

CIB W111: Usability of Workplaces - Phase 3

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**CIB W111
Research Report**

Usability of Workplaces
Phase 3

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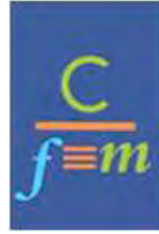
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Usability of Workplaces

PREFACE

CIB is the international association providing a global network for international exchange and co-operation in research and innovation in building and construction. CIB supports improvements in building processes and in the performance of the built environment.

In many ways, the work of the Working Commission W111 extends the work of CIB, by taking the perspective of people, organisations and communities who use the built environment and by developing the process that will enable their active involvement in decision making in its production and consumption. The concepts, methods and tools of the usability approach, envision an environment that is user-centric, service-driven and value adding, bringing sustainable benefit to all stakeholders

Work in the Usability project is now at the completion of its third phase, and has continued to focus on the user experience of buildings and research in the workplace, rather than on laboratory or theoretical studies, and on applications of concepts of usability and manageability in practical situations.

During latest phase of the work, the CIB W111 group has had the opportunity of working in association with the Centre for Effective Learning Environments at OECD. The CIB group commented on a framework and contributed to a pilot study to develop tools for evaluating the quality of education spaces. Case studies were conducted in Norway, Denmark and the United Kingdom to test survey tools in different European contexts.

The joint two-day Research Symposium, as part of the CIB World Congress held in Salford Quays, is organised as a series of workshops, held in Manchester Schools and provides the opportunity of addressing usability issues with teachers, pupils, researchers and educationalists to assess the effectiveness of learning environments.

CIB W111 acknowledges the sponsorship of SCRI to enable the workshops and School visits. Direct involvement in the W111 project, and support for the Symposium, strengthens SCRI's work in the educational sector.

Professor Peter Barrett
President
CIB



FOREWORD

The CIB Working Commission on the Usability of Workplaces (CIB W111) has operated as an integrated, international network of researchers and practitioners since its inception in 2001. The network was originally formed as a task group (TG51) to investigate the application of an international standard on usability (ISO 9421), previously applied in the evaluation of consumer products, to the built environment.

A first round of exploratory case studies (2002/05) sought to investigate the applicability of usability concepts and techniques, adapt them for use in the built environment and to identify methods and tools that would enable a more positive user experience in organisational settings. This work was published as CIB Report 306.

The second phase of the project (2006/08) included three further case studies, five workshops and a final research seminar. The work that comprised this stage of the project focused on contextual issues that were seen to define the difference in applying usability to the built environment as opposed to other consumer products. This work was published as CIB Report 316.

The work reported in this publication, the third in a series of CIB research reports, was carried out in 2009/10 and has developed methodologies for usability and has tested the practical application of usability concepts, tools and techniques. Cases and workshops have focused on evaluation of the usability of learning environments. The work has been carried out in association with other groups working in this field, notably an OECD group, the Centre for Effective Learning Environments (CELE), to test tools for the evaluation of the quality of learning environments.

Senior managers from leading organisations in the private and public sector have participated in the network, co-ordinated by the research-based partners, and have been directly involved in the series of action learning workshops used as the main vehicle for advancing the programme of work.

Participatory workshops provided the opportunity for sharing knowledge of user experience in the workplace, provided and independent review of practice and a means of sharing good practice. Host organisations received feedback from other leading-edge organisations involved in the project and received recommendations from improvement, many of which have been implemented.

The network has provided new knowledge for action on themes including user experience and feed-forward processes, and has explored the links between the quality of the environment, health and well-being in the workplace and productivity in the workplace. Each case has identified and evaluated new appraisal methods and techniques. The network has also provided the opportunity for cross cultural collaboration and information exchange.

An international network of twelve research-based partners, from around the world, have participated in the project and have met separately to reflect on the cases and workshops and to address underlying philosophical, theoretical and methodological issues arising out of the work.

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Usability of Learning Environments

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Abstract

Usability in the built environment is context dependent, a product of user experience related to the social relations amongst users and to the interaction between users and facilities. Usability has been found to be strongly related, not only to relationships between people and physical settings, but also to clear strategies for the organisation of work and the use of facilities. Recent collaborative research, in the CIB W111 network, which aims to extend understanding about usability, as applied to buildings and support services, has focused on learning environments.

This paper explores policies, objectives and strategies for education, for school facilities and their management, to identify criteria for appraising the usability of learning environments. It draws upon an evaluation of the Building Schools for the Future programme in the United Kingdom to establish the need for a more inclusive approach to assessing usability. The need for schools to be considered in context is emphasized, and the necessity for closer integration of the processes of educational transformation, community engagement and development of the built environment, is recognised.

Three sets of criteria are derived from societal goals for sustainable communities, educational transformation, and quality of learning environments, to propose a framework for evaluating the usability of learning environments and for developing facilities management strategies.

The paper concludes that, to improve usability, parallel processes must be reconnected, users must be empowered and communities must be offered the opportunity of meaningful involvement in managing a school as a community resource.

Keywords: Usability, learning environments, appraisal, facilities management, strategies

1. Disconnected processes

Many will recognise the portrait of a crumbling School as an impoverished environment, an isolated building, sitting poorly maintained in the middle of a tarmac playground, separated by a fence (or even barbed wire) from the community in which it sits, empty outside school time. The image this conjures says it all about the relationships that have been created amongst the authorities, the school as an organisation and the wider community, and about a missed opportunity.

When a school, as a building, is conceived separately from its context, in the name of function and for timetabled activity, unloved and uncared for, it is a clear signal that, as a society, we have got our disjointed processes completely wrong. The School has become a potent symbol of malaise in society, the real value locked inside the School gates.

The problems start from the outset if a school is conceived as a building, a capital funded project to meet an accommodation need. Of course the process starts with optimism, is designed and delivered with considerable skill, and well managed within the constraints imposed. Constructed with excellence, but so often – ‘the wrong building, in the wrong place, at the wrong time’.

All this is in stark contrast with the vision of sustainable communities that are well served with public, private, community and voluntary services that are appropriate to people's needs and accessible to all.

Sustainable communities have well-performing local schools, further and higher education institutions, and other opportunities for lifelong learning and integrated where possible with other, high quality services which are accessible to the whole community. They are supported by service providers who think and act long-term and beyond their own immediate geographical and interest boundaries, and who engage users and local residents in shaping their policy and practice.

A School is a vital element at the heart of a community, providing lasting connections, a key community resource, both symbolically and functionally. It is a central part of the fabric of community life, one of an inter-connected set of accessible public facilities, all part of an urban jigsaw.

An early exemplar of this approach are the Schools built by Lothian Regional Council in the early 1990's, particularly Leith Academy in Edinburgh, woven into the urban fabric and providing facilities - swimming pool, library and a base for the local rugby club - and promoting a real sense of community ownership.

Considered in this way the School is much more than an isolated physical manifestation of disjointed thinking, the output of the construction process, and operated and maintained from scarce resources. In this setting, the role of the Facilities Manager develops as a broker of the

processes that integrate the needs of all the stakeholders. Two Lothian Schools, Leith Academy in Edinburgh and St Margaret's Academy in Livingston, were the subject of previous CFM case studies that explored these issues (Jones, 1997).

2. Schools for the future

In a similar vein, the UK Government's Building Schools for the Future (BSF) programme is about increasing educational aspiration and attainment, and not about just building new schools. It is accepted that properly designed, user friendly buildings go a long way to encouraging people to learn, but it is only one part of a total educational transformation being undertaken.

Although Building Schools for the Future (BSF) is about high quality, safe & secure, learning environments, allowing staff to concentrate on their role as educators, it addresses broader societal goals. BSF is also about working collaboratively with communities to create world-class, 21st-century schools - environments which will inspire learning for decades to come and provide exceptional assets for the whole community.

Building Schools for the Future (BSF) aims to rebuild or substantially refurbish all secondary schools in England by 2020. The objective is to ensure that secondary school pupils learn in 21st century facilities. By 2011, every Local Authority (LA) in England will have received funding to renew at least those schools in greatest need. BSF will contribute to achieving educational transformational through providing facilities that will support the delivery of new options at 14-19; providing for the particular needs of pupils with special educational needs; and enable greater use of the school buildings by the community through the Extended Schools initiative.

This community dimension is further reinforced in the White Paper, 'Your child, your schools, our future: building a 21st century schools system (DCSF, 2009), which includes plans for schools to offer more in the way of co-located facilities which can be used by local residents, as well as pupils, thus providing a focal point for the community.

This agenda provides the springboard for significant reforms by seeking major changes in secondary schools, supported by sustained investment and driven by powerful and effective leadership, reform of teaching and learning and new partnerships beyond the classroom.

Thus far, a total of 123 schools had been completely rebuilt or substantially refurbished and are open, and there are estimated to be around 1,000 schools involved in the programme. It is anticipated that innovation in delivery, through the creation of Partnerships for Schools (PFS) (a national delivery partner for Local Authorities and schools) will promote greater value for money, as well as effective implementation.

It is against these objectives that PricewaterhouseCoopers has recently published the third annual audit report of the BSF programme (PwC, 2010). PwC has evaluated progress with the programme and has carried out an assessment of its early impact.

2.1 Achieving strategic objectives

The PwC evaluation sought evidence of achievement of BSF objectives in three key areas – educational transformation, fitness for purpose of buildings (now and in the future) and contribution to the community. PwC conducted interviews and surveys with local authorities, headteachers and pupils and made site visits to completed BSF schools to gain an understanding of perceptions of the learning environment.

It is generally recognised that educational transformation requires a pupil-centred focus, including greater personalisation of teaching and learning and improving the life chances of children. Over four-fifths (81%) of headteachers in the surveys, agreed or strongly agreed, that BSF will contribute to educational transformation in their school. In addition, three-quarters of headteachers agreed that BSF has more potential to deliver educational transformation than previous capital investment programmes.

Most headteachers in BSF schools that are occupied who were surveyed believe that the new buildings provide a more stimulating and welcoming environment and enable the school to improve their relationship with parents.

Pupils in schools that have not yet completed their new/refurbished school building were uninspired by their existing school buildings. However, headteachers were confident that BSF would contribute positively to making their school environment more stimulating and welcoming.

Schools identified a number of potential pitfalls as well as some useful strategies for achieving a building that is fit for the future – failure to future proof new/refurbished buildings could potentially impact on value for money and educational transformation. Development of a clear and shared vision and matching available resources to this was seen as a useful strategy for achieving a successful outcome.

Headteachers were confident that BSF could contribute positively to transformation of the School as an organisation, and identified a number of issues that would, if implemented, contribute positively – for example, the recognised need for additional training to improve the quality of teaching and learning and maximise the opportunities afforded by the new/refurbished buildings. Particular issues were noted for refurbishment projects, for example, the potential for attainment to dip during the construction phase, which could, in particular, pose significant challenge for lower attaining schools.

The evaluation concluded that headteachers are confident that BSF can contribute to raising standards in school and beyond, by extending the benefits of their facilities to the wider community. There was a recognised need to build capacity of staff to enable them to deliver a more personalised teaching and learning experience to their pupils, though our research has indicated that schools need a greater level of clarity on what educational transformation is.

2.2 Assessing the impacts

In the third annual report on evaluation of the BSF programme, for the first time, PwC has begun to address the early impacts of BSF.

The study reports that the vast majority of headteachers in open BSF schools are very positive about the benefits they are deriving from their new/refurbished buildings in relation to providing a more stimulating and welcoming environment (100% of headteachers agreed or strongly agreed), improving buildings that are in poor condition (96%); and in supporting them in tackling fundamental design issues (100%). Pupils in open schools are more positive about their buildings and school environment than pupils in schools currently being built.

PwC has reported early evidence to support the view that schools are fulfilling their commitment to becoming schools at the heart of their community. This is evident in more effective strategies to engage with local communities and in evidence that families in deprived areas are benefiting from the facilities that the new school buildings can offer. This is supported by the headteacher survey which shows that 84% of headteachers indicated that the new or refurbished buildings are enabling their school to improve their relationship with parents.

The school site visits suggest that teaching staff in open BSF schools are benefiting from some early impacts, including ICT training facilitated by the Local Authority and a range of other training opportunities. There is also some evidence of improvements in staff morale, recruitment and retention. The new school buildings have also provided opportunities to change traditional styles and promoted more effective use of ICT. The headteacher survey suggested that there was less impact on increasing the pace of workforce reform and widening the roles and responsibilities for staff.

There is also some evidence from the headteacher survey and school site visits that point to improvements in pupil attitudes, aspirations and behaviour. The key message from schools already in their new/refurbished buildings is that overall there are high aspirations that the new/refurbished buildings will impact positively given time. These findings are supported by the headteacher survey, where 64% of headteachers in open BSF schools indicated that BSF has contributed to some extent in improving pupils' aspirations.

There is early evidence of improvements in pupils' views about teaching and learning in occupied schools compared to pupils in schools going through the process.

The research has demonstrated that school context must be taken into account when assessing the impact of BSF; new buildings alone are insufficient to change pupils' attitudes and behaviour. The real challenge for BSF is to link the transformational agenda to changes in pedagogy and leadership in schools that have in the past been independently rated (by Ofsted) as satisfactory or below.

3. Educational transformation

The art and science of teaching, technology and facilities are intrinsically linked. They affect each other, and have undergone major changes in recent years. Traditional learning has undergone a major revolution, with more variety and ways to facilitate learning. Learning by doing encompasses active, hands-on, problem based and project orientated learning scenarios.

Developments in information, communication and educational technology (ICE) have enabled access to the best of current information to support resource based/self-directed learning via the Internet. The use of wireless technology, web-based projects, smart boards, haptic technology and digital projectors is becoming commonplace. Clearly, this is a basic requirement in the schools of the future.

Educational transformation is at the core of the BSF programme and involves rethinking the way education and learning are delivered. PfS has clarified what is meant by educational transformation and suggest that it is a big leap rather than a small step to:

- improve learning and achievement for every child and young person
- enhance school diversity and parental choice
- increase the use of schools by the community
- use new thinking and opportunities and be creative in designing for learning
- seize opportunities for learning that are exciting, flexible, healthy, safe, secure and environmentally sustainable

Three key features of educational transformation have been identified and are seen to underpin the collaborative research, amongst members of the W111 network, on the usability of learning environments - schools at the heart of their community; transforming teaching and learning; and raising aspirations, achievement and attainment of pupils.

Facilities Managers working in these new learning environments need a strategy for providing facilities that respond to and support continuously changing technology and curriculum developments. They must also reflect on the impact of their actions on educational outcomes.

4. Sustainable communities

Beyond direct responsibilities within the organisation, Facilities Managers need to be increasingly aware of the developing two-way relationship between school and community.

On the one hand, the community is increasingly being seen as an essential resource for learning. Learning in the real world helps to balance the increasing time that students are spending in the virtual world of computers. Libraries, museums, green spaces and work places all provide learning opportunities that suit a wider range of learning styles than can readily be accommodated in the classroom. An increasingly diverse curriculum for students aged 14-19, with more emphasis on work-related and personalised learning, is encouraging schools to look to the community.

As schools look increasingly outwards they become more receptive to welcoming the community into their schools. The PwC research suggests that BSF will impact positively ‘to a great extent’ in involving the wider community in educational and cultural activities. This suggests that schools going through the process may have higher expectations of the programme than what may be realistic in the longer term.

The fortress mentality, an understandable consequence of high profile safety and security issues, is changing. In part this is because schools are increasingly held accountable to the local community. Schools and school designers are becoming more experienced in managing visitors and dual use of their premises, without compromising the safety of the children. Funding often depends on community use of computer suites, performance studios, sports halls and pitches and assembly halls. This represents a more sustainable use of the building stock and resources. It also gives the opportunity for schools to demonstrate sustainable practice in energy use, water, recycling, transport and other areas of environmental management.

Research has shown that schools in England which open outside of school hours have a positive impact on the community - but improved results are not guaranteed, research suggests. According to a research by Newcastle and Manchester universities (Cummins et al, 2007), extended services generally help improve achievement and reduce exclusions.

5. Quality learning environments

For the purposes of the CIB W111 working group, learning environments have been defined as ‘the socio-psychological, physical and digital settings, in an organisation or community context, in which learning occurs and which affects learners achievement and attitudes’ (Alexander, CIB W111, 2009). However, most of the attention of the group, and predominantly in relevant built environment research, in for example post-occupancy evaluation and facilities performance evaluation, is still focused on the physical environment.

However, as previous studies have shown, the majority of users of both PFI and traditionally funded schools in an Audit Commission study, ‘PFI in Schools’ (Audit Commission, 2003) believe there was a link between environment, pupil behaviour and ‘productivity’.

All the schools visited by the Audit Commission, however funded, left room for design improvements. But does this matter? It could be argued that lower, but adequate, design standards give better value for money and allow scarce resources to be spread more widely. Conversely, if in the long run poorer design leads to greater costs and, particularly, to poorer educational outcomes, then clearly it does matter. It is important therefore to establish the links between the built environment and learning.

The Audit Commission recommended that business cases for funding should therefore encompass a more explicit link between buildings and educational performance. Official guidance states that expressions of interest from potential PFI providers should demonstrate this link, and that this is one of the criteria on which bids will be assessed for provisional approval.

The Campaign for Architecture and the Built Environment (CABE) put a higher premium on the value of design and has demonstrated the importance of engaging creative skills for innovative and inspiring solutions to these educational challenges. Work with the RIBA, in the project 'Learning environments for the future' (Ultralab, 2005), has offered design exemplars for 21st Century Schools.

Another early, unpublished exploratory study by BWA, with Kent and Hertfordshire County Councils, provided some evidence of a correlation between the quality of the built environment (as measured by a standard Building Quality Assessment tool) and the league table performance of Schools. This work has been recently extended in an exploratory study by Price et al (2010), which paid particular attention to pupil perceptions of the condition of school buildings.

As part of its programme of work, W111 has undertaken a critical review of a range of methodologies for evaluating usability in the built environment. Amongst other findings, this has clarified the objectives of appraisal methodologies for assessing the effectiveness of learning environments.

For example, a distinction has been drawn between post-construction evaluation (PCE) to verify that project objectives have been met and post-occupancy evaluation (POE) to assess performance in use. Whereas, PCE compares performance against original specification, POE evaluates performance of a building in use from the perspective of those occupying the building. However, analysis of published studies has shown that the majority of POE studies are conducted to complete a feedback loop between design and construction and to verify that the designer's intentions have been met.

A further distinction has been drawn between post-occupancy evaluation (POE) and facilities performance evaluation (FPE). POE is commonly defined as 'the process of evaluating buildings in a systematic and rigorous manner after they have been built and occupied for some time' (Preiser, 1995). FPE is a continuous process of systematically evaluating the performance and/or effectiveness of one or more aspects of buildings in relation to issues such as accessibility, aesthetics, cost-effectiveness, functionality, productivity, safety and security, and sustainability (Zimring, 2005).

However, the emphasis of both POE and FPE is still on the building, rather than on the user experience and primary processes of the occupants. In contrast, usability appraisal seeks to evaluate the user experience of environments, in a particular setting and context, in order to assess their efficiency and effectiveness.

Recognition of the different perspective of usability, together with the experience of working with organisations to develop strategies for managing facilities to improve user experience and support their effectiveness, prompted the development of a framework for evaluating the usability of learning environments.

6. Usability of learning environments

Conventional appraisal methodologies centre on the building as the subject and take a functional perspective, rather than focusing on the effect of the environment on users and on learning processes. Users are seen as feedback loops and are described in relation to the design. User participation in the process is limited and opportunities for engagement and empowerment are largely ignored.

The focus of most conventional evaluation tools in the built environment is on functions and normative aspects. Facilities that are ‘visually pleasing’, ‘symbolic’ and have ‘comfortable spaces’ is difficult to assess without an adequate description of the cultural context in which it is located. In order to achieve facilities that ‘support flexible and diverse teaching’... ‘empowers individuals to manage their lives’ are key issues have to be addressed.

A change of perspective is needed, from the building and its production, to users and the community, and the role of facilities must be seen in the learning context and as part of social development.

After over 10 years of development in W111, usability appraisals evaluate facilities in relation to their context, situation, culture and experience. The usability case study framework, used in W111 research and described in previous CIB Reports 304 and 316 (Alexander, 2006 and 2008), builds on these concepts and offers new evaluation tools. It also promotes a view that it is the use that determines the usability and not the presence of functions. Functions only make certain uses possible.

In a recent, as yet unpublished study of the Manchester Schools BSF programme, important factors impacting on usability and the effectiveness of learning environments were identified as:

- Context - urban setting, regeneration/community context, sustainable communities and social inclusion;
- Situation - actors – learners, personalisation;
- Culture - soul of the school, social cohesion;
- Experience - pupil voice, user journey;

Over the past two years the W111 network has concentrated on the assessing the usability of learning environments. Schools in Denmark, Norway and the United Kingdom have been evaluated to pilot survey . Three schools were evaluated using the usability framework, adapted from previous W111 research, and incorporating tools to evaluate the quality of education spaces (EQES) being piloted by the Centre for Effective Learning Environments (CELE) at the OECD.

Table 1 provides a more inclusive framework for evaluating learning environments, based on the three societal goals of sustainable communities, educational transformation and quality learning environments. The table maps policy objectives and strategic objectives against these goals and identifies facilities management and usability criteria for planning and evaluation.

Appraisal methodologies and tools for evaluating learning environments against these criteria have been the subject of much of the work of W111 and are the subject of many of the papers that follow in this publication.

Table 1: Learning Environments Evaluation Framework (Alexander, 2009)

SOCIETAL GOALS	POLICY OBJECTIVES	STRATEGY	FACILITIES MANAGEMENT	USABILITY CRITERIA Valuable Memorable Enjoyable
Sustainable community	Place new schools at the heart of the community (DCSF)	Community empowerment and engagement Learning in the community	Community resource Extended services Socially sustainable	Co-learning Co-production Openness to the community Visually pleasing Symbolically meaningful
Educational transformation	Increase equity and access to education (EQES) Improve educational effectiveness (EQES) Raise levels of achievement and attainment (BSF)	Organisational context Strategy for change Governance Pedagogical position	Fitness for purpose Available for use Adaptable Change management	Co-learning Co-production Accessibility for all Agility Suitability Habitability Visually pleasing Symbolically meaningful
Quality learning environment	Improve environment for teaching and learning (BSF)	Social environment Physical environment Digital environment	Improve usability Operationally effective Environmentally sustainable	Co-learning Co-production Benefit to user Connectivity Healthy and safe Eco footprint Visually pleasing Symbolically meaningful

7. Conclusions

The PwC research, upon which this paper draws, concluded that school context must be taken into account when assessing the impact of the BSF programme and that, new buildings alone, are insufficient to change pupils' attitudes and behaviour. They suggest that the real challenge is to link the transformational agenda to changes in pedagogy and leadership in schools.

This paper has argued that school facilities should be considered in the context of the communities they serve, and as a prime means of transforming education. Effective learning environments successfully combine appropriate social and digital environments with the physical environment. Creating quality learning environments, which are more broadly

accessible in the community, can also play a catalytic role in regeneration. To improve usability, parallel processes must be reconnected, users must be empowered and communities must be offered the opportunity of managing their assets.

The majority of conventional evaluation methodologies, particularly POE and PFE methods and tools, fail to address strategic objectives, consider buildings out of context and tend to focus on the characteristics and performance of the physical environment, rather than on the effects on users and on benefits realisation.

The evaluation of schools must take account of three key dimensions according to their role in the development of sustainable communities, in educational transformation and the quality of the learning environment.

Assessing the usability of learning environments against these criteria, using appropriate research-based methods and tools, will require the development of new skills. It also suggests the need to develop different relationships amongst key actors in co-production processes. This is a challenging agenda for the Facilities Management of learning environments.

The objectives of Facilities Management are to provide the setting and services that support the effectiveness of organisations, which contribute to the development and creativity of the occupants and provide community benefit. The key is establishing the strategies and processes that connect effective utilisation of the physical, environmental and human resources to create positive outcomes for all stakeholders, through the whole life of the facilities. Stakeholders include owners, occupiers and operators of the facility, all service users and providers, the local community and representative agencies. Seen in this way, Facilities Management is the brokerage of processes amongst all stakeholder interests.

Acknowledgement

The author acknowledges the contributions of W111 members in the development of the collaborative research upon which this paper draws and in the development of the evaluation framework which is presented.

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Usability mapping tool

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Abstract

A building's true purpose is to support and shelter its users, while they are performing their activities and living their lives. Buildings are means to an end. Depending on how well they support their users' activities, our physical surroundings contribute to efficiency, effectiveness and satisfaction in the user organizations. This is what we call the usability of buildings.

This paper reflects on methods for evaluation of buildings in use, and on their applicability for usability assessment. The main contribution is, however, our operationalised perspectives on usability, and a description of the evaluation process and methods as it is described in the handbook for our usability mapping tool, the USEtool.

The research is based on a development process and case studies from three large Norwegian organizations. Previous studies have shown that in order to assess usability, one has to focus on the effect of the building on the user organization's fulfilment of goals, as well as the end users' satisfaction and experience. In this project, we were faced with expectations from our business partners to develop a toolbox, with tools they can use themselves in order to assess the usability of their portfolio of buildings. The objective has been to develop a set of tools that are easy to use, but that yield both an overview and more in-depth knowledge, with an emphasis on aspects of usability related to effectiveness. This has governed the choice of methods and measurement parameters. This approach has also highlighted the need for a more operationalised perspective on usability, as the evaluations should be carried out by Facilities Managers and not by researchers.

The operationalization of usability is developed around the use of questions: For what, for whom, where, and why. The USEtool and the evaluation process is described in a handbook, which guides the evaluators through a series of stages (1-5), including an introductory identification stage (investigation of organizational objectives and relevant user groups), and a systematic general usability mapping and a walkthrough with more in-depth qualitative studies of specific usability topics. The last stages of the process includes comparing findings with objectives, and developing recommendations for improvements in existing buildings or briefing of new facilities.

Keywords: Usability, Buildings in Use, Evaluation Methods, Post Occupancy Evaluation, Facilities Management

1. Introduction

Buildings are seldom an end in themselves. They are, rather, tools that support the activities taking place within them. Depending on how well they support the users' activities, our physical surroundings contribute to efficiency, effectiveness and satisfaction in the user organization. This is what we call the usability of buildings. Usability is defined as *“the extent to which a system can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use”* (ISO 9241-11).

This paper describes a set of tools that has been developed in a research and development project with 3 partners. All of them have large portfolios of buildings, which they manage and develop on behalf of their user organization. The project has aimed at developing a tool that can be used by the Facilities Managers of these organizations in order to evaluate usability of their buildings. A key product of the research project is a process description, detailing how building owners and Facilities Managers can gather user experiences from existing buildings as a basis for improving existing buildings, as input when planning new buildings, or as a reference when choosing new premises. Our project partners wished to collect experiences from their user organizations in cooperation with selected user representatives. We have focused on the development of methods and tools that the project partners themselves can employ. The objective has been to develop a set of tools that are easy to use, but that yield both an overview and more in-depth knowledge, with an emphasis on aspects of usability related to effectiveness. This has governed the choice of methods and measurement parameters. This approach has also highlighted the need for a more operationalised perspective on usability, as the evaluations should be carried out by Facilities Managers and not by researchers. It has also been both an academic and a pedagogical challenge to present the methods and the concept of usability in a way that is both usable and interesting for the evaluators as well as for the user organizations.

Usability depends both on the physical environment and how the environment is used. Any evaluation of usability will thus depend on context. For our partners, the main objective has been to improve usability within their premises. This means that improvements may be related both to use and to the properties of the building.

In this paper, we start with presenting the research projects development process and methods, as well as some theoretical perspectives on evaluation of usability. The main contribution is, however, our operationalised perspectives on usability, and a description of the evaluation process and methods, as described in the USEtool handbook.

2. Research methods and process

In this section of the paper, we present the methodological discussion related to the process of developing and testing the usability mapping tool. Later, in relation to the description of USEtool, we reflect on the choice of methods in the toolbox and their applicability to usability evaluation.

This research and development project has been conducted during a two-year period from 2007 to 2009 on commission of 3 partners, all of them companies that develop and manage facilities on behalf of large user organizations. The usability mapping tool has been developed in close collaboration with the project partners. The researchers and the project partners have been engaged in participatory workshops to develop the project's aims and approach to evaluation, the usability indicator, and an appropriate evaluation process, as well as to reflect on the results of various tests. Each project partner has provided a case that has been used for testing and developing the methods and tools. The cases were workplaces (offices), a highschool and a university college.

All methods described in the USEtool handbook have been tested in the cases. The aim of the testing has not been to evaluate the actual workplaces or educational spaces, but to gain experience with use of the methods, tools and indicators as they were developed and refined. Each test has concluded with a discussion together with the user representatives on how the methods and parameters worked. After testing, findings from each test have been summed up and presented in different workshops with partners. Some methods and tools were seen to work well, and only needed smaller adjustments, while others were rejected, or were in need of major redevelopment due to the results of the test. The following methods have been tested in cases and are part of the USEtool handbook: interviews, document analysis, structured group interviews, walk-throughs, and workshops. As a part of the development process, also questionnaires such as ASTM and DQI have been tested. Questionnaires are, however, not part of the final set of methods in the toolbox.

This project was developed and commissioned as applied research. This positions our work as a "real world enquiry" with the limitations, challenges and focus on practice that this implies (Robson 2002). This means that there was a set of clear expectations from our partners that had to be met: The tools should focus on effectiveness and fulfillment of organizational objectives. The tools should not require the use of questionnaires for all end users in the building, but should use input from a small number of users. The results should be useful both for improvements in existing buildings, as well as for input to briefing. And finally, representatives from FM or the user organization should be able to perform the evaluation without involving external consultants or researchers.

The USEtool handbook explains each stage and step in an evaluation process, enabling trained FM or user representatives to carry out evaluations of Usability. Supporting tools follow each stage to provide support to the evaluator.

3. Theoretical framework

By definition, *ex post* means after the fact, as opposed to *ex ante*, meaning beforehand. In relation to buildings, *ex post* evaluation means an assessment of a new or rebuilt building after it has been completed. *Ex ante* evaluations are analyses and estimations made in advance of project start-up. In this context, an *evaluation* is defined as a '*Systematic and objective assessment of an ongoing or completed project, program or policy, its design, implementation*

and results' (OECD, 2002). In general, we can distinguish between different approaches in *ex post* evaluations:

- (1) Socio-economic evaluations, usually *ex post* recalculations of *ex ante* analyses.
- (2) Business value evaluations, based on principles of corporate finance.
- (3) Holistic evaluations based on a diverse set of approaches and indicators.
- (4) Performance measurement evaluations utilising selected key parameters.

All four approaches can be applied to buildings. Property investors typically apply the second approach, the business perspective, which can be supported by approach 4, performance measurement (Andersen & Fagerhaug 2001, Olsson et al 2007). Government agencies and municipalities often are expected to apply the first approach, the socio-economic perspective, where benefits and costs are being monetarised to as great extent as can be defended scientifically (Sager 1991, Small 1999). Evaluators, especially those who aim at including a user perspective, typically prefer approach 3, holistic evaluations (OECD 2000). The literature shows a number of combinations of qualitative and quantitative evaluation techniques in use, including the logical framework, as described by Samset (2003). This paper is focused on this type of evaluations, in a usability perspective.

3.1 Post-occupancy evaluation

According to Preiser et al. (1988) a post-occupancy evaluation (POE) is: “... *the process of evaluating buildings in a systematic and rigorous manner after they have been built and occupied for some time*”. A POE focuses on the users and their needs, and may include both physical, technical and psychosocial aspects and evaluations.

A number of POE methods focus on building evaluations and take users perspectives into consideration. Examples of this are DQI (e.g. Gann et al. 2003, Markus 2003, Prasad 2004), ASTM (2000) and Buildings Use Studies (Leaman and Bordass 2001). Others are concerned with evaluation of the direct use of buildings (data of occupancy etc.). However, in practice, we have seen that most POE methods focus on technical aspects, and less on the building's relation to the users, as many methods for POE define functional and technical requirements against which the results are measured. Blakstad et al (2007) describe how different methods and tools were explored and tested according to their relevance and validity for Usability in several Norwegian cases. One of the main findings was that very few of the available methods aim directly at evaluation of usability, related to organizational objectives and effectiveness, but that many traditional research and evaluation methods had potential to be developed for the purpose of usability evaluation.

Alexander (2008) points out that in an organizational context, buildings usually are part of a portfolio of buildings, and are evaluated in terms of their asset value (as approach 2 above). He argues that the tools and metrics for considering the use value of buildings are less well understood and developed. The use value, or usability, is not only an attribute of the building, but also concerns the user's experiences, use and satisfaction. Most POEs or building

assessments focus on the building's functional attributes. Functionality refers to what the building can do, to evaluate functionality is to assess to which degree the building works according to specifications. Usability has a broader scope, and therefore evaluations of usability have to focus on how people utilise the functions to meet their needs, and their experiences from doing so.

Granath and Gilleard (2008) voice a critique of traditional POEs, stating that performance measurements and POEs tend to treat the buildings statically, ignoring the dynamic nature of businesses and organizations that inhabit the buildings' space. They also argue that “...*unlike POE or other existing methods to measure performance, usability cannot be evaluated simply on the product alone but also with respect to how the product is perceived by and interacts with the user*”. The National Research Council (2002) recommends to link assessments of physical conditions with *user comfort* in order to link facility design with business goals.

Usability is context dependent, and related to user experiences and social relations between users and facilities (as artefacts). Fenker (2008) argues that usability is a process, and can only be understood as a social construction. Fenker argues that: “... *given that they are designed for one or more activities, the artefacts are bearers of a set of possibilities and constraints as well as, most importantly, activity and social practices models.*”

As we have seen, usability may in many ways been seen as a “wicked problem”. Wicked problems have no definitive formulation of solutions, and they are open to multiple interpretations (Rittel and Webber 1973). Exploring “wicked problems” will usually require multi-method strategies. Blakstad et al (2007) argue for a triangulation of methods and evaluations with multiple perspectives: “... *the complex nature of Usability highlights the importance of triangulation of methods (multi-method strategies) and research teams with different backgrounds and skills.*”

All this implies that usability evaluations are complex, and that there is a need for simplification, and for the evaluator to possess both theoretical and practical knowledge and skills (Baird et al 1996). This means that it is challenging to develop a mapping tool for usability which can be used by evaluators with only limited training in performance assessments, and possibly no knowledge of research methods and skills. In order to develop the mapping tool, the challenge has been to operationalise usability, define which indicators one should consider, as well as provide methods that are focused, participatory and robust, as well as easy to use.

3.2 Operationalising the concept of usability

How can we understand the concept of usability in a way that makes it manageable for assessment and evaluation? In this project, where the objective has been to develop a methodology for assessing usability in context, we have seen the need to operationalise the concept of usability. The definition of usability focuses on:

- **specified users** who use a product (the building) to achieve **specified goals**

- the importance of **context** – in other words, the relationship between building and users
- the **efficiency, value creation and user satisfaction** that contribute to achieving the specified goals

A building's usability is never depending on the building alone. Its usability must be seen in light of the relationship between building and user. This is essential for understanding the concept of usability. The users have their own history, experiences, and perceptions in relation to the building and the activities that take place there. Further, the way they perceive the building will always be influenced by both individual and psychosocial considerations that have little to do with the building itself.

While working on the evaluation of usability, we have focused on the following questions: **What** do we want to achieve, and for **whom**? This is inspired by the research in universal design and quality and use of space, see e.g. Wågø et al. (2006) and Kirkeby (2006). In office buildings, the user organization often formulates objectives related to learning, branding, shared premises for units that should cooperate more, etc. In addition, there are different user groups that will often have different user perspectives. In a day-care centre, it may be desirable to have chairs and other furniture of a height that is suitable for the children, but this does not mean an optimal working position for the adults who work there. Moreover, the perspective may vary, depending on whether the context is the preferences and satisfaction of individuals or the effectiveness of the organization as a whole. For instance, an increased focus on knowledge sharing may require individuals to share their knowledge with others in the organization, which many employees may find demanding. In order to communicate this more clearly, we have focused on the following questions: who, what, where and why.

For what?

The definition of usability emphasises the fact that there are specified objectives to be achieved. Further, we have seen that there is a need to define the activities that are to take place. Thus the question "For what?" is multifaceted:

- What **objectives** are to be realised?
- What **activities** are to be conducted?
- What **work processes** should be supported?

When evaluating usability, it is essential to consider what factors **enhance** or **inhibit** effectiveness or the conducting of various activities.

For whom?

The next question is: Whose objectives should be met? The objectives of different individuals, of certain user groups, or of the user organization as a whole? We have focused on the need to define both the **user level** (individual – group – user organization) and the **type of user** (user group). As the definition of usability designates specified users, it is important to define which user groups are being focused on. Are we evaluating usability from the perspective of a teacher, a pupil or a school librarian? In some cases, and for certain aspects of usability, different user

groups may have divergent or even conflicting views of usability. Thus we have been intent on understanding how usability is evaluated by different user groups.

Where?

In order to obtain useful knowledge about a building's usability, the users' experiences must be related to space or place. Some places or rooms are well-suited for defined users and activities, while others are not. What functions well in one place for some people, need not function equally well for others in another place. Thus there will always be a connection between activities, different user groups and the physical surroundings. This means that in usability evaluations, there is a need to relate the user experience to specific physical surroundings; this influences the choice of methods for such evaluations.

Why?

Discovering factors that enhance/inhibit effectiveness is not sufficient; the next step is to understand **why**. As there will always be circumstances related to the building, the user organization, the individual user, or the way the building is used, that influence user experiences, it is beneficial to discuss the circumstances that influence the evaluation of usability. Why is this group room for students experienced as good to work in? Why does this office solution inhibit collaboration? By conducting discussions of this type, it is often possible to conclude that the reason a room works/does not work well is not necessarily a function of the room itself, but of other circumstances - such as the way the room is used - that do not match with the activities to be conducted there. This is essential when the knowledge acquired is to be applied in order to generalise and learn for later projects, or to improve the existing solution.

4. The USEtool: a 5-stage process

This paper presents a toolbox for evaluating usability, called the USEtool. In the toolbox, we have included a combination of different methods needed for gathering information and evaluating usability. The methods are intended as tools with which organizations or property owners themselves can conduct evaluations of usability using internal resources.

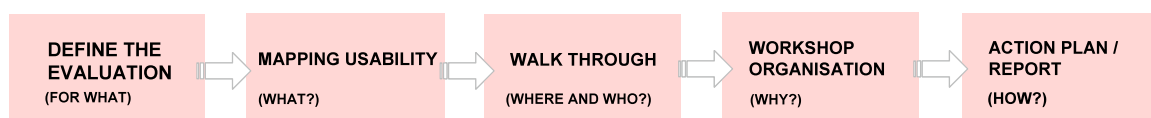


Figure 1: The evaluation process, USEtool

The methodology is presented as a process with 5 clearly defined stages and steps along the way (see figure 1). The steps are described in a handbook with specific and practical guidelines and tools, which provides the evaluator with computerised tools made available as templates and recommendations. The handbook, with active tools and guidelines, will be available in printed version in spring 2010.

Stage 1 – Defining the evaluation

In stage 1, the objective of the evaluation is defined, and a plan for the evaluation process is developed. When the focus is on usability, the effectiveness of the building is of primary importance. In the initial phase, representatives for the administration of the user organization are interviewed, in order to ascertain what visions, goals and strategies they have for the organization, the principles of organization, whether they have particular areas of focus in relation to how the building can boost effectiveness, and what their general impressions are, based on their use of the building. During this stage, the planning and implementation of the evaluation must be clarified.

In this stage we have chosen interviews and document studies, in order to establish a total picture of the situation at hand. Since the input comes from interviews, the quality of the results from this stage depends on choosing the right people to interview, as well as the availability of the informants.

Stage 2 - Mapping

We recommend conducting a general mapping process in stage 2. The objective at this stage is to establish an overall picture of the usability of the entire building or certain parts of it, based on a set of predefined parameters. This is done by holding a structured group interview, and by collecting already available information. During the group interview, questions should be asked about how the building supports activities, adaptability, universal design, architecture and floor plan, image, the indoor climate and the building's support functions, see table 1.

<i>How strongly do you agree with the following statements:</i> (on a scale from 1 to 6, where 1 = not at all, and 6 = to a high degree)
WORK PROCESS SUPPORT 1. Our premises support our activities 2. Our premises help us to work efficiently 3. Our premises help us to have a good work environment 4. Our premises facilitate cooperation within our own unit 5. Our premises facilitate cooperation with customers and collaborative partners 6. Our premises help me learn from others (support knowledge sharing) 7. Our premises support the development of knowledge
FLOOR PLAN/DESIGN 8. We have ready access to the rooms we need 9. The rooms are suitably designed 10. Our units/departments are suitably located in relation to each other 11. The building is well laid out and easy to find your way around in 12. We can easily adapt the building as our needs change 13. Our premises are accessible and easy for all user groups to use (e.g. the motor impaired, visually impaired, hearing impaired, orientation impaired and environmentally disabled)
INDOOR CLIMATE 14. We have a good indoor climate (lighting, sound level, air quality, temperature) 15. It is easy to keep our premises orderly

<p>IMAGE/IMPRESSION</p> <p>16. The building profiles our company in a good way</p> <p>17. Our premises have an attractive design</p> <p>18. Our premises give a feeling of belonging</p>
<p>SUPPORT FUNCTIONS</p> <p>19. I am satisfied with the canteen and the coffee stations</p> <p>20. We have access to help quickly if there is a problem with the building or equipment</p> <p>21. Our premises are kept clean</p> <p>22. We have good systems for reserving rooms and equipment</p>
<p>EQUIPMENT</p> <p>23. We have ready access to the equipment we need</p> <p>24. ICT (information and communication technology) supports our activities</p> <p>25. Furniture and furnishings are satisfactory</p> <p>26. We have access to adequate storage facilities</p>

Table 1: Questions used in group interview, stage 2.

All questions are sent beforehand to the participants in the group interview. During the interview, the evaluator reads the questions, and the participants are encouraged to discuss the question, before giving individual scores (from 1-6) as well as a comment or an explanation of their score. The scores from each individual are not summarised, but the scores for each group of users are represented in a spider-web diagram, and the comments saved for later. The goal is not generalization or statistical analysis of the data. During the development of USEtool, a questionnaire was considered for use in this stage, but this was omitted because the partners wanted to avoid a large-scale survey, involving many users. This made the reliability of such a survey questionable, and we rejected quantitative methods and settled for a qualitative interview with a limited selection of users (6 to 10 persons) instead. Conducting the group interview is one of the most challenging tasks for the evaluator, and a detailed set of instructions is developed as part of the toolbox.

If the objective of the evaluation is to examine specific topics/problems, the structured group interview in stage 2 can be omitted, and stage 3 (the walkthrough) is initiated as soon as the information has been collected.

Stage 3 - Walkthrough

The general mapping process yields an overview of different usability parameters, but it does not provide any in-depth information. The objective of stage 3 is to gather user experiences related to selected topics from stage 2, and to attain a better understanding of why solutions function well or poorly. The mapping process will generate a picture of “where the shoe pinches”, or particular topics that it may be useful to gather in-depth information about. These topics can be explored using a walkthrough (stage 3). A walkthrough is conducted as an inspection tour of the building (with designated stops) with selected users in order to gather their experience in relation to the relevant topic. In some cases, there will be several topics you wish to gather in-depth information about. In that event, you may need to conduct several walkthroughs, with different topics, different stops and different participants.

In most studies of usability, some kind of walkthrough methodology has been used. Walkthroughs are valuable for usability evaluations, due to the fact that they may provide perspectives and experiences from multiple informants with different perspectives, spending a limited amount of resources. They provide contextual data, which can be directly related to place (where), activity (what?) and actor (whom?). Again, this is a qualitative method. The use of the walkthrough in USEtool is described as a separate paper (Hansen et al, forthcoming).

In some cases there will be no need for more in-depth information, if the necessary answers were provided by the mapping process. In that event, the handbook recommends proceeding directly to stage 4 (the workshop).

Stage 4 - Workshop

In stage 4, the results from the mapping process and the inspection tour are summarised and discussed in a workshop with the user organization, in order to evaluate usability in relation to the goals that the organization has formulated. This is the time to explore how physical solutions are experienced in relation to the chosen objectives, and why this is the case. The question “why” is important in order to determine what knowledge can be applied on other buildings, and what knowledge is linked to the interaction between user and building in each concrete instance.

At this stage it is important to always relate the discussions to the objectives. According to Blakstad et al (2007), assessments from users are more based on their personal experiences than on the fulfillment of organizational objectives. This is why the methodology stresses that the discussion always should be about objectives, at this stage. Since most data gathered during the evaluation is qualitative, the discussion also provides opportunities to calibrate and understand the data to enhance the reliability and validity of the assessments.

Another important issue in the workshop is attribution. We are interested in to what extent observed development is related to the physical environment. *Attribution* is a key issue in *ex post* evaluation (Samset, 2003). In this connection, attribution is defined by OECD (2000) as: “*The ascription of a causal link between observed (or expected to be observed) changes and a specific intervention.*” When analysing whether a building project has met its objectives, one must keep in mind that other factors may have an impact, in addition to the building studied. Low attribution means that it is difficult to isolate the impact of the project studied. User perception of the actual building, including light, space availability, and in-door climate, is usually relatively directly related to the building itself. When evaluating the effect of the building on the core activity, such as learning in a school, service production in an office building, e.g., attribution becomes an important issue.

Stage 5 – Action plan/Final report

Stage 5 consists of drawing up an action plan or communicating the results of the investigation by other means. The way these results are reported will depend on the objective defined in stage 1. The results can be used to improve solutions, in the planning of new buildings, and to increase our knowledge about the relationship between a building and its users.

5. Concluding discussion

In this paper we have presented our work on operationalisation of usability for the purpose of usability mapping and evaluation. We have also given a brief description of the proposed evaluation process, methods and tools as well as some reflections on the choice of methods. Based on theoretical and empirical work with usability over many years, our aim is that the proposed process, methods and tools will provide us with better foundations for future work with usability of buildings. The process description in USEtool contains a gathering of known, qualitative methods; such as interviews, structured group interviews, walkthroughs, and workshops. We think that the main contribution is the way these methods are combined in a structured framework with process descriptions and easy-to-use guidelines, as well as the operationalised relation to effectiveness and usability.

The methods in USEtool have been tested as part of a development process. There is still a need for further testing of the entire process (step 1-5), as well as of all the tools as they are described in the final handbook. Further testing carried out by our project partners will reveal the method's usefulness, simplicity, and the necessary amount of resources to carry out evaluations. From what we have seen in the cases and tests, the described methods and tools really assess usability within the given context, with special focus on the effectiveness of the facilities and their ability to support value creation in the user organization. We acknowledge the fact that one cannot generalize directly from the results of highly context dependent evaluations such as USEtool. In fact, the Usability concept is context-dependent in nature. One may argue that the contextual knowledge that may be gained from applying the USEtool is as important as the generic results for building performance. Further work is needed to address this. The purpose of this project has been to provide building owners, users and Facility Managers with knowledge of usability in order to support continuous improvements. In order to take this work to the next step; more generic evaluation of usability, we need further tests and validations to ensure that we really target the most important aspects of usability applying USEtool.

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Usability walkthroughs

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Abstract

Buildings should be regarded as means of production, and should be evaluated based on their potential to support organizational performance and achievement of goals. Despite this, there is a lack of both methods and tools for testing whether facilities really support organizational needs. In order to approach such issues, we need a multiple method assessment strategy.

This paper is part of the ongoing work to develop a theoretical and methodological foundation for the usability of buildings, and here we present the results of a two-year study. The aim of the study has been to develop and test a methodology that the owners and users of buildings can use to assess usability in their own building portfolios. Within a common framework describing the evaluation process, a combination of two assessment methods has been developed: systematic general usability mapping and walkthrough. The proposed methodology is named USEtool. In this paper, we describe the walkthrough method, and how the tool can be applied as a part of a toolbox for usability analysis.

We start off by presenting earlier experiences of walkthrough from different disciplines, before going on to describe the development and testing of the methodology performed within our case studies. We have varied the walkthrough methods with different types of participants, different registration forms, and different ways of conducting the method, from more individual assessments to group discussions and interviews.

Finally, we describe the walkthrough methodology as we have developed it for use within the USEtool framework, and present some examples of results obtained in the case studies. By using the proposed methodology, our research partners aim at developing a systematic dialogue between owners, occupants and Facilities management (FM) staff, in order to enhance long-term effective facilities and improve briefing for new buildings. To date, our experience with usability walkthrough has shown that this may be a powerful tool to enhance the contextual understanding of usability and to achieve these goals.

Keywords: buildings in use, evaluation methods, usability, walkthrough

1. Introduction

How a building actually functions when it is used is critical for both whether or not it is regarded as a success and constitutes an asset for its owners and users. A systematic evaluation

of buildings in use will be an effective way to produce this knowledge in relation to the planning of new buildings and not least for the development and change of existing buildings. There are already many concepts, definitions and methods that are relevant to buildings' quality, standard and condition. Most of these are associated primarily with a building as a physical object and not with its usability. An important approach to usability is that a product in itself has no value, but has value only insofar as it is used.

The concept of usability is widely known in relation to applications within product design, information technology and web design, but recently has also been adapted to buildings through the work in connection with CiB Working Commission W111 on the 'Usability of Workplaces' (Alexander et al., 2004). According to ISO 9241-11, usability is defined as '*the extent to which a system can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use*' (ISO, 1998). Testing usability means making sure that the product supports the actual user's objective and goals, while testing functionality means making sure that a product works according to specifications. A product's functionality will therefore be critical, but not sufficient, for the product to be successful in use.

Usability evaluations are based on different users' experiences and assessments on how well buildings perform regarding different parameters related to usability. There is, however, a lack of methods and tools for testing whether facilities actually support organizational needs. In order to approach such issues, there is a need for a multiple method assessment strategy. Previous studies have shown that in order to assess usability, one has to focus on the effect of a building on the user organization's fulfilment of goals, and also in terms of the end users' satisfaction and experiences. Evaluations should be based on different methods and aspects, depending on objective, purpose, focus, competence, and resources (Jensø et al., 2004; Blakstad et al., 2008).

This paper is part of the ongoing work to develop a theoretical and methodological foundation for the usability of buildings, and here we present the results of a two-year study. The aim of the study has been to develop and test a methodology that the owners and users of buildings can use to assess usability in their own building portfolios. The proposed methodology or framework is named USEtool. It provides a systematic review of the various stages in a mapping process and contains methods and guidelines for best practice when organizing and implementing the various steps in this process.

In the different case study reports by CiB W111, walkthroughs are the most commonly used methods for the evaluation of usability (Nenonen et al., 2008; Hansen et al., 2005; Hansen et al., 2006; Blakstad et al., 2008). Walkthrough is a qualitative, but systematic way of assessing different aspects of a building by using different stakeholders as informants. In this paper we present earlier experiences of the walkthrough method and the development and testing of the methodology performed in several case studies is described. We present a proposal for a walkthrough design within the USEtool framework, and discuss how the tool can be applied as a part of the toolbox for usability evaluations.

2. Theoretical framework

In the literature we find various approaches and understanding of terms associated with the use of buildings and quality of use. In order to assess a certain design or building in use, a number of assessment tools have been developed to assess the design and usage of buildings. Such methods often focus on specific aspects, such as building technology, health, working environment, safety or user satisfaction, and well-being. An overview of different tools can be found in Baird et al. (1996) and Voordt and Wegen (2005). According to Preiser et al. (1988), a post-occupancy evaluation (POE) is *'the process of evaluating buildings in a systematic and rigorous manner after they have been built and occupied for some time'*. A POE focuses on the users and their needs, and may include physical, technical, and psychosocial aspects and evaluations. Preiser introduced a framework for POE with three levels of evaluation – indicative, investigative and diagnostic – proposing several methods for each level.

Usability evaluations are based on a user perspective. Within the work of the CiB W111 Usability of Workplaces, a theoretical framework has been developed describing the concept of usability, and different methods and tools have been studied and examined in several case studies during the last 6–8 years. Previous studies have shown that evaluations work best when they are based on several methods and aspects, depending on objective, purpose, focus, competence, and resources. (Jensø et al., 2004; Alexander et al., 2004; Hansen et al., 2005; 2006; Blakstad et al., 2008).

Evaluators and auditors typically want to see the facility or system they are asked to evaluate. This is also a formal requirement in guidelines for system audits (ISO 19011:2002). Walkthrough is not really one method, but a common term for several different techniques. According to Gill et al. (2005), walkthroughs can be used for needs assessment and guidance for planning, setting up a facility, team-building, internal and external supervision, quality assurance, and evaluation. In the following, we briefly describe some of these approaches. With regard to usability, the existing literature is focused on walkthrough either as a tool for assessing IT (information technology) systems or for evaluating physical facilities, such as buildings.

For IT systems, usability inspection has seen applied as a way to evaluate user interfaces (Nielsen and Mack, 1994), while structured walkthroughs have become a standard method for assessing the quality of software (Yourdon, 1985). Some research studies have even examined the effectiveness of walkthrough on IT systems (Jeffries et al., 1991; Desurvire et al., 1991; Karat, Campbell and Fiegel (1992) have investigated the relative effectiveness of tools for usability evaluations and shown that the effectiveness of walkthroughs can be enhanced by conducting them in groups rather than with individual evaluators.

Two concepts that have relevance to the usability of workplaces are cognitive and pluralistic walkthrough. Cognitive walkthrough focuses on ease of learning (Rowley and Rhoades, 1992; Wharton et al., 1992). At each step in a process that the system is designed to support, the evaluation is focused on how difficult it is for the user to identify and operate the interface, and how clearly the system provides feedback to the user. Pluralistic walkthrough is a method of

usability inspection where a diverse group of stakeholders reviews the design, including user interface designers, users, developers, and management (Bias, 1991). Each of the stakeholders brings a certain perspective, expertise, and set of goals to the project that enables a greater number of usability problems to be identified.

Methods similar to those used on IT systems have been applied to buildings and workplace environments. Lynch and Rivkin (1970) introduced a user participant method for evaluation, and pointed to the differences between the locals and visitors in a given area. Participants that had lived and used the area for a longer period of time found associations with many different activities and physical, social and cultural structures and patterns within or in near proximity to the area. In contrast, visitors just described what they saw.

From research and case studies on planning, we find further use of walkthrough as a method. Laval (1998) has examined the walkthrough method for planners with respect to knowledge feedback in projects. Her experience is that the method provides a quick and fast overview of the different aspects and opinions concerning the chosen case and is an effective learning process for participants. Further, she finds that the choice of participants can influence the results from a walkthrough, especially if the group is too homogeneous. However, the choice of route and stops for the walkthrough also has a strong influence on the results. Hurtig et al. (1995) had similar experiences from their work, and recommend that the walkthrough method should be combined with other methods adjusted to situation, context and focus.

Walkthroughs have been applied in a number of contexts related to building evaluation in a user perspective. Cheong and Chong (2001; 2003) have used walkthrough for assessment of the indoor air quality. Bluysen et al. (2004) describe the development of assessment procedures and guidance on ventilation. Their method included physical and chemical measurements, a questionnaire, and a walkthrough survey checklist. Rowley (1994) studied customer experience in libraries, and proposed a methodology using walkthrough audits for monitoring user experience. In a similar way, Rowley (1999) proposes a methodology using walkthrough audits to map visitors experiences in museums. The methodology includes building a typical visitor or customer profile, designing and executing walkthroughs based on the profiles, and analysing the results from the walkthroughs.

According to Mills (1989) and Karapetrovic and Willborn (2001), audits in different fields typically utilize walkthroughs. An auditor acts as a fresh pair of eyes when reviewing a management system. Saunders (1994) describes walkthrough as a part of supplier audits. Hakkinen (1999) describes safety auditing as a parallel to quality audits. Corn and Lees (1983) describe the use of walkthroughs in the context of industrial hygiene evaluation. In the service sector, Koljonen and Reid (2000) have studied walkthrough audit for assessing the operations management aspects of providing customer service. Bojanic and Rosen (1994) describe walkthroughs as part of their methodology to assess customer perceptions of service quality in restaurants. Gill et al. (2005) describe walkthrough in health care, where a walkthrough reflects the physical paths that patients and the staff who treat them might follow. Ambrose (1990) underlines the importance of obtaining information on differences in interests and opinions,

rather than focusing on consensus. Ambrose argues that a walkthrough should be complemented with a workshop discussing selected topics, focusing on specific problems, and proposing solutions. This is in line with Preiser et al. (1998), who claim that walkthrough is an easy, quick and cost-effective way of gaining a good overview of a building's performance on an indicative level, particularly when focused on just a few evaluation issues.

3. Methodology

Methodology of this paper can be discussed on two levels, respectively related to the methodology that has been applied in the study and use of the method that has been proposed in the study. This paper focuses on the process of development of the walkthrough methodology. The presented research is based on an action research approach, building on the research approaches of Lewin (1946). According to Johansson and Lindhult (2008), action research aims at combining research and development through the involvement of practitioners and users in the research. The aim is for both practitioners and researchers to gain mutual benefit from such interaction. Among recent methodological developments, our research has been inspired by phronetic social science, introduced by Flyvbjerg (2001) as an approach to the study of social phenomena. Phronetic social scientists study social phenomena with a focus on what is good or bad for humans.

The work to apply the usability concept in building design, construction, management, and use has been carried out through a programme of action research, comprising an intensive series of case studies and associated workshops within the network of CiB W111 Usability of Workplaces. The development of the usability walkthrough method within the USEtool framework has been based on relevant theory and experiences from the different national case studies representing a variety of companies from different disciplines. Different approaches, focuses and methods have been used in the case studied in order to develop and explore the concept of usability (Alexander et al., 2004)..

This paper is based mainly on the experiences from a number of Norwegian case studies where different methods and ways of doing walkthroughs have been studied. The studies have been carried out in close collaboration with our business partners in 'real life', i.e. ordinary working situations within the organizations. The subjects of our case studies have been university colleges, offices and secondary schools. The main aim of the studies has been the development of methods and not the results of the evaluations as such. In addition to action research, we have also applied common qualitative research tools such as observation, interviews and focus group workshops.

The different walkthrough approaches are described later in this paper. For each study or experiment the purpose, method and process of the walkthrough was described. For all of the walkthroughs the participants consisted of real users and stakeholders, such as students, teachers, administration staff, representatives from owner and facilities management staff, accompanied by the researchers conducting the walkthrough. The processes were monitored by

the researchers. Each walkthrough was followed up by a workshop in which the method, process and results were discussed, focusing on strengths, weaknesses and relevance for the method related to the usability of the workplace in general and the effect for the organization in particular. The experiences and lessons learned from one case were then incorporated in the design of the next walkthrough. The final design for the walkthrough described in this paper has been formulated to fit into the USEtool framework, and should be seen as one of several methods to evaluate the usability of workplaces.

4. USEtool

An important task in the Norwegian projects has been to develop methods and tools for a usability evaluation process combining different assessment methods within a common framework. The proposed methodology is named USEtool and describes a systematic approach to evaluate the usability of buildings for an organization. The USEtool handbook has been designed as an active tool that property owners themselves can implement using internal resources. The recommended process for mapping usability consists of five stages and culminates in the drafting of an action plan for improved usability for the organization involved. For each stage there is a general (preliminary) introduction, followed by a description of the goals in that stage, the methods used, and the expected results (Figure 1).

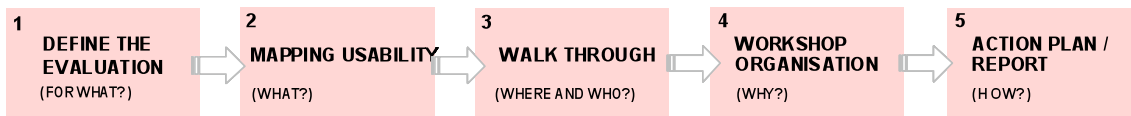


Figure 1. USEtool framework: the evaluation process

In stage 1, the objective of the evaluation or mapping is defined, as well as how it is organized. Stage 2 is a general mapping process, and the objective for this stage is to establish an overall picture of the usability of the entire building or certain parts of it based on a set of predefined parameters. This is done by conducting a structured group interview and by collecting already available information. The objective of stage 3 is to gather user experience related to selected topics from stage 2 and to attain a better understanding of *why* solutions function well or poorly. This is done through a structured walkthrough. In stage 4, the results from the mapping process and the inspection tour are summarized and discussed in a workshop with the user organization in order to evaluate usability in relation to the goals which the organization has formulated. Stage 5, the final stage, consists of drawing up an action plan or communicating the results of the investigation by other means.

The framework reflects the importance of understanding and taking into consideration the contextual conditions that may determine the outcome of the user experiences of the building or workplace (Hansen and Knudsen, 2006; Fenker, 2008).

5. Usability walkthroughs in Norwegian case studies

Several methods and ways of performing usability walkthroughs have been studied in a number of Norwegian case studies. This has been an iterative learning process, where experiences and learning from one case have been discussed, developed and implemented into the following case studies, related to the context of the USEtool framework. The main differences in the walkthroughs carried out in the studies are summarized in Table 1, presented by four cases representing the most significant ways of conducting a walkthrough (2 university colleges, building agency, secondary school).

Table 1. Variations in usability walkthroughs

case	perspective	focus	participants	Method and format
A	university college – individual user's satisfaction	learning/working facilities	mixed group of stakeholders (one with a disability)	talking + taking notes worksheet; open form to note down positive/negative impressions + proposals for improvements
B	the school's visions and objectives	the premises for a specific class	mixed group of stakeholders	silent, taking notes + discussion worksheet; open form to note down positive/negative impressions related to <i>overall objectives</i> + proposals for improvements
C	the university college's visions and objectives	cooperation between faculties/ departments	mixed group of stakeholders (some not informed of the purpose)	taking notes + discussion worksheet; focused and predefined questions related to overall objectives on cooperation and common space
D	organization's/ department's objectives	supporting other departments	staff department, Facilities management staff, guests	silent, taking notes + discussion worksheet; combination of open form to note down positive/negative impressions and use of scale on specific parameters

In the following part of the paper we discuss the main experiences and findings from our experiments and studies of the usability walkthrough method within the context of the Norwegian approach on usability, focusing on the effectiveness element of the usability concept.

Perspective and focus for the walkthrough

Deciding on perspective and focus is crucial in a successful walkthrough. In the case studies we have conducted, we started with a quite open approach to usability. Walkthrough focuses on the different participants' opinions and assessments of their workplace and the building they occupy, often expressed in terms of individual users' satisfaction. In one of the first case studies

(Hansen et al., 2005) we learned that the different participants in the walkthrough did not necessarily relate their opinion of usability to the organization's visions and objectives. We saw a gap between the strategic management level and the different users' focus on their daily activities. In subsequent walkthroughs we always took the organization's visions and objective as a starting point for conducting the walkthrough and as a background for understanding the findings and results from the evaluation. Questions on how a building supports/hinders organizational goals at a strategic level have proven to be hard to answer from a walkthrough. On the one hand, open walkthroughs will yield a lot of adequate and inadequate feedback on how facilities work in general, while on the other hand it is often more relevant to focus on specific topics, aspects or problems, depending on the situation and need for information. The knowledge gained from our case studies has underlined the need for clear and defined subtopics and/or parameters for the evaluation, such as cooperation between departments or the premises for a specific school class. This is in line with Preiser (1998), who states that walkthroughs can be effective when focused on a few evaluation issues. The purpose and the focus of a walkthrough must be clearly communicated to the participants. In one of our cases, several of the participants were unfortunately thrown into the walkthrough experiment, without having the necessary information and background. This resulted in lack of motivation and lack of relevant feedback related to the focus of the walkthrough.

Participants. An important consequence of defining the perspective and focus for a walkthrough, is the selection of participants, route, and stopping points during the walkthrough.. Different stakeholders and organizational levels have different perspectives regarding the usability of workplaces (Fenker, 2008). The selection of participants should be considered in the light of the objective of the walkthrough, as this may influence the findings. Hansen et al. (2005) have shown that the quality of an evaluation will depend on who participates, as the evaluation will reflect their focus on and experiences of the building. This view has been supported by findings from other usability studies (Bias, 1991). In all of the walkthroughs conducted in the Norwegian studies, there have been a mixed and heterogeneous group of stakeholders representing a variety of backgrounds, roles, references and opinions, making the gathered data richer (Hansen et al., 2005). Laval (1998) and Hurtig et al. (1995) argue that the choice of participants can influence the results from the walkthrough especially if the group is too homogeneous. An important premise for the walkthroughs conducted in our case studies, has been to broaden the understanding of usability. Bias (1991) argues that each stakeholder brings a certain perspective, expertise, and set of goals to a project, thus enabling a greater number of usability problems to be identified. It is more important to discover the differences in interests and opinions, than focusing on consensus (Ambrose, 1990). As an example, in one of the cases we had one participant with reduced operability who gave new insight and information on the usability of the workplace from her perspective and that might not have become apparent in her absence. In an organization, all members should ideally work towards the same objectives. In our studies, facilities management staff has also participated in the walkthroughs, providing them with insight into and understanding of the different users' needs and requirements. A common understanding of different user perspectives has been the positive effect of heterogeneous groups, leading to interdisciplinary learning between the different

participants. In this respect our findings coincide with the existing theory on pluralistic walkthrough (Bias, 1991).

Internal / external perspectives. In several of the walkthroughs conducted in our usability case studies, participants have included stakeholders using the premises on a daily basis and also visitors. In some of the studies the researches have also played an active role in conducting the walkthrough. Having a mix of internal and external stakeholders has been shown to be useful as this brings in different perspectives, with different stakeholders complementing each other. Visitors can act as a fresh pair of eyes (Karapetrovic and Willborn, 2001). For example, when testing in an office location where the user representatives were satisfied with their premises as workplace, it was found that the external visitors did not find any evidence of the department's actual task, which was to support the rest of the organization. This illustrates the fact that users often can be blind to the lack of usability in their daily work and explain the situation with different more or less plausible arguments (Hansen and Knudsen, 2006). On the other hand, we also find that stakeholders using premises on a daily basis can have a better contextual understanding of the usability of their workplace because they relate this to organizational, social or technical issues (Alexander, 2008). This fits with studies of Lynch and Rivkin (1970) who reported that 'the visitors just described what they saw'.

Method and format. The walkthroughs have been conducted in different ways regarding method and format. Some of the variations have been 'silent' walkthrough, walkthrough with discussions, or combinations of these. Our experiences have been that a combination of time for individual observation and reflection and group discussions at each stop gives the best results regarding the quality of findings, especially when it comes to contextual understanding of why premises are working well or not in relation to organizational objectives. An important effect of group discussions is the learning perspective among the participants, opening up for other views and explanations. Our case studies show that the success of conducting walkthroughs depends on how the walkthrough is managed. Further, our experiences underline the importance of a trained facilitator or project manager guiding the participants through the route and facilitating the discussions. In her work, Laval (1998) has the same experiences regarding managing the walkthrough process.

One of the main challenges in designing a usability walkthrough method within the USEtool framework has been the question of how to document and record users' assessment of the usability of their workplace. Several worksheets have been developed to help participants to record their opinions of how their premises work for a given purpose. The design of the worksheet has varied. Case A had a quite open form, containing space for noting down positive impressions, negative impressions, and proposing improvements at each stop along the walkthrough route. These are easily understood by participants of different age and background. They engage the walkthrough participants, giving data mostly on esthetical and functional matters. Our experience is that we obtained varied and rich material regarding usability findings, but the data in the form of written material from walkthrough can be difficult to relate directly to organizational goals. Two of the walkthrough variations presented in Table 1 (case B and C) use a worksheet, on which participants were supposed to record their positive and

negative impressions and also make suggestions for improvements to the organization's visions and objectives in order to focus on the effectiveness element of the usability concept. One of the major problems with this approach was the lack of clearly formulated and adapted objectives down to the operational level. In one of our tests the topic of investigation was linked to a superior organizational goal: 'The building's contribution to hindering/enhancing cooperation between faculties'. The participants found this strategic objective hard to link to the premises, and hence hard to answer. In this respect, our experience is that there is a need to break down the overall objectives and link the questions to sub-topics, being precise and giving little room for alternative interpretations of the questions. The last variant described here (case D) has a combination of an open form on which to note down positive and/or negative impressions and use of scale on specific usability parameters such as activities, accessibility, space layout, indoor environment, support, adaptability, identity/image, and architecture. This type of walkthrough generated an interesting discussion afterwards on the different participants' use of scale and understanding, and also the relevance of the different parameters.

As discussed earlier in this paper, the walkthrough can be an effective way to evaluate usability when focusing on a few evaluation issues (Preiser et al, 1988). The design and format of the worksheet must relate to the purpose of the walkthrough and to the organization's vision and objective. An important finding from the different usability walkthroughs in our case studies is that the findings and results are not valid unless they are put into a contextual framework.

6. USEtool walkthrough

Within the USEtool framework, the walkthrough will be the third of five stages. The objective of this stage is to gather user experience about specific topics from stage 2 and to gain a better understanding of *why* solutions function well or poorly. Usability in relation to *what* and for *whom* will be crucial questions at this stage. The goal is to attain contextual knowledge of how various solutions work and to avoid reproducing bad solutions from one project and user organization to another. The walkthrough contains following five steps describing the different activities and tasks, and these are examined in more detail below.

1 Defining focus or sub-topics. On the basis of the topic selected, the sub-topics/parameters to be investigated during a walkthrough must be defined. It is advisable to formulate sub-topics in order to limit and focus the mapping process so it will correspond to the objective of the mapping and the purpose of the walkthrough.

2 Choosing participants. Both the number of participants and types of interest groups to be represented should be chosen based on the objective of the walkthrough and the selected focus areas and/or topics. As usability depends on the perspective of the individual, it is important to choose participants that represent different stakeholders. As a minimum, participants should be included from the user group that uses the facilities and/or building on a daily basis. It may be useful to supplement the group with experts and/or consultants or representatives for various user organizations if relevant to the topic of investigation.

3 Choosing stops. Stops in the walkthrough are chosen based on the purpose of the walkthrough. These stops should provide sufficient data and information on the topic of investigation. To be efficient, the total number of stops in the walkthrough should not exceed eight. A walkthrough with a great number of stops, combined with a high number of participants, yields a vast amount of information. As a rule of thumb, a greater number of stops can be permitted when there are few walkthrough participants than when there are a large number of participants.

4 Conducting the walkthrough. The walkthrough should start with a joint presentation of the object of the walkthrough and the topic of investigation. The purpose of this introduction is to ensure that the participants ‘put on the right glasses’ and to explain how the walkthrough is to be conducted. The participants use a prefilled schema to take notes on their tour. If, in addition to taking notes, the walkthrough participants are to have discussions at the stops, more time will be required at each stop. In addition to guiding the participants to the correct stops and keeping track of the time, a process manager leads the discussion and should have another person who can take notes and be responsible for photo documentation.

5 Summarizing the results. A process manager draws up a summary of the most important findings from the walkthrough on the basis of the available material. This summary should explain why certain solutions are considered workable or non-workable according to function and user. Combining text and photos from the various stops provides useful, comprehensive documentation that is easy to communicate. This documentation is compiled in a separate walkthrough booklet.

7. Concluding discussion and future work

In this paper we have presented theories on walkthroughs from different disciplines, mainly from the software industry to detect potential problems and defects before production. Some of these theories can be adapted and used within the concept of usability. The paper describes the walkthrough methodology as we have developed it for use within the framework of the USE-toolbox, and presents some examples of results obtained from the case studies. An important aim of usability walkthrough within the USEtool framework has been to gather user experience about specific topics for better understanding of why solutions function well or poorly. One may always discuss the external validity of qualitative methods. According to Halvorsen (2008) the main question is not if results may be *generalized* but if knowledge can be *transferred* to other settings. In this paper we have described how these topics can be explored using a walkthrough. There are different ways in which a walkthrough can be conducted, ranging from a completely open structure with evaluation based on spontaneous subjective evaluations by random participants then and there, to predefined stops and evaluation criteria with selected participants. Experiences with the walkthrough method from the Norwegian cases, studies within the CiB W111, and walkthroughs from other fields all conclude that this is an effective method that gives a quick and good overview on an indicative level. The validity and reliability of the method in general can be discussed. As already mentioned, the results gained from

walkthroughs will depend on the purpose of the evaluation in question, who participates and what route is defined. In addition, the results will depend on the feedback from participants regarding the method and also the process itself. The experiences will naturally be influenced by the different participants conducting the walkthrough. One important aim for the development of the method has been its ability to produce and/or obtain relevant information and experience relating to the defined topics for evaluation, understanding the situation and context, and obtaining differences in interests and opinions, rather than focusing on consensus. Hansen et al. (2005) shows that the method gives the same results or even better results compared with interviews and questionnaires, especially when it comes to understanding situation and context. Usability in relation to *what* and for *whom* will be crucial questions at this stage. The biggest advantage with the walkthrough method is the attainment of contextual knowledge of how various solutions work and to avoid reproducing bad solutions from one project and user organization to another. An important effect of the walkthrough method is the learning effect when the participants gain insight into each others' needs and requirements and evaluation of usability related to concrete physical solutions. The discussion after the walkthroughs showed that the participants had increased their understanding of usability (Hansen et al., 2006; Blakstad et al., 2008). By using the proposed methodology our research partners aimed at developing a systematic dialogue between owners, occupants and FM staff, in order to enhance long-term effective facilities and improve briefing for new buildings. Our experience so far with the usability walkthrough is that this may be a powerful tool to enhance the contextual understanding of usability and achieving these goals when used in combination with other methods within the USEtool framework. In an action research perspective, the ultimate validation of our results is the extent to which the intended users will both use and learn from the use of the methods we have developed. Usability is thus the final test of the usability toolkit.

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Usability of HE Campus Buildings

- How can we evaluate it?

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Abstract

The purpose of the paper is to try to explore what should be the right criteria to evaluate usability of campus buildings according to different user needs. Usability concept emphasises on three aspects: efficiency, effectiveness and satisfaction. This paper attempts to interpret these three aspects in a Higher Education campus setting.

The approach was based on usability evaluations of six buildings on campus of University of Salford, by groups of underground students. The buildings portfolio here include library, leisure centre, student union, purpose built department house and multi-purpose built.

The research found a lot of commonalities in the criteria chosen by the groups of student, such as access, comfort, aesthetics etc. They have then used walk-throughs, questionnaires, and interviews to test out different user groups' satisfaction towards those criteria. Combine those criteria & existing literature, the author is trying to build up a standard evaluation of usability of HE buildings.

As usability is still a very new concept, most groups of the undergraduate students find it difficult to comprehend, thus the research they carried out wasn't in-depth. They were also restricted by time limit and the amount of building users that they could talk to directly.

This paper tried to contribute to the development of usability in buildings concept. By creating a more standardised evaluation format, students might find it easier to comprehend what is usability and how to improve buildings' performances for their users.

Keywords: Usability, Building Performance Evaluations

1. Introduction

Usability, is a concept that is mostly associated with human-computer interactions in website designs and software development. It hasn't been linked with building performance evaluations until 2001, when the CIB Working Commission W111 on Usability of Workplace was formed (Alexander, 2008). Since then, the main definition for usability adopted is from the ISO 9244-11:

“Usability means the extent to which a product can be used by specific users to achieve specific goals with effectiveness, efficiency and satisfaction in a specific context of use.”

This definition suggests three key factors in usability evaluation:

- effectiveness
- efficiency
- satisfaction

In comparison to other buildings performance evaluation methods such as POE (Post Occupancy Evaluations), usability in the built environment is still a new concept. To try to advance the development of usability concept, the School of the Built Environment at University of Salford, as one of the key partners in W111, had used the opportunity of a discipline based project with the groups of year 2 Property Management and Investment students. Each group consisted of six team members. In total 11 groups were formed in order to evaluate usability of various campus buildings at University of Salford. The buildings chosen are used for different purposes, including library, leisure centre, student union, and multi-uses. The students were asked to evaluate the building performances from different users' perspectives: themselves as students, staff and also visitors. The results for their evaluation have to be combined into a team presentation, a poster and a project report, for each team. The project was required to be completed within a 12-week period, and the project reports were forwarded to the Estate department for their considerations.

Throughout the evaluation project, the students have total autonomy in choosing what area of the buildings that they want to focus on, what they would consider to be the appropriate evaluation criteria, and how they would approach different users groups. The role of the lecturers is limited to the delivery of a few keynote lectures, which covered the basic concepts of usability and provided directions towards relevant information sources.

2. Evaluation Methods

At the beginning of the project, most students have found it difficult to comprehend the concept of usability. There is limited amount of literature the students can base their research on, even less luck with evaluation criteria that they can use. Being property management and investment students, they've mostly been taught in the context of landlord and tenants perspective. This

project based module was introduced during their second year in the university (4th year for part-time students) and it aimed at making these students considering buildings in use from user perspectives. The main evaluation methods used by the students are walkthroughs, questionnaires and interviews, which will be explained in more details in the following sections. Other methods such as focus groups and workshops weren't used as the students felt the lack of confidence and resources to carry out such activities.

2.1 Walkthroughs

Walkthrough is defined by Blakstad (et.al. 2008) as qualitative and systematic ways of assessing different aspects of buildings by using different stakeholders as informants. It is the most commonly used evaluation method in CIB W111's series of case studies.

As all the buildings evaluated are based on University of Salford's campus, every project group have undertaken some format of walkthroughs in their chosen buildings, from the perspective of students as one of the main user groups. Main feedback from the walkthrough was that it cast somewhat new insights into certain aspects of the building. As in the students' words, they've uncovered new entrances to the buildings that they never knew of, new lifts to different part of the buildings, fire escape route that they never heard of etc. One group even calculated the occupancy rate of the chosen building through two walkthroughs, by peeking through the glass of the offices.

One of the groups also used direct observations to understand usability of the chosen buildings from the other user groups. This took form of two separate thirty-minute sessions where each team member sat or stood discretely to observe how different building users navigate around the buildings and fulfil their tasks. The group has reflected observation as a good way of attempting to identify any patterns of user behaviours.

In general, walkthrough is a "simple and rapid way of getting the first overview and indicators of the usability of the building" (Blakstad, et.al. 2008). The results of the walkthroughs have formed the basis of evaluation criteria that the students haven chosen, and also the basis for the questionnaires that they carried out.

2.2 Questionnaires

For most of the student groups, questionnaires were used as the focus for the usability evaluation. They've used the combination of both open and closed questions. Closed questions have a rigid structure which can speed up the surveying process, but only obtaining limited responses. In comparison, open questions leave the answer entirely with the respondents, but more difficult to analyse the results (Fellow and Liu, 2005). Each group was encouraged to gather at least 50 responses to the questionnaires, to make sure that they have sufficient sample size to represent different users groups.

During the first year of running the project, we found out that the students have never done any training in terms of questionnaire designs. As a result, a lot of questions that were asked were rather random, or not in relation to usability evaluation. For example, there are a lot of questions regarding how people get to the building (car parking, public transport etc), or the age of the building users, without considering how to relate those results to the evaluation itself. Most of the groups didn't consult with the module leaders before they distributed the questionnaire either. Therefore, during the second year, we've given the student a dedicated lecture in terms of questionnaire designs and specifically ask them to show the module leaders the questionnaires before distributing them. However, even so, there is still a lot misunderstanding about good questionnaire design issues, or use of bipolar scale. Most of the questions asked were focused on comfort issues such as temperature, lighting, noise, cleanliness etc. Main usability aspects such as effectiveness and efficiency weren't addressed sufficiently, due to the difficulties for the students in identifying the right criteria for the evaluation.

Having stated the above problems, some of the groups from the second year have attempted to address usability evaluation better, by looking into Personal Construct Psychology (PCP)¹ and the use of repertory grid interview techniques² (Kelly, 1955). In their questionnaire, they've tried to investigate soft issues such as air quality and how easy to use self-service machine. However, what they've missed out was to ask about to what extent those soft issues have impacted on the users' experiences within the building, which was a missed opportunity.

2.3 Interviews

Most of the groups have interviewed direct building users during their project, especially with university staff in order to get their feelings of the place. Some of those initial interviews have helped to form the questionnaire, and some of them have been used to get more in-depth answers on top of the questionnaires.

For one of the groups, they decided to look at the places available for interactions at one of the main buildings. For that purpose, rather than doing questionnaire, they've only carried out interviews with the staff, as it gave a full picture in terms of how students interact with staff, as well as how staff & student interact among themselves. Another reason to choose interview as the evaluation method was also because most of the staff they interviewed have been using this particular building for a long time. They've noticed many changes that happened within and nearby the buildings. They also have a fixed location (their offices) in which they come on day-to-day basis. In comparison, student groups tend to use the building only during term times, and

¹ PCP is a constructivist system of psychology developed by George Kelly (1995). The fundamental postulate for PCP is "*A person's processes are psychologically channelized by the way in which he anticipates events.*" (Kelly, 1955, p.46)

² It uses of factor analysis as a means of properly evaluating the personality of the individual being interviewed and adjusting the course of the interview in a manner that enhances the productivity of the interview.

maybe for a three-year period. Therefore, by using interviews with the staff, the project team can get a more holistic view on the uses of the buildings. The same principle also applied to other groups who have done questionnaires with staff members in other schools.

3. Evaluation Criteria

In this section, the author has summarised the different criteria for usability evaluation under efficiency, effectiveness and satisfaction categories. None of the student groups have actually separated the criteria in this manner. Majority of them have separated them by different areas of the buildings, or different user groups.

3.1 Efficiency Criteria

Most of the groups from the first year of the project have only addressed efficiency from accessibility perspective. Their questions tend to be focused on how easy is it to get to the building either by public transport or by cars. Again provided that their background are in property management and investment, they have largely considered the accessibility issues from location point of view – whether the building is near any main public transport network or car park capacity etc. They've only looked at signage to a certain extent. They didn't differentiate the importance of signage for visitors in comparison to other regular users groups such as staff and students.

One of the groups in the second year took the observation approach to investigate how easy it is for first time visitors to navigate around the building. This proved to be rather successful as they discovered that most of the visitors tend to confuse between the building's reception and the reception of one of the main occupiers. The signage in the building does need major improvement because they found several people wondering around for 10-15 minutes blindly before they found their way.

It is appropriate for the students to consider accessibility issue as one of the criteria for efficiency. From an evaluation point of view, it should be addressed according to the priority to the different users groups. For example, staff who use the building on a day to day basis, would have very little difficulties with getting around the building. In comparison, for visitors or students who come to a new lecture theatre building, a helpful receptionist, clear signage and location map are all very important, and would have a major impact on their satisfaction levels if any of these failed. The same signposting system should be applied across different buildings. As most buildings on campus were built on different period by different contractors, each of the building has used a different signage system. It would be very useful to make all the signage consistent, so that regular users to one particular building can very easily navigate his way around a new building as the signage system is the same. This would also help to build up the image/representation of the university, to have a unified system across different parts of the campus.

Taking into account of what the student's interpretation of what is efficiency, there are a lot more issues that they didn't address. For example, most of the buildings have their own café area, some of which get very crowded during the peak lunch time hours. One of the criteria to address efficiency could be to look at the average waiting time, or how long does it take for one person from getting in the queue, to finally finding a seat to sit down and have lunch. Bank of America has done some interesting research to look at the length of waiting time and its impact of customer experiences by addressing the difference between 'perceived' and 'actual' waiting time (Thomke, 2003). The students could have replicated that research methods to explore whether the perceived waiting time in the canteen could be reduced by changing the layout of the canteen or arranging some 'distractions' from the chore of queuing.

Efficiency should also been addressed in the response rate context. If part of the building is not functioning, for example, lighting in one of the lecture theatres is not working, how long does it take for it to be repaired? Or relating to the signage again, if any of the sign is wrong, how long does it take for it to get replaced? At the moment, all of those issues are supposed to go to the helpdesk centrally controlled by the estate department at the university and the person who filed the problem might not get the direct response. The students could have investigated from the staff's perception, what is the average response time, in comparison to what is the contracted response rate by the estate office.

Sustainability issues dominate the building performance research these days. Nevertheless, due to the fact that the students haven't been taught in the context of energy consumption and conservation, none of the groups have attempted to address energy efficiency in the buildings they chose. They don't consider themselves having the specialist knowledge to look at the lighting system, heating and ventilation system, or waste and recycling system. Only one of the groups have mentioned about the single glazed windows as one of the shortcomings of the building. This is also reflected in the general research for usability studies, which emphasise on soft issues such as user experience and culture sensitivity (Alexander, 2008), rather than on hard issues such as energy consumption and building maintenance services. However, sometimes the boundaries between the two are rather blurred. The single glazed window for instance, not only it is not good for heat insulation thus increases energy consumption, but also impacts on the users' comfort and satisfaction level due to poorly controlled room temperature and increased noise levels. Thus for future usability evaluations, it might worth pushing the students to consider sustainability issues to a small scale.

3.2 Effectiveness Criteria

For most of the groups, effectiveness has been explored in terms of building users comfort which in turn affect their productivity. They've put emphasis on issues such as temperature, noise, lighting, cleanliness and building aesthetic. Lighting for example, has been explored by some groups as the differentiation between natural day light and artificial lighting, on whether it is too bright or too dim. It wasn't until the second year that some groups began to ask questions about how significant were those factors' impact on actual use of the buildings. The results demonstrated that majority of them were not very significant. This proved Vischer's (1996)

view that these physical comfort measures are not noticed by people unless it caused problems. Indeed one of the main issues uncovered by the students was with the acoustic designs in most of the buildings. Majority of the lecturing rooms have poor sound insulation, hence quite often teaching in one room can be disturbed by other activities happening in the adjacent rooms. This then had a direct negative impact on both staff and students' experiences.

Adaptability is another criterion to address effectiveness that has been attempted by two student groups. Both of them have asked questions about whether their respective building has the flexibility to change the layout and purpose of use. They've also tried to ask the regular users regarding whether the building has been adapted in the past three years to reflect user feedback. One of the building (the leisure centre) has recently been refurbished for the gym area. The questionnaire found that the refurbishment has improved the popularity of the gym. However, as the other parts of the leisure centre remain unchanged, there wasn't a considerable increase in the overall satisfaction level or number of users.

Adaptability is a rather difficult concept for the students to investigate as they are taking a snapshot on the use of the building rather than looking at the changes over a period of time. All the buildings on campus have had refit or refurbishment in the past five years. For example, the café area in one of the main buildings was relocated from the sixth floor to the second floor five years ago. However, the students haven't been in the university long enough to appreciate the differences, nor have they gained sufficient support from the estate office to understand the planning and approval of those refurbishment schemes. This has largely limited the research potential in addressing whether these buildings have effectively adapted to the changing needs of Higher Education body such as University of Salford.

One of the groups had specifically looked into the space for interactions within one of the schools. Interactions among students, between staff and students and also among staff themselves have all been investigated. It has highlighted the problem of lack of sufficient informal meeting areas in the school. Even though there are two allocated space available, half of the students either don't know that they can use it, or they choose to use the downstairs café area. This investigation coincided with an occupancy review within the school and as a result, three more interaction spaces have now been created. Therefore, in this occasion, the adaptability for this building is good.

Functionality is another important aspect of effectiveness, but again difficult to relate to solid measures, especially for multi-purpose buildings and for different user groups. The three single-use buildings (student union house, library and leisure centre) has all been designed for a specific purpose, in comparison to other buildings which are quite often a combination of offices, research space, lecture rooms, and meeting/event rooms. The feedback for the library and leisure centre has been generally good in terms of their "fitness for purpose". The library has improved along the years in adding a small drinks/snacks area, making all borrowing/returning self service, and also the introducing of modern furniture and casual layout to create some social interaction areas for the students, which has proved to be very popular. The leisure centre, although not as modern as commercial gym chains, has attracted staff and students due

to the low membership costs, and majority of the feedback has been good. The student union house, in comparison, hasn't been very successful in acting as the hub for student activities. Partly, this resulted from the way the student union is set up, the occupier of the building and ownership of the buildings etc. For example, the student union at Manchester University is run by the students themselves and it hosts far bigger range of activities than the University of Salford's one. The analysis on the uses of these three single buildings also needs to take into account the consideration of the alternative choices:

- Library – has to use it
- Leisure centre – cheapest gym to use
- Student union – lots of other bars and pubs available in the vicinity

This reflects on the “context specificity” aspect of usability (Alexander, 2008). The evaluation on the effectiveness of the use of the building has to allow for its context, which include its background, the location, the purpose, the culture and even its competitors. The comparison of the three buildings clearly shows that the main attraction of the University House – Yours Bar, is not the only choice, nor the cheapest choice that students can have. In addition, it lacks regular students led activities such as live music bands, or other similar activities. Although University of Salford has many student societies, very few of them are using the University House as their base. The combination of these different factors has made it a rather quiet place and didn't score very high in the usability evaluations.

For multi-purpose buildings, functionality evaluation could be conducted from different customer journey point of view. Customer journey is what customers typically do during the service process (Nenonen et. al, 2008). Once the key phases in the customer journey are identified, then we can begin to evaluate how effective they conduct each step within the building. If we look at the students as customers for example, using the five phases of customer journey from Nenonen (2008)'s paper, we can address effectiveness as shown in Table 1.

Table 1: A summary of the effectiveness criteria from student journeys

<i>Phases</i>	<i>Student Journey</i>	<i>Criteria</i>
<i>Orientation</i>	<i>Finding where the lecture room is; or locating where the tutor's office is, where are the bathrooms, drinks machine, cafes etc; locating where is the fire exit if necessary</i>	<i>Correct signage Helpful receptionist Clearly labelled fire exit route (especially for high rise buildings)</i>
<i>Approach</i>	<i>Approach by public transport/cars; finding the quickest route to the desired location within the building;</i>	<i>Building located within good reach of public transport / sufficient car park spaces</i>

		<i>Choices of working lift</i> <i>Disability access route</i>
<i>Action</i>	<i>Attending lectures/tutorials; meeting tutors; meeting with other students; socialisation</i>	<i>Functional comfort: Teaching room is equipped with all the necessary IT equipment; the furniture layout is appropriate for the activities, both in the teaching area and socialisation area</i> <i>Physical comfort: lighting, temperature, air quality, furniture quality, noises, room decorations</i> <i>Psychological comfort: food/drinks are sold at the right price; building represents a welcoming atmosphere; space for privacy / worship</i>
<i>Depart</i>	<i>Leave the building after the lectures or socialisation</i>	<i>The same as approach</i>
<i>Evaluation</i>	<i>Feedback system for learning and interaction spaces</i>	<i>Regular reviews on the learning and interaction spaces according to student feedback</i>

3.3 Satisfaction Criteria

Satisfaction criteria are the most straight forward one among the three factors of usability. There are mainly three different methods of evaluating satisfaction level:

- a. Percentage of satisfied customers
- b. Scale of satisfaction
- c. Number of complaints

Most groups have used the combination of a and b, to explore main user groups' satisfaction with the chosen buildings. c is not used as it is centrally controlled by the estate office. Some groups who have successfully linked the question regarding satisfaction with suggestion for improvement. In this way, they've identified where most of the dissatisfactions come from, then focus their recommendations on those areas.

It was interesting to see that two different groups look at the same buildings respectively at 2008 and 2009, have arrived at two very similar recommendations. They both noticed the problem with the overcrowdings during peak hours at the canteen, thus recommended relocating the canteen to the basement level. They also noticed the occupancy rate at for the offices and recommended open-plan workplace for all staff. The first recommendation is plausible, as the basement area only has occasional uses and still have plenty access to natural light. The current canteen can be converted to solely drinks and cafe area, which would give the students bigger and quieter space for interactions, which is a rather important element in their learning experiences. Open-planned office for academic staff, on the contrary, would be a very difficult recommendation to implement. Enclosed offices are very much taken for granted for academic

staff. In UK, we are still yet to see any examples of open-planned offices for Higher Education institutions. To sell the concept of open-planned offices would require major culture changes within the university, especially among academic staff. There have been some successful examples of open-planned schools in Europe and UK has beginning to learn from it. Maybe after some successful cases of open-planned schools, HE sector will also begin to adopt to this new style of offices.

4. Conclusion

This paper has tried to summarise the research findings from student-led usability evaluation projects that were conducted on University of Salford campus. As groups of year 2 undergraduate students, they have contributed to some interesting insight into usability concept in the built environment. Although their findings are not necessarily in-depth, they did provide a fresh angle to look at the evaluation of usability and came up with some interesting findings and recommendations.

The limitations on the students' project are mostly due to the "newliness" nature of usability. As a concept that wasn't applied in the built environment until 2001, it is still very much in the shaping and developing stage. There aren't any set methods or toolkit that the students can use, nor are there any set evaluation criteria or measures. This paper tried to justify the methods chosen by the students and tried to simplify the methods to the scale that the students can handle within their capabilities and timescales. The paper also attempted to summarise the evaluation criteria for the three aspects of usability: efficiency, effectiveness and satisfaction. The author has looked at the criteria chosen by the students, as well as other criteria that can be used from other literatures. All the chosen criteria are designed to be easily understood and easy to follow, to help any future students who will undertake similar projects on campus.

This on-going project also reflects that there isn't "one size fit all" solution for usability evaluation, due to its "context specificity, situated actions, culture sensitivity, and element of customer experiences" (Alexander, 2008). What has proven to be worked well with the students is that, the evaluation would emphasise only on one area of the building or one element of the building's uses. For future project, students should definitely be encouraged to focus on a smaller scale in order to carry out more in-depth analysis. The newliness of usability also has its advantage, even in terms of students projects like what this paper has described, can provide useful insight. As it is still in the development stage, it can be shaped into a more "usable" tool by combining various researches carried out in this field. Every UK HE institution is facing major budget cuts. Usability evaluation should be a regular exercise that are carried out across every campus, to improve the uses of current building portfolio, to improve user experiences and in turn relieve the pressure of the budgetary cut. More importantly, each usability evaluation should be adapted to its own specific emphasis in order to generate the biggest payout.

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User feedback – developing the system for gathering user information

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Abstract

Usability of the workplaces can be developed by using the feedback information from the users in an effective way. Feedback information helps both the user organisation and the real estate management and provides a source for improving usability of the places in user-orientated way. However the challenge is to create a systematic approach for feedback processes. Such systematics can provide a starting point to turn feedback towards feed-forward, transferring the usability information to knowledge of the usability.

The purpose of the paper is to describe the pilot and testing of PROPAL-user feedback system. It introduces methods in the process of evaluating usability of workplaces. PROPAL II is constructed to collect the feedback about the users' experiences in facilities. The system has been developed to serve real-estate and construction industry in Finland. The feedback system consists on several surveys to measure user experiences and usability in the building lifecycle. The user-feedback system and framework of evaluating usability is piloted and tested in the case study of offices.

The results show that user-feedback tool produces indicative information, which can be used for developing user experiences. This information can be enriched by gathering also qualitative, diagnostic data. This combination helps to achieve mutual learning and development of the usability issues based on versatile user experience information. The motivation to step from feedback to feed-forward, require motivation to learn from the past. The single loop learning can be developed to double loop learning and the information can be transformed to knowledge.

Keywords: Usability, feedback, workplace management, customer experiences, survey

1. Introduction

1.1 Purpose of the paper

This paper examines the user information, feedback and systematic to gather the information. Usability of the workplaces can be developed by using the feedback information from the different user groups in an effective way. However the challenge is to identify the different stakeholders of feedback information and create a systematic approach for feedback processes. This systematic can provide a starting point to turn feedback towards feed forward and assure that the caps between different stakeholders can be reduced. On other words the usability information can be transferred to usability knowledge. However, the first step is to work with usability information.

The development of feedback systematic is based on incipient research, which is a continuation of earlier studies (Kärnä 2009a; Kärnä and Junnonen 2009b) in relation to PROPAL-feedback systematic projects, which has been develop to serve widely Finnish real estate and construction industry. PROPAL I-project aimed to develop versatile, mutual feedback system in the construction and it is operated by Construction Quality Association. Idea of the PROPAL is that it enables parties in the construction supply chain to give feedback to each other, both during the project and after the completion of the project. A multifaceted feedback system denotes the areas needing improvement in the whole branch of industry and gives opportunities for setting benchmarks of customer satisfaction. It consist 15 different questionnaires, which can be used flexible by the needs of the project.

PROPAL II is constructed to collect the feedback about the users' experiences in facilities. It connects end-user in the feedback systematic of the whole building lifecycle. Different stakeholders can use user-feedback data for developing the products and services with a user-oriented focus. In addition, the user-feedback system enables versatile benchmark measures.

The objective of the paper is to present the feedback systematic and result of the case studies, in which PROPAL-feedback tool was piloted and tested. First, we describe the framework of the feedback systematic as part of usability assessment. Then case studies are presented with conclusions and action recommendations. Finally we discuss about the methodological issues related to usability and what is the role of information and in usability of the facilities

1.2 Usability feedback

Usability of the workplaces has been examined recently in variety of perspectives. Current literature suggests that usability is related to user's experiences of the place, instead the concept whereby usability is more related to features of the building and its functionality. Latter approach presents for example Post Occupation Evaluation-method (Preiser *et al.* 1988). POE and evaluation of usability are closely related

but distinct issues. Alexander (2006) states, that user experience encompasses all aspects of the end-user's interaction with an organization, its services, its products and its facilities.

Usability of the facilities has also been investigated theoretically through social practices (Fenker 2008) and interactions (Massey 2007). According to this approach usability is achieved by the interplay of user experience, design and management processes, and buildings. It is also noticed that when evaluating usability of buildings the relationship between building and people/organisation is important. Evaluation of the usability of the building is related not only users experience but also how organizations and individual users achieve their goals (Blakstad *et al.* 2008).

However, the terminology of usability and its formation (expressed, e.g. as a theoretical framework in the construction and real estate field of research) is still unorganized when compared to several other building-related factors and needs clarification (Alexander 2006). In addition, user experiences also affect cultural issues and context (Lindahl and Granath 2006). Evaluation of the usability complicates also the facts that there are many user groups which relation to building is different and their usage of the building also varies. Dynamics of the external business environment reflects also dynamics of using facility. Different people experiences facility in different manner; user experience could still be a pleasant even if it has not been efficient.

These above-mentioned factors complicate the evaluation of usability in the building context. On the other hand large number of contextual factors and on the other hand paradoxes, which appears from the definition of usability, makes it hard to find appropriate method for measuring the phenomenon. Because of the multidimensional and process nature of the usability, it should be also explored using versatile methods, which also W111 workgroup suggests. The process of assessing usability is also important.

The research so far is pointing out that the user is in the main role of gathering usability. The variety of user groups is a challenge: how and what should be asked from them in order to get feedback of the usability. On one hand the usability feedback can be understood as information which can be transferred into knowledge. The usability assessment is not only about gathering the feedback but it is also a process of developing usability. The essential perspective is what the consequences of gathered information are.

According to Ackoff (1989) one can classify data, information and knowledge. Data is raw. It simply exists and has no significance beyond its existence (in and of itself). It can exist in any form, usable or not. It does not have meaning of itself. The usability of workplaces data can be e.g. layouts, documentations of usage rate, data about the building, users and processes.

Information is data that has been given meaning by way of relational connection. This "meaning" can be useful, but does not have to be. In the context of this paper information about the usability of workplaces is approached from three different perspectives:

1. who can provide usability information
2. when the usability information can be collected
3. how the usability information can be asked in different phases
4. what is the content of the questions

Knowledge is the appropriate collection of information, such that its intent is to be useful. Knowledge is a deterministic process. When someone "memorizes" information then they have amassed knowledge. This knowledge has useful meaning to them, but it does not provide for, in and of itself, an integration such as would infer further knowledge. Understanding is an interpolative and probabilistic process. It is cognitive and analytical. The feedback systematic presented in this paper provide usability information, which can be then used in order to develop usability knowledge. The essential perspectives on the transformation of usability information to usability knowledge are

1. how the information is used
2. what other methods are used in order to internalise the information.

The main principle in the usability feedback systematic is that the the information it is providing is indicative. The nature of the information is quantitative. In order to work more with the diagnostic knowledge one has to use more qualitative methods.

1.3 Perspectives of methods

Post-occupancy evaluations (POE) is best known method for measuring building performance. It has been defined as 'examinations of the effectiveness for human users of occupied design environments'. POE typically focuses on assessment of user satisfaction and functional fit with a specific facility. It tends to gather feedback from the users to designers and other stakeholders in order to achieve continuous learning loops.

Probe (Post-occupancy Review Of Buildings and their Engineering) which is based on POE, investigates building performance in the different perspectives, namely technical performance (Bordass *et al.* 2001), energy performance and occupant surveys (Leaman and Bordass 2001). Probe's initial purpose was to provide feedback to building services engineers of generic and specific information on factors of success, and areas of difficulty and disappointment (Cohen *et al.* 2001). The occupant survey method developed by Building Use Studies Ltd (BUS) was also based on Probe-research. Performance criteria of is as follows: 1) Health; 2) Safety; 3) Security; 4) Function; 5) Efficiency; 6) Workflow; 7) Psychological; 8) Social; and (9) Cultural performance (Preiser and Schramm 2002).

Earlier user feedback surveys was presented e.g. Dillon and Vischer (1987), who introduced The user survey instrument, which was focused on staff in office workspaces. The survey was developed by Works Canada and consists of 24 questions, which were classified into a nine parameter scale: 1) Thermal

comfort; 2) Air Quality; 3) Office noise control; 4) Spatial comfort; 5) Privacy; 6) Lightning; 7) Building noise control; 8) Overall satisfaction; and 9) Ability to do your work. The survey was later modified to take account wealth-related factors (Leifer 1998).

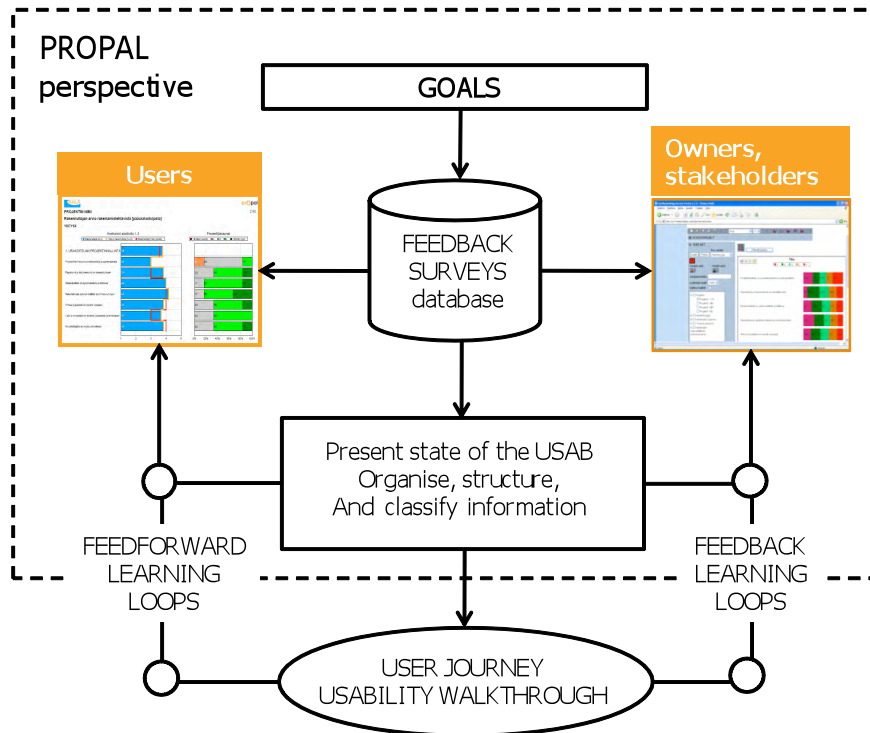
In order to attain deeper and richer understanding of user experiences there are also variety of qualitative methods. In this approach there are two distinct, but as basis similar methods, which are usability walkthrough (Blakstad *et al.* 2008) and customer journey approach (Nenonen *et al.* 2008). Customer journey mapping is the process of tracking and describing all the experiences that users have as they encounter a service or set of services, taking into account not only what happens to them, but also their responses to their experiences. Used well, it can reveal opportunities for improvement and innovation in that experience, acting as a strategic tool to ensure every interaction with the user is as positive as it can be (Nenonen *et al.* 2008).

2. Feedback systematics

The objective of the study was to test and pilot PROPAL user-feedback system and to develop feedback systematic to serve major players in the real estate and construction industry. Picture 1 illustrates usability evaluation process, which emphasize usage of both qualitative and quantitative methods. It also brings viewpoints how usability data can be utilized. The participation and influence of the user organization and users improves the satisfaction regarding the facility and enhances the understanding of design effects. The objective is to create a mutual learning loops amongst all parties, which adds value for the owners and different stakeholders and most importantly, to the end-user. Feedforward loops means that user-companies can exploit feedback information their efforts for developing their premises as an active resource and to support companies' core activities.

Contribution of this study is marked in the picture 1 as a PROPAL perspective. PROPAL is a web-based application, in which different parties can get real time and reliable information about user experiences in their improvement efforts. It contains 16 questionnaires and it enables multipurpose benchmark comparisons with the users own interface. This feedback system provides a workable and resource-saving means of collecting user feedback. As mentioned earlier, nature of this information is quantitative. The information can indicate some development targets and it can show also black spots in the processes. In general, it presents the current state of the usability as perceived by users and this information can be organized, structured and classified further.

The Picture 1 indicates that the starting point of the usability process in the goals of the user organization. This phase includes also the step identifying the different user groups. The identified user segments conduct a survey and the indicative information is analyzed. The relevant themes are identified and they will be approached in qualitative way. There are usability walkthroughs, which can be compliment also by workshops, and interviews. The qualitative process produces diagnostic information which in interactive process is transferred to usability knowledge.



Picture 1. Systematics of the usability process.

3. Case study

The case study focused on office users in the Department of Engineering and Building Technology at the Helsinki University of Technology. In the year 2010 three major universities: University of Helsinki, Helsinki School of Economics and Helsinki University of Technology will emerge for one big unit, Aalto University. This sets challenges for management and re-organisation of facilities in a university level, but also in the department level. On the other hand new Aalto University is interested to get feedback from their premises and create new workplace concepts. On the other hand, in the department level, there is new research strategy, where one objective is “out of silos”, which means that department is seeking new ways of organise their usage of facilities.



Picture 2. Indoors and outdoors

By the objectives of this study building-in-use questionnaire were used. Building-in-use questionnaire contains rather large number of questions (total 93) and some background information about the respondents. In the survey, questions are classified in six usability factors, which are:

- 1) Accessibility;
- 2) Navigation;
- 3) Services;
- 4) Office environment;
- 5) Functionality and
- 6) Suitability and comfort

The questions were formed as statements and connected to a scale in which answer (1) describes the operations very inaccurately and, correspondingly, (5) very accurately. No opinion (N/A) could also be chosen as an answer.

The survey was send to all staff of the department by email. Staff of the department consists of 80 persons, which professional background was administration staff, research staff and teaching staff. Totally 57 persons responded into survey. The responded rate was rather high, 71 %. The distribution of the respondent's professional background is presented in the Table 1.

Table 1. Distribution between respondents professional background.

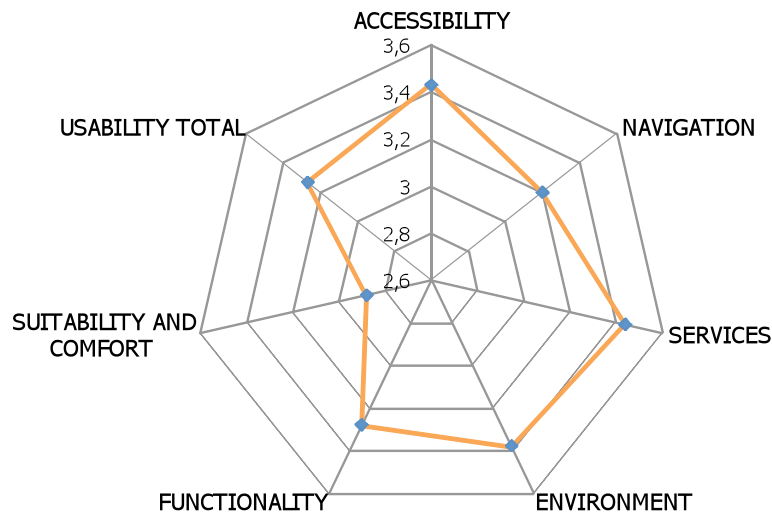
	<i>n</i>	<i>%</i>
Research	38	66
Teaching	11	19
Administration	8	14
Total	57	100

In this chapter we empirically examine usability of the facility as experienced by its users. The objective of this analysis is to get diagnostic information about how users assess the usability of the facility. The mean values vary from 2.88 (Suitability and comfort) to 3.43 (Accessibility). The overall usability rate is 3.26. On the whole, it could argue that results are rather poor, or not over acceptable. Results of the survey are illustrated in the Picture 3 and Picture 4.

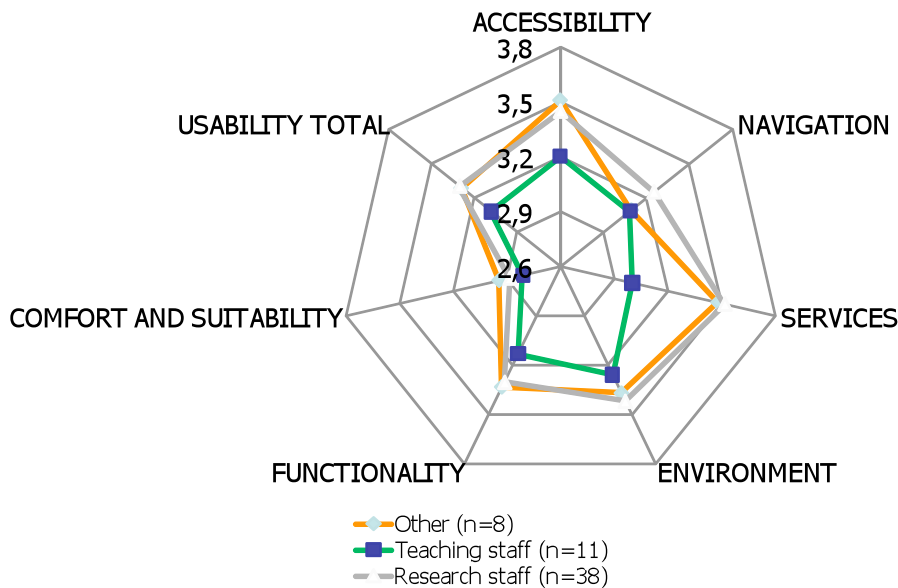
In general, low rates could be found in factors related to Suitability and comfort of the facilities. Especially poor level was found items like flexibility of the facility and comfort of the facility. According to results the facilities do not support innovation and creativity in work. In contrast, respondents assess that facilities are suitable for independent and quiet work. In addition the reception service staff was friendly and helpful. All in all items related to factor Service, got the best feedback and this is due the good service staff.

In relation to other factors Navigation was also rated rather low. Especially, a sign for Navigation in the lobby was at the lower level than other items, e.g. there were no signs into the elevator and neither in the elevator. This could astonish pedestrians and other visitors, which visit in the building infrequently. Lack of parking slots is quite universal problem also in this study, but people still thinks that routes from the public transport are at the good level. In Functionality factors most of the dissatisfaction was related to work space e.g. ergonomic furniture and adjustability, and lack of storage space.

The results were also examined amongst different user groups of the facility (Picture 4), which were classified in three groups. In general, research and administration staff assessed usability in a similar way, but teaching staff's experiences were at the lower level in every factor.



Picture 3. Results of the survey by radar-diagram (means).



Picture 4. Comparison of the results according to respondents' professional background (means).

4. Conclusions

This paper presented a framework and systematics for the usability process from usability information to usability knowledge. The feedback systematic is part of this process and the piloting of it in the case study is presented. The result of the case study found some critical aspects, which will be investigated in the next steps of the study. Through effective feedback systems organizations can foresee changes in the business environment and could also adapt to these changes beforehand.

In general, a result of the case indicates relatively poor or acceptable level of usability. Naturally, in this phase of development, there is not enough empirical data for wider benchmarking. However, next step of the case analysis will take account context related factors, which improves reliability of the study and brings more deepen, diagnostic knowledge about usability of the facility. Interestingly, when examining results by the different user-groups it can be stated that experiences of teaching staff are at the lower level than other ones. The variety occurs in the usability factor Service: this user group has more versatile needs for services.

Based on the results, the survey was easy to conduct. Standardized survey, which produces indicative information, is an efficient method to investigate user's experiences. It also enables organizations to monitor user perceptions of their performance and to improve their performance in various areas. The value of the user-feedback system is also that it assesses user's processes and links them into the building lifecycle as a whole. The feedback system offers clear, real time reports which can be targeted at the company's products and end-users processes. By comparing various background variables, the company

can compare its own performance with the similar ones in the market. Therefore, the project feedback system is a cost-effective tool for the company's internal and external benchmark.

According to the case, PROPAL user-feedback system suits well also to a teaching and research field. This might occur that the survey is concentrated to evaluate the relationship between user and facility, which all respondents should have experienced. In addition, questionnaires have been developed to describe "customer journey", from entering to the building to the phase of leaving facilities. Such logic is convenient for the user to orientate towards their daily experiences when responding. Additionally the logic can be used in the qualitative usability walkthrough. On the other hand respondents responded that the questionnaire was a bit too long and in the future it should be modified to take account of respondents' feedback concerning the survey. This can be done for example by using factor analysis or other data-based methods in order to decrease the amount of factors.

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Management for Usability of the Built Environment

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Abstract

The purpose of the paper is to identify the kind of management needed to create and maintain usability in the built environment. The study is part of the ongoing international research collaboration in CIB W111 and will include theoretical discussions based on the results from the first two phases of this work as well as literature studies.

Usability being dependent on context, culture and situation means that the possibility of dynamic changes in the built environment is central. One way of conceptualizing change in the built environment is the idea of learning buildings. However, what seems to be missing in the discussion on learning buildings is the role of management. Some kind of management is needed to make a number of individual people work as an organization with common objectives, and a specific kind of management is needed to create a learning organization. Similarly, management is needed to make buildings work as learning buildings. This is the role of Facilities Management (FM).

Evaluation is in general an important part of learning and evaluation of usability and performance of buildings is an important part of creating learning buildings. From a FM and corporate management point of view such evaluations should be part of a feed-forward from the corporate experience with existing buildings to make improvement in both existing and new buildings. This is in contrast to the traditional view on building evaluation carried out by POE (Post Occupancy Evaluations), where the main purpose is feed-back from finished buildings to the design team.

The focus on buildings in FM is concerned with how the corporate needs for facilities can be provided and optimized in both a short and long time perspective. Therefore every phase of the life cycle of buildings is of importance. This paper proposes continuous briefing and continuous commissioning as two interrelated concepts, which together with the concept of learning buildings can be used to integrate the management of buildings and usability.

Keywords: Management, Usability, Briefing, Commissioning, Learning Buildings

1. Introduction

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The paper starts in section 2 by a discussion of the concept of usability in relation to users and management based on previous research. This is followed by an introduction of the life cycle of buildings and organisations and the concepts of continuous briefing and continuous commissioning are explained and related to the life cycle perspective in section 3. One of the big challenges in relations to usability of buildings is to adapt to changing needs. The concept of learning building is in section 4 suggested as a possible way to meet this challenge, but the previous work on learning buildings seems to miss the management aspect, which is discussed by analogy with the concept of learning organisations. The paper is finished with conclusions in section 5.

2. Management and Usability

2.1 Usability and users

The starting point for analysing usability of the built environment was originally the definition in ISO 9241-11 (ISO, 1998), where usability is measured in terms of efficiency, effectiveness and satisfaction. The basis for this definition was evaluations of consumer products and user interfaces of computers programs. The experiences from the research on usability of the built environment indicate that the user experience is equally important.

In the building industry there has traditionally been a strong focus on the functionality of the products based on technical rationalism, where the attributes of the products are described in objectively measurable terms. The introduction of the concept of usability challenges this approach of technical rationalism by introducing the subjective views of the users in the evaluation of the products. Granath & Alexander (Alexander, 2008a) propose that usability represents an approach of pragmatism, where the focus is on the effect of a product or an environment on the users and not merely on the physical attributes. Usability of the built environment cannot be evaluated without taken the specific situation, the context and the cultural aspects into consideration (Alexander, 2008a).

Research also shows that usability is evaluated differently by different groups of users. This was for instance clear in an evaluation of a university college in Norway, where the perception of the building's usability varied considerably between students and staff (Hansen and Knudsen, 2006). Therefore it is important to distinguish between different types of users. The students and staff of the university college can be seen as two groups of end users, which evaluate the facilities from their individual perspective. Visitors can be another group of end users. The staff can also represent the organisation, or at least staff at a management level will often represent the organisation as a specific type of user. A third and special type of user is the management and staff of the Facilities Management organisation in charge of operation and development of the facilities. They can be seen as professional users, who can play an important role as mediator both between top managers and end users and between the users and the building.

2.2 Management and research on usability

The previous empirical research on usability in the built environment has mostly been based on case studies and most of them are presented in two CIB report (Alexander, 2005 and 2008b). The role of top management as organisational user is mainly clear in the case studies which involve a completely new building layout that change the business processes in the organisation. This is particular clear in the case from the 2005 report concerning a new facility for product development in the car manufacturer Renault in France and in the case from the 2008 report concerning remodelling of an operation theatre in a hospital in HongKong.

The case from the 2005 report concerning a new discovery centre for NCR in the UK shows how the disappearance of a strong commitment by top management can cause a severe setback in the planning of a new facility, while the case from the same report concerning the new university college in Norway indicates that a lack of involvement at a strategic level in the project throughout the whole process means that concerns for a longer time perspective like future pedagogic principles, flexibility and adaptability was not taken into account. A case of a new Danish media centre shows that the managers generally were more positive in their evaluation of the usability of the facilities than the ordinary members of staff, but this was not necessarily a strong dividing line as the evaluation by the ordinary members of staff varied much more than the evaluations by the managers (Jensen, 2007 and 2008).

The role of the facilities managers is not very much in focus in the empirical studies, but it is discussed in some of the theoretical contributions. Alexander (2008a) concludes that a new extended role is beginning to emerge, where practitioner instead of becoming a facilities manager might turn into a facilitating manager. Similar thoughts are expressed by Fenker (2008), who argues that usability is achieved by the interplay of user experience, design and management processes and buildings as shown in figure 1. These are also the three main elements that are investigated in this paper with particular focus on how management of the relationship between user experiences can lead to usability in the life cycle of buildings.

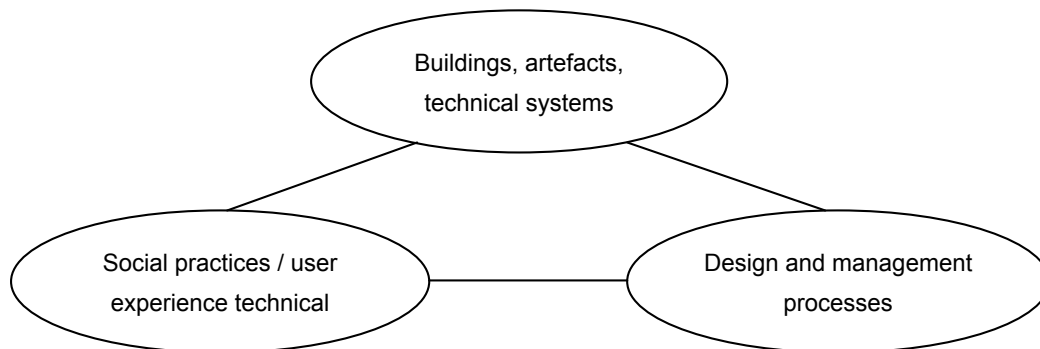


Figure 1: Elements involved in achieving usability (Fenker, 2008)

3. Management and the life cycle of buildings

3.1 The life cycle of buildings and organisations

It is common to divide the life cycle of buildings in a number of phases. One such division is represented in the ISO-standard on service life planning and whole life costing according to which the life cycle of assets or projects consist of four distinct phases: Acquisition, Use and maintenance, Renewal and adaptation, and Disposal. The first phase of acquisition is subdivided in 7 individual activities: Definition of need, Conceptual design, Preliminary design, Detailed design, Construction, Commissioning, and Occupation (ISO, 2007).

However, when we look at an organisation’s need for space, it is important to combine this with the corporate life cycle. The international literature gives a lot of different models for corporate life cycles. Adizes (2004) have written several books on managing corporate life cycles, and he divides the corporate life cycle in 10 stages. The need for additional space for a corporation is obviously related to stages with growth and expansion. However, for most large organisations the situation will at any time be characterized by on-going use and adaptation. There will always be smaller or bigger building projects going on to adapt the facilities to changing needs. For the purpose of this paper it is only necessary to distinguish between phases with new building projects and phases before and after with on-going use and adaptation as shown on the horizontal axis of figure 2.

3.2 Continuous briefing and continuous commissioning

The activity “Definition of need” in the ISO standard mentioned above is usually called “briefing” in the UK and “(architectural) programming” in the US. An obvious way to achieve usability is to involve the users in the briefing process. Briefing has traditionally as expressed in the ISO standard been seen as an activity in a distinct phase at the beginning of a building project leading to a brief document with a specification of the client requirements. It has often been a very expert based activity, where the users at the most have been used as information sources.

However, we have in the last decades seen a trend towards other forms of briefing processes. In Jensen (2006) this development is described by the term “continuous briefing” based on a case study of a huge media building project in Copenhagen. Recently the term “inclusive briefing” was also introduced for this development (Jensen and Pedersen, 2009). The differences between traditional briefing and continuous or inclusive briefing are shown in table 1.

Table 1: Comparison of traditional and continuous briefing (Jensen, 2006)

<i>Traditional briefing</i>	<i>Continuous briefing</i>
<i>Concerns new building/construction</i>	<i>Concerns all client/user needs in developing facilities</i>
<i>A definite phase at an initial stage</i>	<i>A continuous process with changing focus in different phases</i>
<i>An expert based information collection</i>	<i>A guided learning and dialogue process</i>
<i>Users mainly involved as data sources</i>	<i>Users actively involved as part of a corporate change process</i>
<i>The result is a brief, i.e. a requirement specification</i>	<i>The result is acceptance of solutions based on a brief</i>

A main reason for involving the users in the briefing and design process is the fact, that the users are the experts in relation to their work. However, users are not necessarily particularly competent when it comes to the relation between the design of buildings and workplaces on one side and how they best support their work activities on the other side. Designers may have such competences, but often they may be more concerned with architectural expressions and details or technical novelties. The use of visualisation tools is very important in the dialogue between designers and users and the use of concrete tests of design solutions in one-to-one mock-ups can be very helpful in achieving usability.

A limitation of involving the users in the briefing and design process is that their perspective is their work as it is in a specific situation and perhaps with the foreseeable changes which can be predicted from implementation of new technology, products and/or organisation. However, the life time of buildings is often 50-100 years, and it is impossible for anybody to predict the changing need for facilities over such a long period. As shown in the case of the university college in Norway, it is necessary with involvement at a strategic level to take the longer time perspective into account, for instance in relation to flexibility and adaptability. The concept of learning buildings can be used to accommodate this as explained later in this paper.

Another activity in the acquisition stages is “Commissioning”. Just like briefing, commissioning is also changing from being limited to a distinct phase towards becoming a more widespread activity in the building life cycle. In the ISO standard mentioned above, commissioning represents the handover phase from construction to occupation. Recently the term “continuous commissioning” has been introduced, for instance in an official American guide book on commissioning (US Dep. of Energy, 2002). The International Energy Agency, Annex 40 on Commissioning (Visier, 2004) gives this definition of commissioning:

“Commissioning is a documented way to diagnose and verify building systems performance, and to propose ways to improve the performance in compliance with owner’s or occupant’s requests. Commissioning is performed in order to keep the system in optimal condition through the life of the building from viewpoints of environment, energy and facility usage.

The commissioning begins with pre-design phase and can be applied through life of building including all phases, which are pre-design, design, elaboration, construction and operation and occupancy phases.”

Commissioning thus focus on validation of the performance with main focus on the technical installations and the interplay between the different technical systems in a building through-out the whole life cycle. Commissioning can be seen as an approach of technical rationalism like functionalism as described earlier, but evaluation of usability can complement commissioning activities in a combined validation of both the technical and the user oriented performance of buildings.

The parallel development in the introduction of continuous briefing and continuous commissioning in relation to the buildings' and organisations' life cycles is illustrated in figure 2.

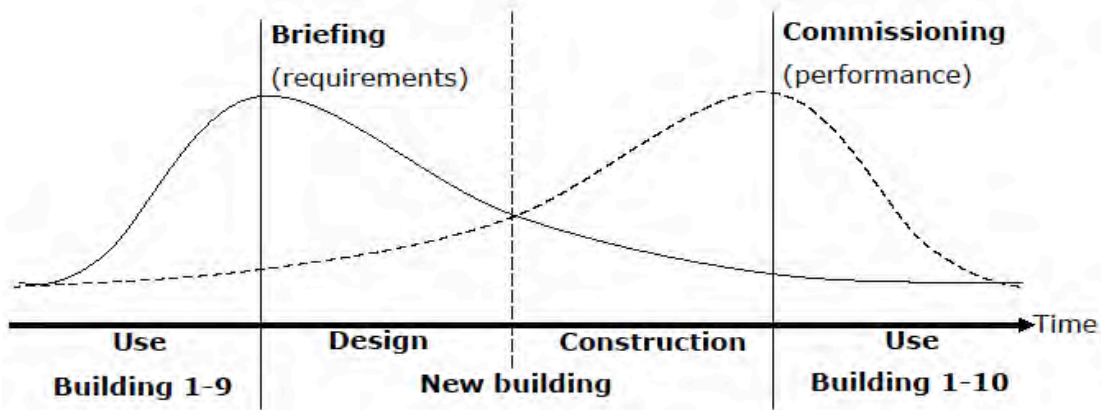


Figure 2: Continuous briefing and continuous commissioning (Jensen et al., 2009)

The briefing process takes place during the use of existing buildings as an ongoing capturing of requirements based on experience and changing needs. When the need for a new building evolves, the briefing activity intensifies and has a peak around the start of the design phase, but continues as a dialogue with designers during the design phase and to a certain degree with designers and contractors during construction. When the new building is occupied briefing continues as an ongoing capturing of requirements in the extended portfolio.

The commissioning process has a similar development but with an opposite intensity. During the use of existing buildings it takes place as an ongoing optimization of building performance and when a new building project starts, the commissioning process of ensuring and verifying the performance of the new building begins and intensifies during design and construction with a peak, when the new building is occupied. When the initial building performance is verified, the commissioning continues as an ongoing optimisation of the extended portfolio.

4. Management and learning buildings

4.1 The concept of learning buildings

One way of conceptualizing change in the built environment is the concept of learning buildings, which was introduced by Brand (1997). Adaptivity is according to Brand the main characteristic of a learning building, which is a building that learns from its occupants, and they learn from it. He recommends use of scenario methodology to plan new buildings for future needs. Brand use the illustration shown in figure 3 as a representation of the learning building with six layers – or the 6 S's as the names of all layers begins with "S".

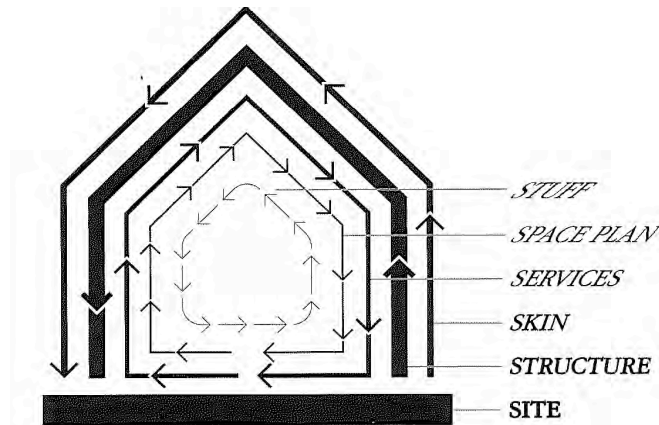


Figure 3: Shearing layers of change in buildings (Brand, 1996)

The concept of learning buildings was elaborated further by the “Learning Building Group” in the UK as documented by McGregor & Then (2001). They defined the following five key characteristics that a learning building must possess: Adaptability, Capability, Compatability, Controllability, and Sustainability. The first three of these characteristics can be regarded as technical characteristics of buildings in line with functionality, but the last two characteristics are like usability more related to the effects of the building design. Controllability is defined as “Providing users with the means to maximize their use and operation of the building, its services and facilities, while minimizing the conflicts between corporate values and individual values” and sustainability is defined as “To ensure that the building and its ‘assets’ are operated and maintained to enhance individual and corporate productivity, their health and well being at all times, and environmental responsibility throughout the entire life of the building”.

Recently the concept of learning buildings has been investigated further in a Norwegian PhD-study (Bye, 2008), who by inspiration from actor-network theory (Latour, 2005) introduces the idea, that buildings not only is provided with technical characteristics and properties from the design, but also possess abilities like skills and dexterities. One of the conclusions from this research is that building operators play a crucial role as mediators between users and buildings (Aune et al., 2009).

4.2 Management of learning building

What seems to be missing in the previous research on learning buildings is the role of management. Learning is not something that can be implemented in buildings like human intelligence can be implemented in intelligent buildings by installation of building automation systems etc. as shown by Himanen (2003). It is more relevant to compare with the concept of learning organisations. Senge (1990) defines learning organisations as “Organisations where people continually expand their capacity to create results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free, and where

people are continually learning to learn together". Management is needed in general to make a number of individual people work as an organisation with common objectives. A specific kind of management is needed to create a learning organization, where traditional hierarchical structures are removed and a shared vision has been defined and accepted.

Similarly, a specific kind of management is needed to make buildings work as learning buildings. This involves identification of visions, strategies and requirements for the long term development of buildings in the planning phase and on-going monitoring of performance and usability to capture new needs and requirements for changes during the use phase of buildings. Facilities managers should be the obvious profession to take on this important management role in close collaboration with the top managers and users in the organisation.

Evaluation is in general an important part of learning and evaluation of usability and performance of buildings is an important part of creating learning buildings. By implementation of continuous briefing and continuous commissioning such evaluations can be part of a feed-forward from existing buildings to make improvement in both existing and new buildings. This is in contrast to the traditional view on building evaluation carried out by POE (Post Occupancy Evaluations), where the main purpose is feed-back from finished buildings to the design team.

5. Conclusions

The focus on buildings in FM is concerned with how the corporate needs for facilities can be provided and optimized in both a short and long time perspective. Therefore every phase of the life cycle of buildings is of importance. This paper has proposed continuous briefing and continuous commissioning as two interrelated concepts, which together with the concept of learning buildings can be used to integrate the management of buildings and usability. Just like the development of learning organisations needs a specific form of management, where traditional hierarchical structures are removed and a shared vision is defined and accepted, so does the development of learning buildings need a similar specific form of management.

The management tasks to obtain usability include formulation of visions, strategies and requirements for the long term development of buildings in the planning phase, involvement of users in defining needs and requirements and deciding on design solutions in continuous briefing and on-going monitoring of performance and usability to capture new needs and requirements for changes during the use phase of buildings. Facilities managers should be the obvious profession to take on this important management role in close collaboration with the top managers and users in the organisation

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INTERNATIONAL COUNCIL FOR RESEARCH AND INNOVATION IN BUILDING AND CONSTRUCTION

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An example of a recent major CIB collaborative activity is the Thematic Network PeBBu Performance Based Building: a four-year programme that included 50 member organisations, that was co-ordinated by CIB and that was funded through the European Commission Fifth Framework Programme.

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