

USABILITY – A MATTER OF PERSPECTIVE? THE CASE OF NORD TRØNDELAG UNIVERSITY COLLEGE

Geir K. Hansen, Faculty of Architecture and Fine Art, NTNU, Norway
Wibeke Knudsen, SINTEF Architecture and Building Technology, Norway,
geir.hansen@ark.ntnu.no, wibeke.knudsen@sintef.no

ABSTRACT

The CIB Task Group 51 was established to develop concepts of Usability for application in practice, and to promote, develop and share methods, processes and techniques for the evaluation of buildings in use. In the Norwegian contribution to TG 51, Usability defined as the effectiveness, efficiency and satisfaction with which a specified set of users can achieve a specified set of tasks in a particular environment (ISO9241-11, 1998), form the basis for the discussion. In our work Usability is studied from different stakeholders' point of view, and the relation between Usability and the time perspective is being explored. Using the Nord-Trøndelag University college as case study this paper explore challenges and interfaces between different approaches to parameters in a theoretical framework. We further describe and evaluate methods used in the case study.

KEYWORDS usability, building performance, post occupancy evaluation, university college

INTRODUCTION

There is now much greater recognition of the need to consider buildings in the context of business, and from the perspective of end users. Buildings are means to an organizational end and an instrument of use. The concept of Usability deals with buildings ability to support an organization's professional and economical goals, i.e. creating value in a broad context. Lack of functionality may prevent the organizations chance of development and adaptation, and so their competitive power.

Buildings affect our health, our work, our thoughts and emotions. Each of us wants the buildings we use to support our individual needs. If organisational objectives are to be met as well, it is vital to understand how these diverse and sometimes contradictory requirements can be matched to the performance of our buildings (Baird et al., 1996). The largest companies are performing regular internal examinations or investigations related to health, working environment, safety, user satisfaction and well-being. These investigations can occasionally merely be directly related to physical surroundings and building conditions.

Productivity and effectiveness are generally emphasized as a strategic management issue, while individual workers are engaged with user satisfaction and practical aspects in their daily working situation. Conventional approaches to building performance usually deal with technical, functional and operational aspects. More recently, building performance appraisal has explored serviceability and accessibility to widen the remit (Davis et al.1993, Davis and Ventre, 1990).

Several terms are used related to different measuring methods for buildings. The terms building-in-use-studies, building diagnostics, building pathology and building evaluation are all used in this sense. The problem with these terms is that they are focusing on the building as a product, and do not include the process-oriented evaluation of the building process as a

whole. An important question is what parameters and criteria that are relevant to usability, and how we measure those aspects.

This paper explores challenges and interfaces between different approaches to parameters in a theoretical framework, and discusses usability particularly according to different user's perspectives. Nord Trøndelag University College completed in 1999, is used as a case example (Hansen et al., 2005).

THEORETICAL FRAMEWORK - THE CONCEPT OF USABILITY

In the literature we find various approaches and understanding of terms associated with the use of buildings, and quality of use. According to Warell the term functionality can be defined as a property given to an artefact in order to create a practical effect (Warell, 2001). An important effect can be described as usability (ref ISO 9241). Functionality defines whether the product will offer functions and features that users need to complete tasks. Product designers suggest two categories of functionality; *technical functionality* and *interactive functionality*

In the book *Architecture In Use* (Voordt and Wegen, 2005) the criteria for functional quality is discussed. Here usability relate only to physical accessibility, and distinguish the three components reachability, accessibility and usability. Voordt and Wegen describe the concept of functional quality quite close to the usability definition used in this paper. Research on the evaluation of buildings has some widespread and valuable component internationally. *The Serviceability Tool* (Davis, G. et al, 1993) is acknowledged as one of the most widespread practical and theoretical vehicles to evaluate building performance. Davis distinguishes between *performance* and *serviceability* He argues that: "Serviceability is about whether a building or facility is *capable* of performing as required (...) whilst Performance means actual behaviour in service at a given moment" (Davis and Ventre, 1990). Davis' definition of performance acknowledges the importance of the *situation*.

The characterisation of the concept serviceability, as it is defined by Davis et al., is that serviceability and hence performance is causally tied to functionality. In Davis' reasoning, serviceability is synonymous to usability in the meaning it has in ISO 9241-11.

It is important to distinguish between the terms functionality and usability. In the CIBTG51 case study of the Örebro University Hospital, Granath et al. (2004) states that functionality alone does not make a certain artefact usable. The technical and physical properties of the artefact and its theoretical potential to deliver a certain effect do not automatically make it usable in the real world. As a result of the definition of usability it also depends on the *situation* in which the artefact is used, on the *context* the artefact is designed and used in, and the *values* of the designers and users. Both context and values change with *time* and *place* (Granath et al., 2004). Good usability in buildings seen from the user's point of view depends on robust performance on basic factors like comfort and space provision. With the basic factors in place, the other factors tend to follow (Leaman, 2000).

The concept of usability

The concept of usability is widely known in relation to applications within product design, information technology and web-design. There is a growing body of work on usability in related fields, particularly engineering and computing and web design. Usability refers to the

many aspects of human interaction with a man-made system. The user interface is everywhere where people have to use something: from process control systems to software applications, from VCR's to ticket vending machines, from buildings to traffic systems.

In the standard ISO9241-11 Ergonomics of human system interaction, usability is defined as the effectiveness, efficiency and satisfaction with which a specified set of users can achieve a specified set of tasks in a particular environment. This can further be explained as;

1. *Efficiency*, which splits into organisational factors such as the cost and quality of outputs, and building use factors like operating costs and intensity of use. To be 'usable' in the broadest sense, buildings need to operate within performance 'envelopes' which do not threaten the financial viability of the organisation.
2. *Effectiveness*, which is concerned mainly with adding value to existing products and/or services. One of the main purposes of buildings is to improve potential for the ways tasks are carried out and create conditions for innovation. This is productivity in the broadest sense.
3. *Satisfaction*, which is whether building users are happy, healthy, safe and comfortable, and whether conditions are improved for 'customers' and visitors as well.

In the CIB Task Group 51 usability is described as the buildings ability to support the user organizations economical and professional objectives. In order to evaluate a building's usability it is necessary to define the criteria, parameters and methods relevant to measuring those aspects of the building (Jensø et al., 2004). Figure 1 sets out a framework considering building usability with three main considerations developed from the ISO9241-11.

Efficiency		Effectiveness	Satisfaction	
Related to organization	Related to building	Added value	for employees	for customers
Production time/cost per unit produced (services or products)	Operational cost/sqm	Increased potential for....	Improved conditions.	Improved.....
Development time/cost of new products/ services	Sqm/employee	Innovation	Personal well-being	Accessibility
Time/cost because of interruptions due to changes in the use of area	Number of users/ sqm/h	Productivity	Personal efficiency at carrying out work tasks	Image and identity
	Hours in use per day/week	Flexibility and adaptability	Air quality	Value of products and services
	Time/costs per change in the use of area	Communication	Lighting conditions	Service quality
		Learning/ development of knowledge	Temperature	
		Cooperation	Aesthetics	
		More distinct identity and image	Image and identity	
			Functional performance	

Figure 1. Framework for usability criteria

This framework was developed in a Norwegian workshop on usability (Arge, 2004) using earlier more theoretical work from the CIB TG51 (Alexander et al., 2004, Jensø et al., 2004). An important outcome was the conclusion that usability should be related to organisational, technological and spatial factors in a wider framework, not just related to the individual user.

Different perspectives

Different stakeholders and organizational levels have different perspectives considering usability of buildings (Fenker, 2004). The terms usability, effectiveness, efficiency and satisfaction are interpreted and understood in different ways. The four international case studies in the CIB TG51 have used different approaches to the stakeholder perspective. While the British case study (Alexander et al., 2003) was focusing usability related to teams and individual workstations, the Finnish case study (Nenonen et al., 2004) evaluated the main areas in the building and the usability perspective from the facilities management and the business concept point of view. The French case study was discussing usability according to the company's overall vision and mission (Fenker, 2004).

In the Norwegian case study we have focused on usability from the user perspective, and emphasized the perspectives of the administration staff, teachers, students and the Facilities manager.

THE CASE STUDY

Nord Trøndelag University College campus is located close to the centre of Levanger, a small town north of Trondheim. The campus has a complex group of buildings, totally 28.000 m², of varying age and use. At present 2500 students and employees have their daily work at the campus. The case study Nylaana with offices for administration and teaching facilities has a total area of 10.800 m² including offices for administration and teaching facilities. The planning process was initiated in 1992 by an open architectural competition. The winning project was "ABC", developed by HUS Architects of Trondheim. Lack of funding led to a long planning phase. In 1997 the project received the necessary funding from the ministry of education, and the planning and design could proceed. The hand over of the building took place in 1999. At the official opening of the building, the former minister of Education declared Røstad as "the most beautiful campus east of California".

As Figure 2 illustrates, "Nylaana" consists of three almost independent buildings, connected by a corridor with teachers' offices.

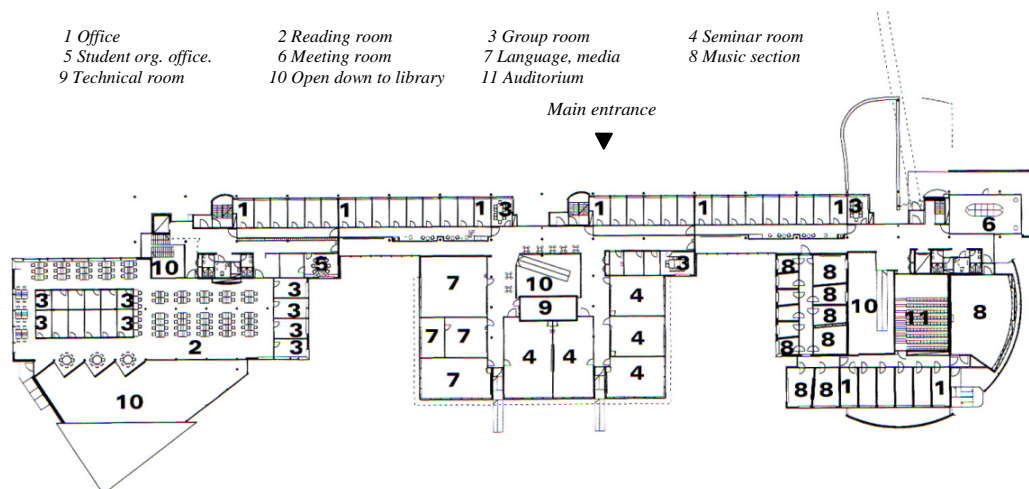


Figure 2. Nylaana first floor plan

The library and reading rooms are located in the south building volume (10), adjacent to the secondary entrance. The middle building volume is used for general teaching activities, with three auditoria, seminar rooms, media room, information technology and a language laboratory. In the north building volume (8) special rooms belonging to the different departments are gathered separately.

RESEARCH METHODOLOGY

In the case study we have used a combination of four relevant and supplementary quality and quantity research methods both to study what information we could get out of the different methods, and also in order to develop the methods further.

Document analysis

The program for the architectural competition and the jury's evaluation and assessment was analysed in order to understand the intentions and requirements for the project and to make a comparative analysis of the program requirements, changes during the project development and the use of the building after completion (Statsbygg, 1996).

Workshop and walk-through

The main purpose of the workshop was to discuss the concept of usability from different users' point of view, and to identify the users' criteria and parameters for evaluating the usability of Nylaana. In total nine representatives from the staff, teachers, students and facility management were present. As a part of a four-hour workshop, we arranged a walk-through of the building. At eight different locations in the building, the users were asked to write down their positive and negative impressions regarding usability, together with suggestions for improvements. In the preparation of the workshop and walk-through, the participants were asked to point out key factors relevant and essential for the building being suitable for different activities in a college facility.

Interviews

Interviews were conducted with participants from the design and planning phase (the architect and the project manager) and user representatives (the user coordinator and a user representative at the briefing stage). To explore the building in use, we interviewed four user representatives with different perspectives and functions in the building. The participants were selected from the group attending the workshop and the walk-through, making it possible to be more specific on usability related to their own workplace. Interviews dealt with user experiences focusing on the relationship between users' needs and what the building actually offered.

User survey

A user survey was developed, based on the existing standard occupant survey by Building Use Studies (Leaman, 2005) to compare with UK dataset. Some minor adjustments were made to the standard questionnaire. In the building usability study we were assessing how the building works from the user's perspective, especially in the ways it enables them to carry out their work effectively.

Responses were obtained from 48 staff (response rate ca 85%) and 129 students (response rate app. 50%). The survey was carried out as the last part of the case study.

EXPERIENCES OF USING DIFFERENT METHODS

Document analysis

The document analysis gave important input to comparative analysis of the program requirements, changes during the project development, and the use of the building after completion. Together with interviews, document analyses identified imbalance between physical concepts and pedagogic principles.

Workshop and walk-through

In our workshop and walk-through we had representatives from teachers, administration staff, students and FM staff. Together their knowledge covered a wide range from technical aspects to accessibility, functionality and user satisfaction. The participants' definition of key-factors essential for the buildings suitability was reflecting their work tasks and experiences with the building. The users attached the following qualities to usability: contentment, functionality, accessibility, climate/indoor environment, satisfaction, independency and communication. Altogether the answers more or less covered all the three aspects of usability according to the ISO definition with main focus on user satisfaction, without being detailed and exhaustive.

The workshop, including the walk-through, is a simple and rapid way of getting the first overview and indications of the usability of the building. The walk-through has a visual approach, and the findings reflect this: the focus was on space, architecture, indoor environment and accessibility. The results from the walk-through and the quality of the evaluation will depend on who is participating, the preparations, the route for the walk-through and the focus of the evaluation. One of the participants had a physical handicap that helped us understand aspects of accessibility. Similarly, greater details came from the staff from the music and nursing departments in the group.

Users will naturally relate their opinions to their day-by-day experiences, while a designer will rely more on general knowledge about building use. Our discussion after the walk-through showed that the users had increased their understanding of usability, and also added management and productivity to their list of factors, which they thought were important.

Interviews

Interviews give the opportunity to go deeper and also to put the answers in a broader context for understanding the results. While the walk-through mainly was based on the participant's subjective and more ad hoc opinions of usability, the interviews were more structured. We used the definition of usability to structure the interviews and to systematically examine the effectiveness, efficiency and satisfaction.

From this case study, we experienced that it is easier to get information about the users' satisfaction and the effectiveness of the building, than findings on the efficiency of the space. There was good accordance between the different interviewees' answers and comments on

satisfaction and overall comfort. Regarding efficiency, the question of usability seems to be more dependent on different persons' perspectives and standpoints. What appears as usable and efficient from a students' point of view, does not necessarily mean the same to the teachers or the administrative staff. The four interviewees focused on their own departments, and responded on questions from that point of view. None of them had an overall perspective relating to the university as a whole. One reason might be the selection of interviewees, as none of the four represented strategic management. The findings from the walk-through tended to be confirmed, with more detailed information being added.

The findings will depend on the selection of interviewees and which questions are being asked. Here we see a greater need for a framework and a vocabulary that support an evaluation on usability.

Questionnaire

The questionnaire gave us the opportunity to benchmark our case study against the UK dataset (no comparable Norwegian data are available). The survey gave a comprehensive picture of the indoor environment of the building. We found that the survey gave some hints about the effectiveness of the building, but it is not specific enough to give detailed information on efficiency. This may reflect the difference in culture and focus on different aspect of usability between the Scandinavian countries and UK. In the questionnaire there were also room for comments. These comments gave a broader picture of the different aspects of usability.

The question of what usability means, and how we can understand the concept is essential in the design of a questionnaire exploring usability. This is directly related to the question of indicators and how we can measure usability in a certain building, for a particular organisation, at a specific time. From this case study we see a need for developing the questionnaire to give more answers regarding the efficiency and effectiveness of the building. Topics like way of working, need for space, need for technology, flexibility and adaptability would be more central in this survey.

HOW WELL DOES THE BUILDING PERFORM?

In this study we assessed how the building worked, from user's point of view. Especially in the ways it enabled them to carry out their work effectively. In particular we looked at the overall context of the building; its location, design, spaces, circulation and internal environment. These factors will usually be in the background, normally becoming perceived by users only when they emerge as a source of persistent chronic problems which affect, for example, user's health or productivity at work. Further we looked at opportunities for users and building managers to intervene and to improve things, and the user's individual workplace covering the everyday use of everyday things.

This case study shows that the building in general gave a high degree of usability, but there are also several areas of potential improvement. Figure 3 shows the summary for main study variables concerning the comfort parameters.

5: Summary for main study variables used in short rating method, with comments.							
Nyálana, HINT	Staff			Students			Comments
	Score	Better than benchmark?	Percentile (study building mean)	Score	Better than benchmark?	Percentile (study building mean)	
Overall comfort	5.02	Green	81	4.49	Green	62	Students find it more uncomfortable in winter, and tend to give lower ratings for most variables. Even so, the building still scores very well.
Temperature in winter	5.07	Green	95	3.92	Amber	34	
Temperature in summer	4.58	Green	88	4.60	Green	91	
Air in winter	5.26	Green	99	4.35	Green	69	
Air in summer	5.03	Green	99	4.69	Green	96	
Lighting	6.12	Green	99	5.03	Green	88	
Noise	5.44	Green	98	4.72	Green	87	
Perceived productivity %	+3.35%	Green	80	+1.90%	Green	77	
Design	4.91	Green	57	5.10	Green	73	
Needs	5.19	Green	75	5.28	Green	76	
Health	4.47	Green	97	4.08	Amber	90	
Image	5.83	Green	71	5.22	Amber	36	
Details: Appendices A2, D2							

Figure 3. Report of building Usability survey, Building Use Studies Ltd.

The scores are based on mean values of responses to standard rating questions on 1-7 scales. The benchmarks are based on mean values of 50 recently studied buildings in the UK. Green means significantly better or higher, amber means no significant difference, and red means significantly lower or worse from benchmark and scale midpoint. Percentiles show where the case building fit compared to the benchmark dataset. A building being at the 95th percentile is in the top 5% of the dataset. Detailed statistical findings from the staff survey may be viewed on: www.usablebuildings.co.uk/619Charts/FrameSet.html.

The users involved in the workshop, walk-through and interviews had articulate opinions on both positive and negative aspects of the usability. Students tended to give lower ratings for most variables than staff. Even so, the results of the questionnaire were extremely positive. According to the summary report from Building Use Studies Ltd. “the results were exceptional. When compared with the UK dataset, the building came in the top 3% of the dataset using a wide range of user performance criteria. The main lesson to be learned was that good usability in buildings depends on robust performance in basic factors like comfort and space provision. If the basics are in place, as they were here, other factors tend to follow, creating a virtuous circle. As such, this building was a model example” (Leaman, 2005).

The results from the case study indicate that the building to a high degree support the activities. We also found that the users are very satisfied with the operation and the maintenance of the building, and that the staff responds to their problems. The building has become more and more functional being adjusted to the user needs. The University College has had a significant increase in the number of students, but has been able to meet this increase by using the building more intensive and by widening the teaching period in the afternoon. But still there is a lack of smaller rooms, places for informal meetings and ad hoc activities.

Overall, the use of the building is still more or less the same as when completed in 1999. However, there has been a change in pedagogic practice with growing need to divide the large classes into smaller groups. There is now an increasing need for smaller seminar rooms.

Nylaana was intended to provide improved range of possibilities for the students and staff. Different departments together in the same building should create opportunities for better communication and interaction across the older branches of study. The case study showed that those intentions still are not fulfilled. This is partly cultural based, and partly due to the fact that there are few possibilities for formal and informal meeting places in the building.

USABILITY – A MATTER OF PERSPECTIVES?

In this case we see that there are some important conditions that influence on usability. First we have the program for the architectural competition, giving some guidelines for the master plan and the design. The competition gave different answers on how the design and layout should be, giving different opportunities and barriers. One of the arguments for choosing this concept was the opportunity to gather three different departments in one building. Another premise for the project was the total space budget and the investment budget for the building, giving a framework for developing the project.

The procedures for the project are quite detailed, giving instructions on how to deal with different processes, information, documentation and decision making. Even the fact that those procedures are present, does not necessarily mean that the reality follows the routines or that the results are good if the routines are followed.

A good example is the user involvement. A user group was established, but their mandate was vague and not defined. The group was more reflecting a minimum of democratic representation rather than having the right competence and experience for this work. Usability depends on the different stakeholders' perspectives. Both the walk-through, interviews and survey clearly state that there are different opinions on the usability issues reflecting different views of the students, teachers, administrators and the FM-staff. The findings also show a difference in which factors that are important for the different users, and that the users are mainly concerned about the space they use regularly. What appears as usable and efficient from a students' point of view, does not necessary mean the same for the teachers or for the administration staff. A reason for why the students like the building less than the staff can be explained in the fact that the students use the whole building in study, while the staff only uses parts of the building.

We have found that the cultural aspects play an important role in the project. Relocating the three departments in the new building, Nylaana, the deanery wished for a synergy effect of more professional and social collaboration between the occupants. Even there is a lack of space for informal meetings in Nylaana, most of the barriers are in the head of the people using the building. However it seems that the departments are quite satisfied with a situation where they have a more internal focus. We also can assume that the persons responsible for the operation and maintenance of the building have another relation to the building. They often have their office and workplace some other place, and will be more concerned about accessibility to the different technical systems, cleaning, security, maintenance. From the students and the staffs' perspective, it will be essential that the technical staff understand the users needs to support their activities.

Another aspect that seems to be missing in this case was the involvement from a strategic level in the project throughout the whole process. This is especially important when you come to the two aspects of efficiency and effectiveness for the University College. A

strategic discussion would also include a longer time perspective, and questions about future pedagogic principles, flexibility and adaptability.

The organisations goals and needs attached to effect, efficiency and user satisfaction should be defined at a strategic level. Definition of the organisation's goals is vital in understanding results from user surveys. Involvement at a strategic level in the organisation is also important for implementing physical or organisational changes based on results from user surveys.

CONCLUSION

As a common understanding, the term usability describes whether or not a product is fit for a specific purpose. Different stakeholders and organizational levels have different perspectives considering usability of buildings. The terms usability, effectiveness, efficiency and satisfaction is interpreted and understood in different ways. Productivity and effectiveness are generally emphasized as a strategic management issue, while individual workers are engaged with user satisfaction and practical aspects in their daily working situation. From this case study we see a need for developing the framework and the criteria for measuring usability in buildings from different users' perspectives.

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