be adults soon too, and they will expect a different way of working, because their learning experience was also different.
I4	-

8.3.3 Interview Summary - Central Question 4: Current and future technology

What are the most significant changes to teacher workplaces in the last 10 years that have been driven by technology?	
I1	It's become so easy to connect to the net and to get access to materials. Technology is naturally integrated into the classroom. Smart-boards or interactive projector/tv are now an important part of the classroom. Newer technology makes things easier and faster. Don't have to «log in» to stationary machines, wait to get the whole class connected. With iPads they are immediately connected and able to use the net or materials right away. Huge time savings compared to earlier. Can remember sitting in a «computer lab» - and used almost 30 minutes to get everyone online and using the machines. All teachers at my school have an iPad and a laptop. Students share iPads or class sets of laptops.
I2	User-friendliness has made things easer to use. Price-point makes it possible for every student or teacher to have their own device. Technology will make it easier to communicate with parents and students. Textbooks will be more electronic… less storage of sets towards books. Flipped classroom, where students prepare their own information at home, and then do the work at school. The students can do so many different things, film a little, talk a little. There are new possibilities to customize the teaching to the individual. Teachers can also sit where they want, but they don't. It's mostly due to tradition. Perhaps it will change as the teachers also learn to use the new building
I3	Touch technology is the most important new technology. Computers are for «searching», but touch has given a new level of interactivity. In some places iPads are out-competing laptops. Specially for learning to read or learning letters compared to previous methods. The internet allows for a wide search of material. When working with my son to learn something about hinduism, instead of reading a text in the book, we went to NRK Skole and found various movies and other kinds of information to build a presentation around. Learning by discussing and watching instead of just reading in a book.
I4	Flipped classroom concept. Students can access instruction at their level, individualized. Khan academy - lots of math information. Very helpful for students to go at their own pace, and review with the class or really challenge themselves. Technology allows for an individualized approach, but needs guidance by a teacher. Gives the students more ownership to their learning process. But they still need a lot of guidance, what information to get, how to process it…Students still need a guide. Textbooks on iPad. The most exiting option there is that kids can work at their own pace, and it can be more individualized. You can quickly gather more information about their progress. Especially for students who are working hard, but keep getting the same grade. Would be good and motivating to show the students that they are progressing. Giving feedback that helps students move forward. Individual technology would help enable that.

If technology allowed for a truly «paperless classroom», how would this effect the needs of teacher workspaces?	
I1	If the «paperless office» ever becomes a reality, the classroom will be the last place it happens… schools are still traditional. Lots of double-up today. Information placed both on the school's webpage, but information is also printed out and sent home with the students.
I2	-
I3	Previously when preparing for a course, I would look in books to make my presentations. Now I never do that. Its cut and paste from articles on the web, movie clips, or other resources on the net. I never open a book for that now. There is more paper for the younger levels, whereas the older students could be mostly paperless already today.
I4	Students submit electronically today, but I prefer to grade and comment on paper.

What current or future technologies do you think will have the greatest effect on a teacher's physical working environment outside the classroom?	
I1	Collaboration is easier with new technology. Co-writing, use of collaborative technologies (google groups, osv). «Schools will be the last place new technology is taken into use» - traditional, historical, hard to change quickly.
I2	-
I3	I believe that in 20 years the classroom will be a virtual room, where you can decide that you are going to learn about the stone age for example. You can push some buttons and the room will appear that you are in the stone age. You can walk around the bonfire, and meet cavemen. It wouldn't be surprising if that happens. The possibility to travel to other places or other times. «holodeck» like, or with VR/AR glasses. It will probably begin with glasses, but at some point the room will be a kind of 5D room that you can go into. 3D technology, AR Technology will come into the classroom at some point.
I4	One area that technology opens up is collaboration. More cooperation and connection between different schools, or internationally. Skype in the classroom. There is not a lot of sharing going on today. Too busy, or not very good systems for sharing. Data labyrinth. Hard to find the information you want.

How do you think teacher workspaces will differ from your current workspace in 2025?	
I1	The new school we have is top-modern, difficult to imagine that a workplace in 2025 is different. Would require a revolution before teachers started new ways of working. If the current principal started sitting on a couch and working it would be very strange. Perhaps a much younger principal could pull it off? Easier to collaborate with good technology. Easy to collaborate regardless off location. But still important to be able to have face-to-face meetings with colleagues.
I2	More important in the future to maintain human-relations. Look kids in the eyes and let them know they are being seen. A good school needs professionals at all levels.
I3	Ideally in the future the difference between the adults workspace and the students workplace would be wiped out. There would be different zones, zones for teaching, zones for conversation, quiet work, working with computers, creating things. Knowledge and competency is developed in another way today. I think differently about learning today than I did before. It can only go forward, and not go back. Spaces should allow for learning as a process, a part of communication, discussion, collaboration instead of someone talking and someone listening. The physical environment should match this.
I4	More individualized instruction, more technology, tools that would help with dyslexia, and so on. Better support and technology to meet the needs of each student. More collaboration within a school district and internationally. More green buildings, less paper. Greater degree of individualization for students.

9. Bibliography

2005. Kastellet Skole, Oslo. DivA Arkitekter. Byggekunst 01, 01.

2008. Bergenhus Skole, Rakkestad. Kristin Jarmund Arkitekter. Arkitektur N 08.

2010a. Cicignon Skole, Fredrikstad, Ola Roald AS Arkitektur. Arkitektur N 06.

2010b. Marienlyst Skole, Drammen. DivA Arkitekter. Arkitektur N 06.

2010c. Standardprogram for nye grunnskoler i Oslo kommune. Oslo Bystyret. Oslo: Bystyret.

22, N. 2004. Velholdte bygninger gir mer til alle (Upkept Buildings Give More To All). Ministry of Local Government and Regional Development (KRD) Oslo.

ADLER, R. 2014. Innovation in a Hyper-Connected World.

ADUCCI, R., BILDERBEEK, P., BROWN, H., DOWLING, S., FREEDMAN, N., GANTZ, J., GERMANOW, A., MANABE, T., MANFREDIZ, A. & VERMA, S. 2008. The Hyperconnected: Here They Come! An IDC Whitepaper sponsored by Nortel.

AHRENS-HEIN, N. & EICKMEYER, P. 2011. Future: Workspace - Arbeitswelten für Morgen an der TU Braunschweig: IGS - Institut für Gebäude- und Solartechnik, Prof. Dr. M.N. Fisch. Xia Intelligente Architektur, 56-61.

ARBEIDSTILSYNET 2005. Brev fra Arbeidstilsynet til Utdanningsdepartementet, KS, Utdanningsforbundet. In: ARBEIDSTILSYNET (ed.).

ARKITEKTEN 2010. Byåsen Barneskole, Trondheim. Arkitektur N 06.

ASPELUND, G. N. L. J. 2008. Når kunnskap gir resultater: Arealeffektiv bruk av skolebygg i videregående opplæring. Oslo: Rambøll Management.

BAKKE, J. V. P. 2013. Ikke Glem Dagslys og Utsyn! Arbeidervern, 3.

BAUNE, T. A. 2007. Den skal tidlig krøkes. Skolen i historisk perspektiv.

BECKER, F. 2005. Offices at work: Uncommon workspace strategies that add value and improve performance, John Wiley & Sons.

BECKER, F. D. & STEELE, F. 1995. Workplace by design: Mapping the high-performance workscape, Jossey-Bass.

BELL, W. & OLICK, J. K. 1989. An epistemology for the futures field: Problems and possibilities of prediction. Futures, 21, 115-135.

BEN-PERETZ, M., SCHONMANN, S. & JACKSON, P. W. 2000. Behind Closed Doors: Teachers and the Role of the Teachers' Lounge, State University of New York Press.

BEST, R., LANGSTON, C. A. & DE VALENCE, G. 2003. Workplace strategies and facilities management, Routledge.

BLAKSTAD, S. H. 2001. A strategic approach to adaptability in office buildings.

BLAKSTAD, S. H. 2013. Intro og Strategisk Virkemiddel, AAR6028 Strategisk Arealforvaltning.

BLAKSTAD, S. H. & ANDERSEN, I. A. 2013. Added value from workplace design, management and use? A case study. Corporate Real Estate Journal, 2, 340-353.

BLYTH, A. & WORTHINGTON, J. 2010. Managing the brief for better design, Routledge.

BØLVIKEN, R. S. 2013. Utforming av skolebygg-vurderinger og kunnskapsgrunnlag-En studie av prosessen fram mot et nytt skolebygg på" Maritun ungdomsskole".

BUVIK, K. 2005. Funksjons- og arealprogram for nye Nesna skole. SINTEF avd. Arkitektur og byggeteknikk.

BUVIK, K. 2007. Trender innenfor fysisk utforming av grunnskoler. SINTEF avd. Arkitektur og byggeteknikk.

BUVIK, K. 2009. Elementary School Buildings, Layout and Design. Building Research Design Guides. SINTEF.

CANEPA, E. P. B. 2011. New ways of working and their impact on future physical work spaces.

CHERMACK, T., LYNHAM, S. & RUONA, W. 2001. A review of scenario planning literature. Futures Research Quarterly, 17.

CUNNINGHAM, W. G. & GRESSO, D. W. 1993. Cultural Leadership: The Culture of Excellence in Education, ERIC.

DEWEY, J. 1916. Democracy and education, Courier Dover Publications.

ECONOMIST, T. 2001. Broadband blues. The Economist.

FRIED, J. & HANSSON, D. H. 2013. Remote: Office Not Required, Crown Business.

GRANDE, A. 2014. Hver lærer har krav på seks m2 kontorplass. Dagens Næringsliv, 06.03.2014.

GRANKVIST, R. 2000. Utsyn over norsk skole: norsk utdanning gjennom 1000 år, Tapir Akademisk Forl.

GRUENERT, S. 2005. Correlations of collaborative school cultures with student achievement. Nassp Bulletin, 89, 43-55.

HAGEMANN, G. 1992. Skolefolk: lærernes historie i Norge, Ad Notam Gyldendal.

HÅKONSON-HANSEN, M. K. 1901. Über Schulgebäude auf dem Lande in Norwegen. Zeitschrift für Schulgesundheitspflege, XIV, 163-170.

HALVORSEN, K. 1987. Å forske på samfunnet: en innføring i samfunnsvitenskapelig metode, Bedriftsøkonomens forlag.

HATTIE, J. 2009. Visible learning. London: Routledge.

HOUCK, L. 2013a. Dagslys i klasserom og grupperom. Bedre Skole, 3.

HOUCK, L. 2013b. Dagslys i Skoler. Arkitektur N.

HOUCK, L. 2014. De Riktige Grepene. Arkitektur N.

K. C HOAAS, H. K. M. 2010. Baseskoler gjør ingen forskjell. Bergens Tidende.

KOMMUNE, O. 2012. FKOK Skoleanlegg 2012 - Del 1 Virksomhetskrav. In: KOMMUNE, O. (ed.).

KUNNSKAPSDEPARTEMENTET 2014. Lærerløftet - På lag for kunnskapsskolen.

KUUSKORPI, M. G., NURIA 2011. The future of the physical learning environment: school facilities that support the user. Learning, 11.

LARSEN, A. K. 2007. En enklere metode: Veiledning i samfunnsvitenskapelig forskningsmetode, Fagbokforl.

LEWIS, S. & COOPER, C. L. 2005. Work-life integration: Case studies of organisational change, John Wiley & Sons.

LHOEST, L. 2012. Workplace Trends 2012: Activity Based Working in the Netherlands, Veldhoen + Co.

LORTIE, D. C. & CLEMENT, D. 1975. Schoolteacher: A sociological study, University of Chicago Press Chicago.

LØTVEIT, B. A. 2014. Planlegging av nytt skoleanlegg og pedagogisk utviklingsarbeid. Norconsult.

MAUSETH, C. 2012. Norway and the EU Education Programmes.

MAYER, D. 2006. The changing face of the Australian teaching profession: New generations and new ways of working and learning. Asia−Pacific Journal of Teacher Education, 34, 57-71.

MEISTER, J. C. & WILLYERD, K. 2010. The 2020 workplace, Harper Audio.

MØLLER, P. 2012. Scenarier–genre og genrefartøy. Sakprosa, 4, 27.

NENONEN, S., AIRO, K., BOSCH, P., FRUCHTER, R., KOIVISTO, S., GERSBERG, N., ROTHE, P., RUOHOMÄKI, V. & VARTIAINEN, M. 2009. Managing workplace resources for knowledge work. final report on Prowork project, available at: www. proworkproject. com (accessed 10th January, 2010).

NICOLAISEN, H. & NYEN, T. 2004. Lærernes arbeidstid. Evaluering av avtale om arbeidstid for undervisningspersonalet i skoleverket, 2006, 2004-2006.

NORRIS, C. S., ELLIOT. 2015. Why Has Technology Failed To Substantially Improve Student Achievement. THE Journal, 04/03/15.

OLSSON, N. 2011. Praktisk rapportskriving. Trondheim: Tapir akademisk.

OVERLAND, E. F. 2000. Norge 2030: fem scenarier om offentlig sektors framtid, Cappelen Akademisk.

PEDERSEN, T. L. 2014. Dagslys i skoler: et case-studie: Veiavangen ungdomsskole.

PERIE, M. & BAKER, D. P. 1997. Job Satisfaction among America's Teachers: Effects of Workplace Conditions, Background Characteristics, and Teacher Compensation. Statistical Analysis Report.

PIERIK, L. 2011. The effects of new ways of working: An empirical study of municipalities in the Netherlands, looking at the relation between New Ways of Working and social cohesion, work life balance, and performance and the moderating role of leadership on these effects.

RANJBARRAD, M. 2014. Group behaviour anomaly detection using data mining and location tracking.

RASKAR, R., WELCH, G., CUTTS, M., LAKE, A., STESIN, L. & FUCHS, H. The office of the future: A unified approach to image-based modeling and spatially immersive displays. Proceedings of the 25th annual conference on Computer graphics and interactive techniques, 1998. ACM, 179-188.

REIKVAM, A. 2012. Room and Function Program, Rygge Ungdomsskole. Rygge Kommune.

ROKSVAAG, K. A. T., INGER 2012. Arbeidsmarkedet for lærere og førskolelærere fram mot år 2035. SSB Rapporter, 18/2012.

ROSENHOLTZ, S. J. 1989. Workplace conditions that affect teacher quality and commitment: Implications for teacher induction programs. Elementary School Journal, 89, 421-39.

SCHANKE, T. S., A 2008. Kunnskapsstatus skolebygg - en kartlegging av forskning på sammenheng mellom skolebyggs utforming og elevers læringsutbytte. ØF-notat nr. 02/2008.

SCHNEIDER, M. 2003. Linking School Facility Conditions to Teacher Satisfaction and Success.

SCHOEMAKER, P. J. 1995. Scenario planning: a tool for strategic thinking. Sloan management review, 36, 25-25.

SKOLEBYGGPRISEN Skolebyggprisen. [Oslo]: [Norsk form, Senter for design, arkitektur og bygningsmiljø].

STORSTRAND, E. 2014. Trender i nye grunnskolebygg.

TEK10 2010. TEK10 - Regulations on technical requirements for building works. In: DEVELOPMENT, M. O. L. G. A. R. (ed.).

TJELDFLÅT, G. M. 2014. Dette handler lærerstriken om. Bergens Tidende, 08.08.2014.

TSCHANNEN-MORAN, M. & HOY, A. W. 2001. Teacher efficacy: capturing an elusive construct. Teaching and Teacher Education, 17, 783-805.

UTDANNINGSDIREKTORATET. 2015a. Barnehage og Skoleanlegg, regionale rådgivingstjeneste [Online]. [Accessed 04.04.2015 2015].

UTDANNINGSDIREKTORATET. 2015b. Skoleporten [Online]. Available: https://skoleporten.udir.no [Accessed 04.04.2015 2015].

VAN DER HEIJDEN, K. 2011. Scenarios: the art of strategic conversation, John Wiley & Sons.

VARTIAINEN, M. 2007. Analysis of multilocational and mobile knowledge workers' work spaces. Engineering Psychology and Cognitive Ergonomics. Springer.

VINJE, E. 2011. Baseskoler og viktige lærerkompetanser: hva mener lærerne?

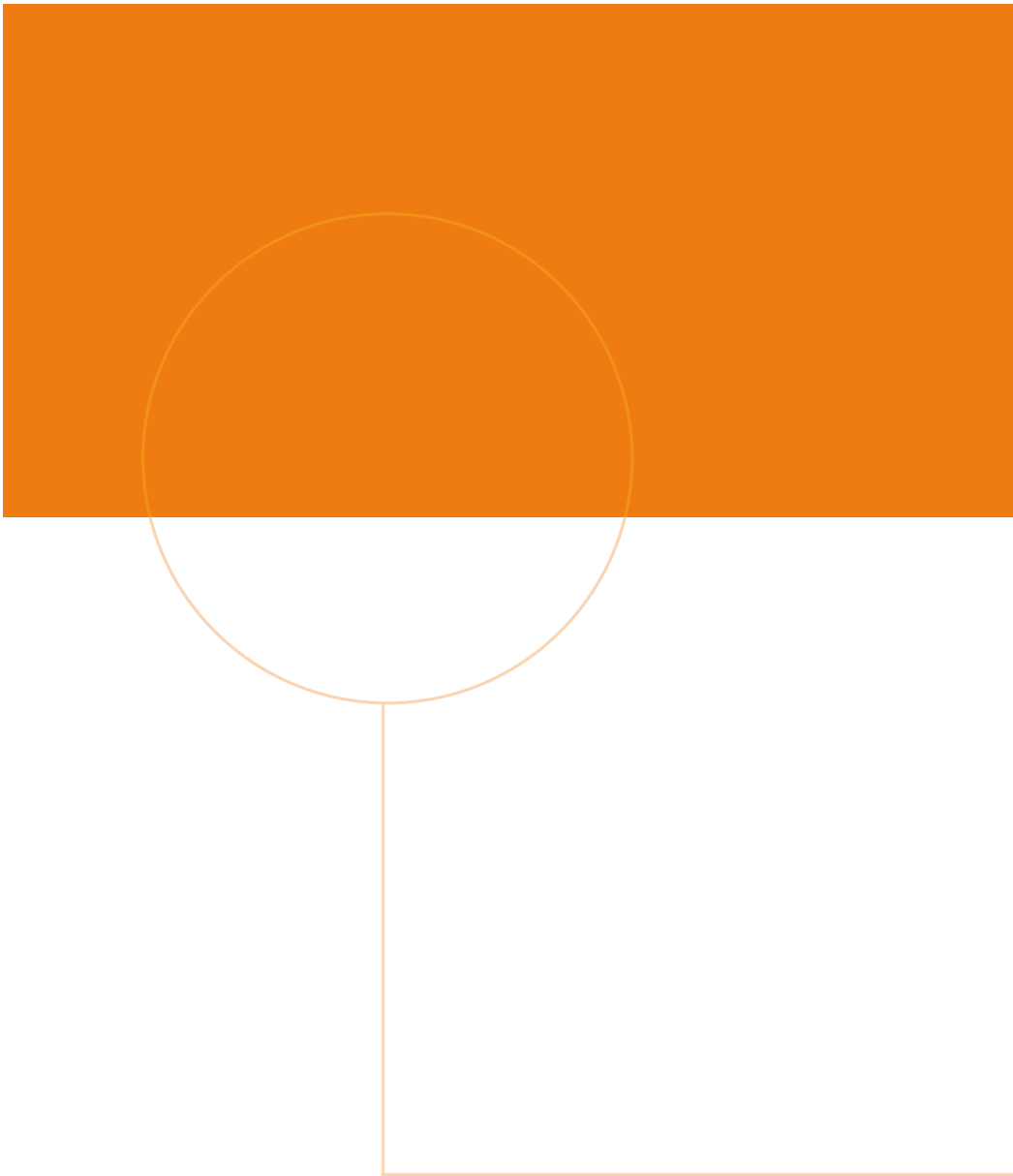
VINJE, E. 2013. The battle about the school building–the history behind the new wave of open plan schools in Norway. FORMakademisk, 6.

WACK, P. 2004. Shooting the rapids. Strategy: Critical Perspectives on Business and Management, 2, 115.

WILLE, H. P. & SVANBERG, R. 2009. La stå!: læring - på veien mot den profesjonelle lærer, Oslo, Gyldendal akademisk.

YOUNG, E., GREEN, H. A., ROEHRICH-PATRICK, L., JOSEPH, L. & GIBSON, T. 2003. Do K-12 School Facilities Affect Education Outcomes? Staff Information Report.

ZUBOFF, S. 1988. In the age of the smart machine: The future of work and power, Basic Books.



NTNU – Trondheim
Norwegian University of
Science and Technology