Universal Design in Primary Schools

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Abstract. The Norwegian building code give an apparently clear framework for the implementation of universal design (UD) in public buildings. However, it seems that neither increased awareness of UD, nor compliance with building regulations can so far guarantee equal use. Statistics and inspections reveal that there still are shortcomings as regards accessibility for many groups. Children with reduced mobility or impaired vision are better cared for than students whose needs are less documented. There is still a necessity for understanding the needs of other groups, such as children with hearing impairments, or other sensory challenges, children with social anxieties and those within the autism spectrum. A key part of achieving UD should be a design process where users' needs are in focus. Based on recent research carried out by SINTEF Building and Infrastructure and funded by the Directorate for Children, Youth and Families, this paper presents 1) Examples of practices where primary and lower secondary schools have been designed within a framework of UD, and 2) Important drivers for universal design during the design process. Recommendations will be proposed for further development of standardized tools. Findings indicate that opportunities to challenge the minimum requirements for UD within a conventional design process are few without having a supportive and competent client. The regulations and standards do not necessarily ensure inclusion and equal use. Low understanding about what UD entails in terms of user knowledge and involvement may be one reason. Norwegian standards for UD do not appear to be in significant use. Tools for UD often appear as checklists, based on the building regulations. The examples show that effective collaboration between the client and the architect plays a central role in the UD of schools. Architects not only need tools to think about usability at all design levels, but the ability to collaborate with the client and users in every phase.

Keywords. universal design, school environments, user involvement, user needs, regulations, standards.

1. Introduction

The Planning and Building Act with regulations seemingly provides a clear framework for universal design in public buildings. However, it does not appear that either increased awareness of universal design or dutiful compliance with the building regulations (TEK) guarantee equal participation for all in new school buildings and outdoor areas.

Statistics, several surveys [1] [2] as well as independent controls carried out by SINTEF show that there still are shortcomings regarding accessibility for many groups of users, even in new schools. Children with reduced mobility or visual impairment are better cared for than pupils whose needs are more easily documented, but where requirements are less explicit. The understanding of universal design is traditional, i.e., there is a strong focus on physical barriers for people with reduced mobility, vision, or hearing, while little consideration is given to invisible disabilities or diagnoses, because it can be more difficult to understand what solutions are needed [2].

SINTEF has been commissioned by Standard Norway to study schools' and municipalities' use of standards and other standardized documents for universal design. The Directorate for Children, Youth and Families (Bufdir) has funded the project.

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1.1. Regulatory Framework

Norway has a system of Building Code and regulations supplemented by recommendations and guidelines. These form the basic framework for accessibility and universal design, within which architects must design the built environment. Most requirements are function-based, few specifications are to be found in the regulations. Compliance with the regulations is a matter for the companies who apply for a building permit (mostly architects) and during the last 20 years, they have developed systematic routines for checking just that, including accessibility and universal design. However, accessibility checks have received less attention than fire safety or building construction and relates to the minimum requirements in the regulations.

The purpose of the regulations is "*to ensure that projects are planned, designed and executed on the basis of good visual aesthetics, universal design, and in a manner that ensures that the project complies with the technical standards for safety, the environment health and energy*." A central function-based requirement in the regulations points out that rooms in public buildings, which must comply with universal design requirements, must be designed, and dimensioned to enable *equal participation*.

The building regulations refer to guidelines, to Norwegian standards and to descriptive series published by the Norwegian Building Research Institute. These series or planning leaflets contain detailed specifications and advice, but none of them are to be understood as requirements, nor do they have legal powers. They show solutions which satisfy the functional requirements, and which in direct translation from Norwegian are called "pre-accepted solutions".

1.2. Approach to universal design

Accessibility, quality of use and universal design are discussed by Iwarsson and Ståhl [3] as three central concepts in research and practice that deal with human-environment interaction. According to them, the difference between accessibility and universal design is mainly about social inclusion, democracy, and citizen equality. Universal design is therefore in clear contrast to accessibility requirements and is much about changing attitudes in society. Universal design represents an approach to design that is more about process than result. Traditional design can provide accessibility to otherwise inaccessible buildings and products. The underlying principle of accessibility is that there are two different populations - the normal population and the population that deviates from normality, i.e., people with disabilities. The result is segregation and stigmatization, as opposed to «universal design», which is based on the principle that there is only one population consisting of individuals with different characteristics and abilities [3].

Ryhl [4] notes that universal design still is defined in relation to disability and accessibility, and not as a part of the academic discussion about quality in architecture. In the Norwegian context, the understanding of universal design as a high level of accessibility has overshadowed the dimension of universal design as a principle and a design method for increased quality of use for everyone [5]. UD is largely associated with regulations and standards. This is partly due to the structure of Norwegian regulations, which require that public buildings such as schools shall be universally designed while housing must be accessible, and thus conform to a different level of performance requirements. However, the building code is clear about UD as an overall principle for all construction works.

Ryhl [6] sheds light on the importance of sensory experiences through architecture, and therefore she also includes visual, acoustic, and tactile quality as central qualities for everyone. This approach is particularly interesting in terms of primary schools.

According to Ryhl, the complexity of sensory impairments is so great that it would not be possible to set general requirements for solutions, partly because there would be contradictions between the needs of different groups. An example is how environments adapted to some visually impaired people can provide unpleasantly strong light for normally sighted people or other visually impaired people.

Universal design presupposes a user-centered process. This requires extensive knowledge of the needs and preferences of different user groups. The disabilities and user groups that are taken care of through universal design are constantly expanding. It has traditionally been focused on mobility impairments, and thus the needs of wheelchair users are well known and to a large extent taken care of in new buildings. Allergies and disabilities related to the senses, such as sight, hearing and orientation are taken care of to varying degrees. There is an increasing focus on other groups, such as children, elderly, people with cognitive impairment, dementia, and neurodevelopmental disorders.

2. Objective

Objectives for the project has been 1) to gain better knowledge about how standards for universal design and other normative documents are used in the design phase of new schools and to what extent they can contribute to inclusion, equal use, and a broader approach to diversity among pupils, teachers, and staff, and 2) to map drivers for a more ambitious approach to UD in the design phase

3. Methodological approach

This paper is based on qualitative case study methodology research. The method has been twofold: 1) Document review: Norwegian standards that apply to educational environments; guidelines with a focus on specific user needs; requirement specifications for schools in municipalities where such exist, and recent Norwegian research within universal design of primary schools; 2) Semi-structured interviews with key stakeholders in 5 municipalities. A total of 11 interviews have been conducted: four builders, three architects, two ICT managers and two consultants for universal design in the case municipalities. In addition, we have had a dialog with universal design advisors in two other municipalities. The informants were selected based on their knowledge of the early phase of the building process, either as clients in relation to the municipality (builders and UD advisers), as consultants (architects), or because they had experience with planning for a digital learning environment (Municipal ICT managers).

The framework for the study did not allow any post occupancy evaluations. The schools have therefore primarily been assessed on basis of the informants' insights, in addition to an examination of site and floor plans, as well as photos of the schools.

The municipalities were selected because of their recent experience in planning and building primary schools. The schools are built according to new legislation and can be said to represent «best practice» in terms of inclusion and universal design. The municipalities are of different sizes and located in different parts of the country, because we assume that small, medium-sized, and large municipalities face different challenges

regarding universal design. The schools have been in use for at least one year, and it has thus been possible to obtain considerations about trade-offs during the construction process and experiences with the solutions as well.

4. Examples

4.1. Example 1: A large school in a small municipality

The new school replaces two smaller schools and includes a primary and lower secondary school. The architect who designed the school had experience with many users' participation processes, but they were not specially related to UD. The former principal was responsible for user participation and according to the client, he was good at leading the process with the educational team, the municipal board, and the users. He knew the students and teachers personally, but only representatives of the employees, the students and the parents were involved.

The client trusted that the architect met the requirements for universal design in the regulations but had no higher ambitions. The architect, for her part, was primarily concerned with complying with the regulations. She suggested the need for a simpler document with an overview of all requirements, provided it is kept up to date. There were rewarding discussions along the way between architect, consultants, client, and users, and they had time to address various topics about use and users. The municipality had a meeting with all the parties where they discussed the process itself afterwards. Having competent consultants along the way was crucial.

4.2. Example 2: A primary school in a medium-sized municipality

The school is located on a challenging site as regards step-free access. The design team chose to address the height difference, so that the building has two separate entrances, one on ground floor and one on the second floor. The youngest children enter on the second floor and thus meet a low-rise building, which according to the client, provides a less overwhelming impression. The design team was aware that a centrally located lift is required but opted, after discussions, to place it out of sight. The lift has been subject to trade-offs for two reasons: 1) the children do not need to use the lift, as they all enter on the floor where they will be during the school day, and 2) the school is a BREEAM[2] project, where one of the prerequisites is that the stairs should be the main alternative, and the lift should not be used unless it is necessary.

Doors are a theme in three of the cases and are especially mentioned by the builders. In example 2, the municipality has decided not to deliver a completely threshold-free building but make use of threshold eliminators when needed. If they had decided to go for a threshold-free building, it would have been a large additional cost because of fire safety. The toilets are decentralized and located near the classrooms, out of consideration for the children's experience of security, since they will not have to go past "bullying zones" with older children.

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[2] Building Research Establishment Environmental Assessment Method

4.3. Example 3: A primary school in a large municipality

The school has had a special particular focus on auditory environment and exhibits an extensive use of colors to facilitate different functions, while at the same time meeting the requirements for contrast. The school has a separate area for children with autism.

One of the informants has many years of experience as an occupational therapist for children and has been involved as UD advisor in the planning of many schools. She is part of a resource group for UD with 7 employees, which forms a favorable professional environment in the municipality. She has been a driving force in putting the acoustic environment on the agenda as an important part of UD and is clear that the official regulations for sound are not compatible with the goal of an equally designed school. A separate document with municipal requirements for schools is under completion. This will have stricter requirements than the official regulations, especially for acoustics.

She points out that only a small proportion of students need accessibility measures, while all users of the school, not just the hearing and visually impaired, can benefit from a good sound environment. According to her, children with reduced mobility also need a good sound environment, because they more often experience mental challenges and need more energy in meeting their fellow students. The same goes for students for whom Norwegian is as a second language.

5. Results and discussion

5.1. Understanding of universal design

The interviews show varying approach to universal design both in the municipalities and among designers. The understanding of what universal design implies also varies. There is a significant difference in the municipalities' approach.

The study confirms Fuglesang's [2] findings about a traditional understanding of universal design but nuances it. Most stakeholders are primarily focused on meeting the minimum requirements of the regulations regarding accessibility for students and staff with reduced mobility, sight, or hearing. Contributors to the design process often understand UD just as a set of requirements beyond accessibility.

Nevertheless, the cases show several examples of schools aiming for the inclusion of broader groups of pupils, such as children with autism or other cognitive challenges. We have seen better sound environment than required in the regulations, floor plans with many small and accessible rooms or furnishings to meet the children's needs to withdraw. Two of the schools in the sample have special departments, which may have influenced the approach to universal design and accessibility for the rest of the school in a positive direction. We do, however, badly need new solutions and a new approach to meet the intentions of the building code and embrace wider than just meeting performance requirements for thresholds, width of doors, turning area and contrasts.

The cases show that new school projects usually fulfill accessibility requirements, but not always the intention of equal use for all. A compact and clear plan and a centrally located lift are highlighted by the architect in one of the cases, as it is stated in the regulations. However, in two of the schools, the entrance situation does not allow equal use. The children who need access to the lift must use another entrance than their peers. This is a typical problem in schools on two levels with a main entrance and decentralized

entrances to the various grade levels. Most schools have only one lift located near the main entrance.

Three different approaches emerge from the examples:
1) traditional and conforming to regulations
2) pragmatic and questioning the regulations and guidelines
3) ambitious and delivering solutions better than the regulations, often because of specific concerns

Pragmatic solutions as in example 2) are practically useful and appropriate, but they do not necessarily follow overarching principles or rules. There are several examples of trade-offs, based on constructive discussions. Not all result in solutions that meet the requirements, but they are well-founded and a result of a seeking approach in accordance with the UD principles. Most of the informants do not place qualities such as acoustics or daylight in the context of universal design. They do not relate flexibility and variation in the learning zones to universal design, nor do they relate the organization, number, size, design and furnishing of the group rooms to potential solutions for pupils with sensory challenges or concentration difficulties.

It would have been good news if considerations of varying user abilities were a normal part of the design process. However, there is still much left to meet the needs of other groups than mobility impaired students, such as children with hearing impairments, social anxiety, autism, or sensory challenges.

5.2. Sharing knowledge

The cases show that there is a great need to discuss both principles and innovative solutions for universal design. Interpretation of the requirements is a central question and both clients and architects demand sparring partners with whom they could discuss different solutions and concepts.

The municipalities consider conferences and network meetings as important arenas for discussing the learning environment and universal design, both indoors and outdoors. Reviewing examples and inspections of schools in their own or another municipality improves their competence considerably. Design teams are developing many solutions to accommodate children with a vast diversity of abilities, but there is no system to assess them. Experiences must be shared, but there are few fora for sharing experiences except for the municipal networks.

Acoustics and daylight often do not meet the requirements, even in new schools. The municipalities can carry out inspections on universal design during the design phase or when applying for a permission to use. Municipal inspection of luminance contrast occurs, but it is not known to us if acoustics have been investigated. Deviations from requirements for the acoustic environment are discovered only after schools are put to use if at all. One type of recommendation to be communicated more clearly to the municipalities is that they require sound and light measurements of their schools from qualified personnel, even where the building meets the current building standard.

5.3. Competence at the right time

It is a well-known problem that consultants with innovative expertise enter the design process too late to make important decisions. The cases show that this applies not only to the general competence in universal design, but also to lighting, acoustics and ICT. An early involvement of the consultants would allow interaction and discussions in line

with universal design considerations and thus improve the quality of the projects. The cases show that when expertise, i.e., an acoustician, is involved, it is because the school has auditoriums or sports facilities intended for use by the public. However, the sound quality should be just as important for the pupils and teachers in the teaching areas.

Gathering all the necessary expertise in the architect's firm may be relevant and feasible in the largest offices, which also employ consulting engineers. But for most other firms, increased awareness of expertise necessary to achieve universal design could be useful, for instance in the form of a tool i.e., a standard that describes the type of external competence needed at each phase of the design process.

5.4. Tools in use

The case study shows that although the standards for universal design are known to stakeholders, municipal builders and architects hardly use them. Only one municipality requires it for the design of school buildings. The case sample in the study is limited, so this should possibly be re-examined among a larger sample.

The standards used by consultants are those referred to in the regulations, such as standards for sound/acoustics in music rooms, or those referred to in the municipalities' specifications for schools. Neither has anything to do with universal design. Reasons why the standards for universal design are rarely used could be: 1) architects design in accordance with statutory regulations, and they primarily use the official website for building regulations, where they can easily check requirements and guidance. Nevertheless, they say that they would have preferred a tool that is both easier to navigate and provides more references and clearer requirements; 2) other documents, such as municipal guidelines, are perceived as more relevant than the standards. Guidance material from the Norwegian Association for the Blind and selected instructions in the Building Research Series are closer to use and include more considerations.

Standards for universal design may be more meaningful tools in small and medium-sized municipalities than the large ones. The municipality's requirements often go further than the national, statutory requirements (TEK) and they are specific to the schools, i.e., the architects find the information they are looking for more easily in the municipal documents than in TEK or the standards. The large municipalities have usually established professional environments with advisers in universal design. This enables them not only to set clear requirements, but also to provide advice to the various sectors of the municipality. For small municipalities, which rarely build schools, it will not be necessary to have own specifications for schools. The study shows that several municipalities rely on documents from large municipalities. For smaller municipalities, however, the standards could be a valuable basis for discussion.

The architects signal a wish for easier reference material, for example in the form of updated and comprehensive checklists for universal design, which include more than the requirements in the regulations.

5.5. Participation

The case study shows that user participation processes are carried out routinely in school projects, but they are usually about topics other than universal design. It emerges in the interviews that participation largely depends on the school management.

One of the advisors for universal design had some experience with thematic participation related to universal design. Some of the cases have "super users", such as

students with autism or other sensory challenges, foreign language students, students with reduced mobility or students with mental disorders, such as social anxiety and depression, but there have not been specific involvement processes with them. Their needs are taken care of in other ways, i.e., by special educators. Both the youth council and the council for disabled people usually participate. According to the informants, the councils are experienced, professional, and good at promoting their views. One of the clients thought it was reassuring to know that they were involved in the process, so that important considerations were not overlooked. However, the cases show that municipal councils for the disabled can generally be more involved in building processes.

With respect to the qualities for the users, the positive impact of participation was by large confirmed by the interviewees. Several believed that the quality depended on how much the developer was willing to invest in interaction with users.

6. Conclusion

The study confirms that competence is a key premise for a broad approach to universal design. There is a need for a mutual understanding of universal design among the stakeholders and enough knowledge to get external expertise at the right time. More experience with ambitious solutions for universal design in schools should be systematized so that they can be conveyed, both locally and nationally, to municipalities, designers, and consultants. Such experiences can form the basis for new tools or standards, which should apply to the early phase of the building process as well as to the completion, the use and operation. The field of universal design is relatively new and is constantly evolving. It should therefore be a goal to further develop standards for universal design so that they promote innovation, and do not hinder it, as some fear they may do. There is still much left to meet the needs of other groups than the mobility impaired, such as children with hearing impairments, social anxiety, autism, or sensory challenges. However, many of the needs of these pupils turn out to coincide with more general needs and preferences. All pupils and teachers will benefit from a sharper focus on the diversity of needs among users of school buildings. A big share of the solutions to meet the needs of students with hearing impairment and autism related conditions will have a preventive effect on stress, and in the long run also be profitable for the learning conditions at school.

7. References

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