

INCLUSIVE HIGHER EDUCATION

Edited by Zuzana Čerešňová

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Nakladatelství Gasset
Prague 2018



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Publisher: Nakladateľství Gasset – Allan Gintel, Czech Republic, Prague, 2018

Printing: ForPress Nitrianske tlačiarne

Press run: 120

First edition

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The European Commission support for the production of this publication does not constitute an endorsement of the contents which reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

ISBN 978-80-87079-60-7

Co-funded by the
Erasmus+ Programme
of the European Union



This publication is one of the outputs of the UNIALL project: "Accessibility of Higher Education for Students with Special Needs", co-funded by the Erasmus+ Program of the European Union (grant agreement No. 2015-1-SK01-KA203-008959) and supported by the Ministry of Education, Science, Research and Sport of the Slovak Republic.

"The highest result of education is tolerance."

Helen Keller: My Key of Life (1904, p. 32)

Hellen Keller was the first deaf-blind person to earn a bachelor of arts degree.

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Introduction

Zuzana Čerešňová

This publication summarizes research of the current state of accessibility to higher education for students with special needs in selected European countries and provides analyses of a new concept of human-centred (student-centred) approach in higher education. The publication is one of the research outputs of the UNIALL project: **Accessibility of Higher Education for Students with Special Needs**, co-funded by the European Union in frame of the Erasmus+ program, Key Action 2 – Strategic partnership in higher education. The significance of the UNIALL project, conducted in 2015-2018, is an accentuation of the social responsibility of higher education institutions to create an inclusive educational environment for diverse students. The aim of the UNIALL project is to implement human-centred approach in education and design process to enhance the access to higher education and to support the equity and inclusion of all people in higher education. The UNIALL project focuses on all aspects of accessibility to higher education. Project partners from European countries (Czech Republic, Italy and Slovakia) have a wide range of expertise in various fields

of human-centred design and inclusive education. The Centre of Design for All at the Faculty of Architecture, Slovak University of Technology (CEDA FA STU) in Bratislava coordinated the UNIALL project.

The publication consists of five chapters that define the research framework and methodology for the creation of inclusive higher education. This comprehensive methodology covers the monitoring, evaluation and implementation of the human-centred approach in the following fields:

- 1) Teaching and learning process by using student-centred pedagogy;
- 2) Support services, study materials, information and communication technologies (ICT) accessible to diverse students;
- 3) Designing of inclusive environment of higher education institutions and campuses.

The first chapter is focused on the framework of inclusive higher education, including the definition, development and fundamental legislative and policy documents, as well as the analyses of current state of access to higher education in the UNIALL partner countries. The second chapter provides analyses and comparisons of selected human-centred methods (e.g. Inclusive Design, Design for All, and Universal Design) for creation of an inclusive learning environment. The third chapter proposes various support services and assistive technologies that can facilitate higher education for students with special/specific needs. The fourth chapter defines the fundamental design criteria of inclusive university campuses, including outdoor spaces, sport, leisure time and recreational facilities, and student dormitories. The fifth chapter provides the proposals of basic requirements and design recommendations for the creation of inclusive school environment, including various learning spaces and circulation areas with common spaces for informal learning and social activities. Moreover, this chapter is focused on the wayfinding aspects by providing appropriate spatial solutions and multisensory elements. This chapter is based on the outputs of selected case studies of inclusive higher education, which were elaborated within the UNIALL project.

1

**INCLUSIVE
EDUCATION**



1. Inclusive Education

Zuzana Čerešňová

Petr Peňáz

Giuseppe Di Bucchianico

Education and work are the main conditions of human independence and substantially contribute to the fulfilment of life. Therefore, it is essential to create an environment that does not restrict an access of persons with disabilities to education and work. To improve the inclusion of persons with disabilities into society, it is necessary to strengthen the inclusive education and to create favourable conditions for this type of education. The aim of inclusion is not to eliminate differences among people, but to enable every person with different abilities and capabilities to be accepted by the community on the basis of human rights (Ceresnova, 2013).

Inclusive education is the education that is **equally available and accessible** to every person, while respecting individual differences in physical and cognitive abilities, various social, cultural and religious backgrounds.

Inclusive education is based on solutions that can be flexibly adapted to diverse abilities of each individual, taking into account preferred learning and communication style or other specific needs of students in higher education (Ceresnova, Rollova, 2015).

Inclusive education, encompassing “universal accessibility to knowledge”, does not refer solely to the needs of people with special educational needs, but includes all learners, taking into consideration their differing needs to achieve **effective education for all** (Porfirio et al., 2016). Also, very important aspect is active engagement of all students in the process of decision making regarding their needs to accessibility. According to Erkilic (2012, p.198), inclusive education *“has to be conceived of as a strategy or system that embraces all students with their diverse abilities and disabilities and promotes a wide level of accessibility with equal opportunities and full, active participation”*. Inclusive education also plays an important role in the formation of human attitudes since childhood, creating prerequisites for developing empathetic thinking and accepting the diversity of human society.

Inclusive education is focused on the application of **human-centered approaches**, where the center becomes a person with individual abilities/disabilities that are respected. Attention is aimed at creating such an educational environment that is friendly, accessible, safe, and healthy for all participants in education, including teachers and other staff. Human-centered approaches in the educational and design processes are one of the tools to create the inclusive educational environment. In both areas, the focus is on the needs of diverse people, while respecting their individuality and various requirements. The physical environment should take into account the different spatial demands of people, including those who have disabilities or limited abilities. In the field of education and training, it is about respecting the individual qualities of each person in terms of educational as well as social needs.



1.1 Development of Inclusive Higher Education

The first steps to accessible higher education for people with disabilities were evident after the end of World War I, mainly in the United States. The US government passed the Vocational Rehabilitation Act of 1918, which help to create educational assistance for veterans with disabilities at colleges (Madaus, 2011). Also, after World War II, the huge numbers of veterans with disabilities were enrolled in colleges. Some higher education institutions provided them various services, for example: accessibility adaptations of buildings and provision of readers and note-takers, priority seating and course registration. At that time, the discrimination still existed, and some colleges were refusing the students with disabilities because of inaccessible campuses.

Until 1960s, the support was focused mainly on the students with **physical disabilities**. In 1963, the term **learning disability** was presented by Samuel Kirk, and later this term was designated by the US government as a category of disability in primary and secondary education (Madaus, 2011). An important step towards developing inclusive education was the US federal law on Education for All people, including children with disabilities, adopted in 1975. Later on, the Americans with Disabilities Act (ADA) was adopted in 1990 and amended in 2008, which has significantly contributed to the promotion of the rights of persons with disabilities (Nussbaumer, 2012).

In Europe, the progressive initiatives started in the United Kingdom in the late 1970s by "The Warnock Report" (1978), and by adopting the Education and Learning Act (1981). These documents defined integrated education and also a new concept of **Special Educational Needs** (SEN), which was widely spread throughout the world (Priestley et al., 2010). The Special Educational Needs and Disability Act (SENDA) was adopted in UK in 2001. This act requires that student with disabilities should not be subject to "less

favourable treatment” in educational institutions (including schools, colleges and universities) and that **“reasonable adjustments”** should be made to provide accessible education to all students (Priestley et al., 2010).

Later, the process moved from integration to inclusion, and the term *“special needs”* was replaced by the term **“individual needs”**. In framework of inclusive education, we are talking about a heterogeneous learning environment that is made up of diverse people with various preferred learning style, type of intelligence, abilities and requirements. Therefore, some countries (e. g. Nordic countries) rejected the categorization of persons with special needs, because it can cause the exclusion of certain group of people. However, it is necessary to know the specifics of each student, and therefore the categorization of the needs should rather help to find appropriate support, methods, forms and tools in the learning process.

The development of inclusive education on an international scale was evident mostly in the 1990s, particularly with the support of the United Nations Educational, Scientific and Cultural Organization (UNESCO). UNESCO’s activities aim to eliminate any discrimination in access to education. In 1990, the **Education for All movement** was launched, which adopted the World Declaration on Education for All in the same year (UNESCO, 2009). Since then, several international documents on inclusive education have been issued to support its implementation in the country’s education policies in order to create and ensure inclusive society development. Many activities were focused mainly on inclusive education at primary and secondary level, not tertiary education. Improvement started after the United Nations (UN) approved the **Convention on the Rights of Persons with Disabilities (CRPD)** in 2006, which is very important document focused on various aspects of social inclusion, covering also inclusive education system at all levels and lifelong learning.

In 2015, UN approved the **2030 Agenda for Sustainable Development**, which provides a unique opportunity to build more inclusive and equitable societies. According the Agenda, Sustainable Development Goal (SDG 4) calls for inclusive and equitable quality education and lifelong learning opportunities for all by 2030. As a part of this Agenda, UNESCO leads and coordinates the **Education 2030 Agenda**, which has the central mes-



sage *“every learner matters and matters equally”* (UNESCO, 2017, p. 12). The Education 2030 Framework for Action provides guidance for the implementation of this ambitious goal. This Agenda defines inclusive education as *“a process of strengthening the capacity of the education system to reach out to all learners”* (UNESCO, 2017, p. 7).

1.2 World Documents on Access to Education

With regard to ensuring the access to education on the equal basis for all people, several international documents have been adopted, including:

- **Convention against Discrimination in Education**, adopted by UNESCO in Paris in 1960, enshrines the right of every person to accessible and quality education. According to this Convention (Article 5) *“Education shall be directed to the full development of the human personality and to the strengthening of respect for human rights and fundamental freedoms.”*

- **World Declaration on Education for All**, adopted by UNESCO (the Education for All movement) in 1990, states that every person (children, young people and adults) should have appropriate and equitable conditions for education so that everyone can fully develop individual potential. This Declaration (Article 3: Universalizing Access and Promoting Equity) emphasizes universal access to education for all persons, respecting their individuality. The Declaration states (Article 5) that *“the basic learning needs of youth and adults are diverse and should be met through a variety of delivery systems.”*

- **Salamanca Statement and Framework for Action** – adopted by UNESCO at the World Conference on Special Needs Education in 1994. The Statement affirmed the international agreement on the principle of **“education for all”** that every student has unique characteristics, interests, abilities and learning needs and the education systems should be designed and educational programmes implemented to meet these diversities among students.

Very important document focused on social inclusion and equal rights is the **Convention on the Rights of Persons with Disabilities (CRPD)** approved by the United Nations (UN) in 2006 and ratified by many countries



(including Slovakia, Italy, and the Czech Republic). One of the CRPD aim is to stress the implementation of Universal Design into legislation. CRPD, Article 2 defines **Universal Design** as:

“...design of products, environments, programmes and services to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design. Universal design shall not exclude assistive devices for particular groups of persons with disabilities where this is needed.”

CRPD, Article 9 (Accessibility), specifies measures related to provision of **accessibility** to the physical environment, to transportation, to information and communication technologies and to other services for the public. These measures also relate to indoor and outdoor facilities, including also the higher education institutions.

The requirement for provision of **inclusive education** is stated in CRPD, Article 24 (Education): *“States Parties shall ensure an inclusive education system at all levels and lifelong learning...”*. Moreover, CRPD (Article 24, Item 2) specifies the requirements for provision of support and appropriate measures with the regard of individual needs of persons with disabilities, for example using the most suitable ways and means of communications for the particular person, e.g. in Braille, other alternative information-communication ways or sign language. CRPD (Article 24, Item 5) stipulates that *“States Parties shall ensure that persons with disabilities are able **to access general tertiary education**, vocational training, adult education and lifelong learning without discrimination and on an equal basis with others.”*

According to the **UN document “Accessibility and Development”** (UN, 2015), accessibility is a global value and must be perceived as an investment, and not as a cost issue, so it requires a change of mind and policy. The objectives should not be just to equalize opportunities for people with disabilities, but to ensure equitable accessibility for all people by applying the principles of Universal Design that take into account the diversity of people and their different capabilities and limitations.

1.3 European Documents on Access to Higher Education

The fundamental European document on human rights is the **Charter of fundamental rights of the European Union** approved in 2000. This Charter states (Article 14 Right to education) that *„Everyone has the right to education and to have access to vocational and continuing training“* (EU Charter, 2000).

The most important document is the **Convention on the Rights of Persons with Disabilities (CRPD)**, approved by the United Nations (UN) in 2006 and ratified by many European countries; therefore, they have to implement the provisions stated in CRPD into national legislation (see chapter 1.2).

In 2009, the **European Disability Forum (EDF)** issued the **Statement: Inclusive education** – Moving from words to deeds (EDF, 2009). This document is intended to contribute to the implementation of Article 24 (Education) of the CRPD into national legislations of European countries through concrete guidelines and actions.

One of the first EU document focusing on the importance of **accessibility** and implementation of Universal Design in education is the **Resolution (2001)1 on the introduction of the principles of Universal Design** into the curricula of all occupations working on the built environment. This resolution was adopted in 2001 and defines **Universal Design**:

“as a strategy which aims to make the design and composition of different environments, products, communication, information technology and services accessible and understandable to, as well as usable by, everyone, to the greatest extent in the most independent and natural manner possible, preferably without the need for adaptation or specialized solutions.”



In 2009, the EU issued the **Recommendation (2009)8 on achieving full participation through Universal Design**, which emphasizes the need to integrate the UD principles into national policies, legislation and practice to promote an active and independent way of life for all citizens, including people with disabilities. This Recommendation sets out incentives to introduce UD requirements as one of the conditions that must be fulfilled in public procurement. At the same time, a control over the consistent application of these principles in practice must be ensured.

In 2010, the European Union adopted a new strategy: **Europe 2020 – A strategy for smart, sustainable and inclusive growth**, which presents the three basic priorities of the EU. The strategy outlines the five headline targets to be achieved by 2020 in the areas of employment, research and development, energy, education and social inclusion. A target on educational attainment is to reduce the dropout rate and to increase the share of the population aged 30-34 having completed tertiary education from 31% to at least 40% in 2020.

Following the new Europe 2020 strategy, the European Commission endorsed the **European Disability Strategy 2010-2020: A Renewed Commitment to a Barrier-Free Europe** (ED Strategy) in 2010. ED Strategy aims to ensure a consistent inclusion of people with disabilities in society and to enable them to participate actively in different areas. The main areas defined in ED Strategy, where measures need to be taken, include: Accessibility, Employment and Education. ED strategy defines **Accessibility**:

“as meaning that people with disabilities have access, on an equal basis with others, to the physical environment, transportation, information and communications technologies and systems (ICT), and other facilities and services. ...Accessibility is a precondition for participation in society and in the economy.”

ED Strategy also emphasizes the importance of education and promotion of inclusive education for students with disabilities.

The European Disability Forum (**EDF**) **Alternative Report** on the implementation of the CRPD states that the above-mentioned ED Strategy has limited scope and insufficient financial resources for its implementa-

tion. According to the EDF Alternative Report, harmonization of European legislative and regulatory requirements in defining “*disability*” and “*reasonable accommodations*” is needed, as well as in the area of accessibility of environment, products, services and information and communication technologies. This harmonization of regulations is also important from the point of view of the mobility of students and academic staff (e.g. under the Erasmus + program), so as to create equal conditions within the EU member states.

In February 2017, the European Commission issued the **Report on the implementation of the ED Strategy**, stating that access to inclusive education is still difficult to reach for people with disabilities. This report states that about 29.5% of people with disabilities (aged 30-34) have successfully completed higher education, which is not sufficient in comparison with the other population (42.5% of university graduates). In the field of accessibility (3.1 Accessibility), the need for the adoption of the *European Accessibility Act* and the development of *European Standards for Accessible Environment* in accordance with Design for All / Universal Design principles is highlighted. The report defines steps how to achieve inclusive education at all levels (3.5 Education and training).

The other important European documents focused on **accessibility of higher education** are as follows:

- **Strategic framework for European cooperation in education and training (ET 2020)** approved by EU Council in 2009 with the aim to ensure all citizens their personal, social and professional fulfilment, social cohesion and active citizenship. One of the objectives of ET 2020 is to promote inclusive education and ensure that all learners, including those with special needs, complete their education. One of the priority areas of ET 2020 is to promote personalised learning, to ensure the early identification of special needs and to provide well-coordinated support services.

- **Council conclusions on the modernisation of higher education**, approved by EU Council in 2011, focuses on the systematic development of effective inclusive strategies to ensure access for under-represent groups, in particular through student-centred learning and by providing relevant support, guidance and counselling. This document also stresses the



importance to increase the social responsibility of higher education institutions to create inclusive educational environment.

• **Council conclusions on the social dimension of higher education**, approved by EU Council in 2013, invites the EU Member States to take the following measures:

- Secure more equitable access to, participation in and completion of higher education (HE), because there are many individuals who do not participate in HE due to insufficient system of support and guidance;
- Adopt national strategies and action plans which are aimed at increasing the access, participation and completion rates of disadvantaged groups in HE;
- Facilitate the development of proactive strategies and provision of counselling and support services for the students with special needs;
- Increase opportunities for flexible learning by diversifying the way in which learning content is delivered, for instance by adopting student-centred approaches to teaching and learning.

Many European documents and projects focused on inclusive education are covered by the **European Agency for Special Needs and Inclusive Education**, which aim is to help member countries improve their educational policy and practice at all levels of education and lifelong learning.

1.4 Access to Higher Education in the Czech Republic

At the turn of the twentieth century and in the first decade of the twenty first century, Czech universities gradually reached the level of accessibility comparable to the European standards; paradoxically, the degree of implementation is at the moment higher than at Czech primary and secondary schools. In 2018, the Ministry of Education, Youth and Sports supports the services for the existing 1988 students who declare specific needs (0,81% of the total number of students) to the amount of 80 million CZK (approx. 3.2 million EUR).

Following the Report on the situation of persons with disabilities, prepared for the Government Board for People with Disabilities (Hruby, 1992), the accessibility process has occurred in several, originally independent, institutional levels:

1. The development of the departments for research and training in special education. Although, their objective was the preparation and training of teachers for inclusive education on the primary and secondary levels, they were also connected to the establishment of the first counselling centres;

2. Pedagogical and psychological counselling centres became a standard at universities which resulted in the foundation of the **Association of university guidance counsellors**;

3. The development of service centres which at first provided technological services (Czech Technical University in Prague, Masaryk University in Brno, etc.) resulted in the foundation of the **Association of the service providers for the students with specific needs at universities** (AP3SP) in 2013.

In the 1990s, Czech universities started using European funds for reno-



vation of their premises and removing the physical barriers in the campuses. In addition, the first support services focused their attention primarily on the accessibility for persons with visual impairments. A particular attention needs to be paid to the case of the Czech Technical University in Prague: Centre Tereza (today a part of the Centre Elsa) was founded as a result of a Tempus project in 1992. The centre provided the accessibility of electronic and physical documents also for blind students of other Prague universities (the separation of Czech and Slovak Federal Republic was the reason for the fact that the same project started a similar centre at Comenius University in Bratislava). At the end of the 1990s the Faculty of Informatics at Masaryk University joined this initiative which laid the foundations for the present Teiresias Centre.

In relation to the Decree No. 155/1998 Coll. on sign language (amended by the Decree No. 384/2008 Coll. to a law on the communication systems of deaf and deafblind persons), the attention of universities at the turn of the 20th and 21st centuries turned to students with a hearing loss. Noteworthy projects from this period include Drama Education for the Deaf at Janacek Academy of Music and Performing Arts in Brno and sign language linguistics at Charles University in Prague. Both of the universities started to provide internal interpreting services to meet the needs of their students. In 2003, the extent of the services at Masaryk University broadened and included also speech-to-text reporting.

The early years of the 21st century brought the turn of attention towards specific learning needs and other invisible difficulties of students. The requirement for more accurate diagnostics culminated in the years 2012-2015 in the development of a new diagnostic test battery – DysTest – standardized for higher education students. In the same time period the extensive investments of the European Social Fund (Education for Competitiveness Operational Programme) enabled the removal of the remaining physical barriers in university buildings and the foundation of service centres at a number of universities, which later formed the association AP3SP.

1.4.1 Czech National Documents on Accessibility of Education

1. Action Plan for Inclusive Education for 2016–2018

The action plan is based on the priorities contained in the **Strategy for Education Policy of the Czech Republic until 2020** and defined in more detail in the **Long-term Plan for Education and the Development of the Education System of the Czech Republic (2011–2015)**.

2. *The Strategic Plan for the Scholarly, Scientific, Research, Development, Innovation, Artistic and Other Creative Activities of Higher Education Institutions for 2016–2020*

This strategic plan is based on the proposal to amend Act No. 111/1998 Coll. on Higher Education Institutions and on Amendments and Supplements to some other Acts (the **Higher Education Act**), as proposed to the Government of the Czech Republic in November 2014. The Priority objective 2, “Diversity and accessibility”, describes situation the Plan strives for, i.e. accessibility of HE to a wide range of students. It envisages that HE institutions will offer a broad and diversified **access to good quality education**: *“The education offers of HE institutions will reflect the needs, interests and possibilities of the wide population of students, including the exceptionally talented. The diversified education will enable the achievement of apparent added value for knowledge, skills and competencies of all students, regardless of their social and economic background, age, nationality, previous educational or professional experience or special needs caused by health or other difficulties.”*

One of the measure to be adopted in order to achieve these objectives is the provision of **financial support for institutions** enabling access for specific groups of students: *“The higher costs incurred by HE institutions which support the study of students with specific needs and problems, including students with lower socioeconomic status, parents with children,*



members of language and ethnic minorities, students with specific educational needs and health difficulties and students enrolled in further education while employed ("specific groups of students") will be compensated in a contribution from the state budget. Financial support will be provided for projects focused on strengthening the capacities for their education, from building barrier-free access up to organising compensatory courses for applicants from socially excluded communities."

1.4.2 Overview of Czech Legislation Related to Accessibility of Higher Education

The key legislative regulations that determine the requirements of accessible higher education in the Czech Republic are the following:

- **Convention on the Rights of Persons with Disabilities**, which entered into force for the Czech Republic on 28. 10. 2009. Due to the fact that the Convention is an international agreement modifying rights and duties of persons (Art. 49, point a) of the Constitution of the Czech Republic), it belongs to the category of so-called presidential agreements and in compliance with Art. 10 of the Constitution of the Czech Republic its ratification requires the agreement of both Chambers of Parliament of the Czech Republic. The Convention was announced under No. 10/2010 Coll. of International Treaties, but the Czech Republic has not yet proceeded to the ratification of the Optional Protocol.

- **Act No. 198/2009 Coll. (Sec. 1–7) on equal treatment** and on legislative means of protection against discrimination and amendments to certain other acts (**Anti-Discrimination Law**). This is the key law, which defines the group of people with disabilities quite widely (according to Sec. 5

there is no doubt that, for example, persons with specific learning disorders and other invisible disabilities are from the point of view of Anti-Discrimination Law persons with disabilities) and grants them very excessive and sometimes not easily implementable rights – it introduces, for example, the possibility of positive discrimination (Sec. 7) and states that it is not discriminatory in the view of Anti-Discrimination.

- **Act No. 155/1998** Coll. (Sec. 7–10) on the **communication systems** of persons with hearing loss as amended by Act No. 384/2008 Coll. (hereinafter only Law on the communication systems). This law defines the use of communication systems of deaf and deafblind persons as their means of communication. For higher education of persons with hearing loss, Sections 7 and 8 (right to free education in special communication systems and to the study of the systems themselves) are relevant. The well-known weakness of the act is the fact that it does not deal with education of the service providers (e.g. sign language interpreters) and the service then cannot be provided due to the lack of providers.

- **Act No. 121/2000** Coll. on copyright or related rights, (**Copyright law**), Section 38 is the relevant provision granting the persons with disabilities a free licence of an electronic or other accessible format of published works which would enable them to access documents published in a format inaccessible to them.

- **Decree No. 64/2008** Coll. on the **form of publishing information** related to the exercise of public authority via **web sites** for persons with disabilities (**Regulation on accessibility**). This Decree (as well as the measures implementing Act No. 81/2006 Coll., which amends Act No. 365/2000 Coll. on information systems of public administration and amending certain other laws) defines the format which the published information should follow to ensure that persons with disabilities are in the necessary extent able to access the information connected with public administration activities published in a form which enables remote access. Thus, the Decree helps persons with disabilities to reach the same or very similar conditions of everyday life as other users. Nevertheless, the rules described in the Decree no longer comply in all respects with the current requirements on real Web accessibility. Thus, even websites which satisfy the Decree may be problematic



for persons with disabilities. Despite these drawbacks, the Decree can be used as a solid basis for a preparation of accessible websites.

- **Decree No. 398/2009** Coll. about general technical requirements securing **barrier-free use of buildings** (Regulation on barrier-free use of buildings). A key legal regulation determining technical requirements for buildings and their parts to secure their use by persons with motoric, visual, hearing and mental disabilities. The bottleneck of the Decree is the pragmatic provisions Sec. 2 and Sec. 14, which enable exemptions from normally mandatory provisions and which are in practice often applied particularly during the renovation of older buildings, including schools, instead of technical adjustment.

Act No. 111/1998 Coll. about universities and on change and amendments to other acts as amended by Act No. 137/2016 Coll. (**Higher Education Act**). The accessibility of higher education institutions is not specifically defined by the law. The only relevant resolutions include Sec. 1, which vaguely refers to the accessibility of university education in compliance with principles of democracy; Sec. 21, which mentions the obligation of schools to publish information of accessibility; and Sec. 78, which also vaguely mentions the obligations a school has in relation to the persons with disabilities when it applies for institutional accreditation.

- **Rules for providing support to public universities** by the Ministry of Education, Youth and Sports, Appendix No. 3 **Financing** increased costs connected with the education of students with special needs. This is a **methodological guide**, which is amended every year. For 2018, the valid amendment is R. No. MSMT-1251/2018-2, p. 27–57. There are two main sources of financing inclusive HE institutions, both enshrined in the same document. Firstly, counselling services and school infrastructures needed for providing counselling and other indispensable services, as arises mainly from the Convention and the Anti-Discrimination Act, Act on the Communication Systems of the Deaf, etc. (i.e. not the service itself), are funded by the same principle that applies to mainstream students. The ministry does not specify the amount of money the individual HE institutions should spend on the necessary service. Secondly, apart from counselling, the mechanisms of financing the increased costs incurred by HE institutions with

regard to incapacities are specified in the Appendix. The document contains a **typology of students with special needs**, which takes into account their disability, and a list of **standardized measures** designed to satisfy the needs of students with disabilities. The procedures result from an agreement between a student, professional service office of the institution of higher education and a representative of a faculty or a study programme based on the student's communicative possibilities. The main aim is to enable the student to successfully progress through the studies both formally and from the point of view of content and to reach the necessary goals of studies, work and/or research.

The above described classification results in the following scale:

- A. Student with visual impairment
 - A1. Screen user
 - A2. Braille/speech output user
- B. Student with hearing impairment
 - B1. Spoken language user
 - B2. Sign language user
- C. Student with mobility impairment
- D. Student with specific learning disorder
- E. Student with autism spectrum disorder
- F. Student with other difficulties

When a university applies for a contribution in connection with this methodological standard, it is obliged to prove that:



1. The institution of higher education is able to guarantee the provision of services satisfying special needs of students;
2. The institution of higher education is able to guarantee a minimum staffing to provide the study of students with special needs;
3. The institution of higher education proves that it has adopted organizational measures.

1.4.3 Summary of Current Status

The Czech legal framework is fragmented and scattered throughout individual documents with different degree of compatibility among them. With exceptions, the rights defined at the highest level are difficult to implement. Their implementation (the implementing decrees and other specific measures) is delayed in relation to more general regulations, and it often fails to satisfy the end users. Focusing purely on the Czech context (i.e. without taking into consideration the international context), the striving for internationalization, and student and staff mobility, the following measures would make a significant improvement:

1. specifying obligations of the HE institutions in terms of accessibility of education in the education law and authorizing the Ministry of Education to issue an implementing decree which would address the service needed in general;
2. changing the current methodological document (the Rules and its Appendices, amended on yearly basis) into a decree in order to turn the existing contribution into guaranteed means of funding;

3. improving professionalism and establishing standardised services in order to share them more easily among institutions and verify the quality;

4. defining more precisely the required competencies of the applicants and graduates on the accreditation level to make clearer whether the medical restrictions are compatible or not with the chosen field of study.

Regarding the European perspective, it is desirable to achieve similar goals at European level and enable **the same standards in the European area**. However, it is impossible in the current political and particularly academic conditions, to circumvent the ongoing process of seeking national solutions and promoting the implementation of additional conventions, whether the regional or national users identify themselves with them or not.



1.5 Access to Higher Education in Italy

There is generally always a close relationship between a national legislative framework on a specific area or theme and the direct effects on citizens' everyday life. In Italy, in relation to the issue of inclusive education this occurs only partially.

Italy, in fact, has an extremely rich and articulated legislative framework on the general subjects of disability and accessibility and on the more specific ones referring to university education and instruction, but very often there is a clear distance between what the laws provide and their applications.

1.5.1 Overview of Italian Legislation

Related to Accessibility of Higher Education

By limiting itself only to the reference legislation on accessibility of the educational system, as we have said, the framework is quite complex. The principal laws (followed by procedures for the updating and application), here given in chronological order to grasp the evolution of the legislative content, are as follows:

- **Law 5 February 1992, No. 104:** *“Legge-quadro per l’assistenza, l’integrazione sociale e i diritti delle persone handicappate”* (Framework Law for the Assistance, Social Integration and Rights of Handicapped Persons): it

guarantees the full respect of human dignity and rights of freedom and autonomy of persons with disabilities and for the first time promotes the full integration in the family, school, work and society in an extensive manner. This is based on the idea of preventing and removing conditions that impede human development, the achievement of maximum possible autonomy and the participation of disabled persons in collective life. The law provides for interventions pursuing the functional and social recovery of those affected by physical, psychic or sensory disabilities, ensuring services and amenities for preventing and overcoming the social marginalisation and exclusion of disabled persons.

- **Law 28 January 1999, No. 17:** *“Integrazione e modifica della Legge-quadro n. 104/1992”* (Integration and Modification of Framework Law No. 104/1992): it integrates Law 104 from 1992, introducing specific instructions relative to activities that Italian Universities must provide to favour the integration of students with disabilities during their university education. Each University is obliged to provide specific services, including technical and didactic aids, specialised tutoring services and individualised treatment to assist with passing exams. In particular, the law imposes that each University Rector delegate a member of its teaching staff with the responsibility for initiatives concerning integration within the University environment.

In particular, this law deserves a deepening in the treatment because it introduces the theme of **national coordination**, probably one of the elements that really contributed to change the collective approach to the issue of disability in Italian universities. Starting from 1999, the delegates of the Rectors to Disability have met in several occasions with the purpose to favour the exchange of experiences and best practices already in place in some Universities. That is until 2001, when the **CNUDD (National University Conference of Delegates for Disability)** was established, the main national coordination body for accessibility to university education of special needs students. Back in January 2002 the CRUI (Conference of the Rectors of Italian Universities) started a cooperation with the CNUDD, also aimed at preparing common guidelines for the Universities, recognizing it as national body of coordination and guidance of all the actions in favour of the students with disabilities. The first Guidelines were drafted, then reviewed in 2014, understood as basic indications to prepare, albeit in accordance



with the independence of each University, suitable and as much as possible homogeneous services, inspired by shared principles of admission, participation, independence and integration of students with disabilities, who should be granted equal opportunities of training, study and research, while promoting the awareness raising of the academic community on the topics of diversity and disability.

Over the years the CNUDD has become increasingly important as a reference body for the Ministry of education, university and research for all that concerns the enforcement of the provisions laid down in Law 17/1999 and, then, in Law 170/2010, the latter concerning the problems with **Specific Learning Disorders** (DSA). The Delegate in fact supervises the utilisation of the funds allocated under Law 17/1999 in his/her University and makes sure that the procedures established by ministerial directives are completed by the set deadlines (in particular the completion of the annual assessment form for the performance of interventions by the Universities). However, the result is that each University, despite applying the same directives and guidelines, can act independently, actually generating an unequal treatment for students with disabilities between the more virtuous Universities and the less virtuous ones.

- **Law 9 January 2004, No. 4:** *“Disposizioni per favorire l’accesso dei soggetti disabili agli strumenti informatici”* (Measures Favouring Access to Information Tools by Disabled Subjects): also known as the “Stanca” Law from the name of its promoter, this law recognises and protects every person’s right to access all sources of information and relative services, including those offered via information technologies and telecommunications. In particular, this law protects and guarantees the right to access information and telecommunications services offered by the public administration and services of public utility without discrimination, even to those who, suffering from a disability, require assisted technologies or particular configurations.

- **DPCM dated 30 April 2008:** *“Regole tecniche disciplinanti l’accessibilità a strumenti didattici e formativi a favore degli alunni disabili”* (Technical Regulations Governing Accessibility to Didactic and Educational Instruments in Favour of Students with Disabilities): it dictates the technical rules disciplining **accessibility to didactic and educational instruments** of Law No. 4 from 2004. In particular, it describes accessibility as the

capacity of information systems to provide services and useful information, without discrimination. It also clarifies the assistive technologies that permit persons with disabilities to overcome and reduce disadvantageous conditions in order to access the services provided by information systems.

- **Law 3 March 2009, No. 18:** *“Ratifica ed esecuzione della Convenzione delle Nazioni Unite sui diritti delle persone con disabilità, con protocollo opzionale, fatta a New York il 13 dicembre 2006 e istituzione dell’Osservatorio nazionale sulla condizione delle persone con disabilità”* (Ratification and Implementation of the UN **Convention on the Rights of Persons with Disabilities – CRPD** –, with an optional protocol, realised in New York on 13 December 2006 and Institution of the National Observatory on the Situation of Persons with Disabilities): with this law Italy committed to ensuring all acts, actions and policies necessary for a decisive change in the strategy for dealing with issues of disability. The CRPD, by focusing the efforts of the State on the rights of persons with disabilities, definitively abandons the vision of non-ability as an illness and works to bring about a cultural change: conveying interventions in favour of those with disabilities from a sector-specific and fragmentary approach toward a global approach to the construction of a fully inclusive society and an environment for all.

With regard to the implementation path of the CRPD, which basically began from this law, it is appropriate to make a reflection. In the period of time following the ratification of the CRPD by Italy, not much has been done so far to implement its contents: the practice and experience that have been witnessed that the cultural change underlying the new approach proposed by the CRPD is not consolidated nor homogeneous on the national territory. Disability continues to be a theme neglected by political agendas, while a medical and welfare approach continues to dominate, far from the principles of accessibility and comfortable and autonomous use of environments, products and services by everyone.

- **Law 8 October 2010, No. 170:** *“Nuove norme in materia di disturbi specifici di apprendimento in ambito scolastico”* (New Regulations Governing Specific Learning Disorders in the School Environment) and relative guidelines: it recognises dyslexia (difficulties in learning to read), dysgraphia (inability to write coherently) and dyscalculia (severe difficulty in



making arithmetical calculations) as **specific learning disorders**, successively known as “LD”. These disorders are manifested in the presence of adequate cognitive capacities, in the absence of neurological pathologies and sensory deficits, which may represent an important limitation to particular daily activities. For those with LD, the law pursues the aim of guaranteeing the right to an education.

- **Ministerial Decree 12 July 2011:** *“Diritto allo studio degli alunni e degli studenti con disturbi specifici dell’apprendimento”* (Educational Rights of Pupils and Students with Specific Learning Disorders) and relative guidelines: it issues **guidelines** for the right to an education of students with specific learning disorders (LD). In particular, the Decree opens up toward a further protection of the right to an education, focused specifically on students with LD, diverse from that foreseen in Law 104/1992. In fact, the type of intervention for exercising the right to an education foreseen in the Decree focuses on individual and personalised teachings, compensative instruments, dispensatory measures and adequate forms of verification and evaluation.

1.5.2 Summary of Current Status

If the Italian legislative framework therefore appears to be widely structured on the themes of accessibility to the educational system, this does not find the same efficiency or homogeneity on the implementation and above all the applicative level in Italian universities.

The current inefficiency is due to the physiological slowness with which the culture of inclusion is able to spread. On the other side, the **lack of homogeneity** is probably due to a set of factors, both of a legal nature, i.e. “legislative federation”, which determines a division of legislative competences between the State and the Regions (which has led to territorial inhomogeneity even between the different definitions of disability), both of the “administrative autonomy” of the Universities, which have teaching, scientific, organizational, financial and accounting independence. Although it is in accordance with national laws and under the coordination of collegiate bodies such as the CUN (National University Council), the CRU (Conference of the Rectors of Italian Universities) and, in particular, the CNUDD (National University Conference on Delegates to Disability).

So, trying to describe the **Italian university system**, the first aspect that emerges is that in Italy the Universities are numerous and **inhomogeneous**: there are 85 Universities, 66 of which are state-run and 19 of which are private. Moreover, there are further 11 online institutions (non-state), for a total of 96 Universities. They often differ widely, not only in size (from Mega Universities with more than 40,000 students, to Small Universities with less than 10,000 students), but also in the quality and quantity of services offered, though all referred to the current national legislative framework. That's why also services favouring the inclusion of students with special needs are very different from one to another.

Starting from this framework, recently Censis, a famous Italian socio-economic research institute, developed a special national investigation on inclusion of university students with special needs (Censis, 2016). The data gathered are particularly significant for their vastness and methodological

rigour. In particular, the coverage of 45 universities with respect to the total number of students enrolled in a university program for the academic year 2014-15 (the year examined by the study) is equivalent to 74.2%: hence while a reading of the data provides only a partial vision of the phenomenon in absolute terms, it is however significant in relation to present trends and the incidence of the phenomenon in Italy.

The report from Censis (2016) points out how over the past decade the **number of students with disabilities** attending Italian universities has grown consistently: during the academic year 2014-15 alone the number of enrolled students with LD amply exceeded the threshold of 12,000 individuals (12,826), with an increase of 11.2% over the course of three years. This process may be a result of:

- processes of reform dealing with the structure of secondary educational programmes and the consequent effects on the continuation of studies by the two typologies of students mentioned above;
- recent legislation supporting the inclusion and full exercising of the rights of citizenship by students with disabilities and LD.

If current Italian legislation is a symptom of a **diverse cultural approach** to the issue, it has also promoted further changes in social attitudes, increasing the awareness and maturity of diverse stakeholders, first and foremost the families of students with disabilities and LD. This has triggered a sort of virtuous cycle supporting the inclusive potential of the Italian university system.

Moreover, the enrolment of students with disabilities is constantly on the rise. This trend, contrary to general enrolment and registration numbers, witness to a contraction during the three-year period 2012-14 of more than 4 percentage points (-4.4%), led on average in 2014 to a total of 8.6 students with disabilities for every 1,000 students enrolled (considering a "disability level" greater than 66%, in a disability scale from 0 to 100%).

The disaggregation of the average regional value reveals how the incidence of students with disabilities is significantly higher than the average value in universities in the central part of the country, aligned with the analogous higher number of these students in the secondary school system.

Relative to the size of the Universities, in terms of enrolment and registration figures, there is a greater incidence of students with disabilities in smaller schools whose total number of students does not exceed 10,000.

A further aspect considered by the survey from Censis was the presence of individuals with disabilities among those who go on to earn their diploma: in this case the so-called mega-universities present a value of almost 6 students per every one thousand (5.9 per 1,000), higher than the corresponding national average of 5.

It would thus appear that the smaller universities are more attractive to students with disabilities, also because they are logistically “easier” and “closer”, being greater in number and distributed across the country. That said, they are not distinguished for their performance in supporting a successful education.

A further reflection must be made for specific learning disorders, considering that solely among the 45 universities examined, the number of registered students with LD rose from 1,303 individuals during the academic year 2012-13 to 2,619 in 2014-15, marking an increase of +101%. The university system must thus face up to the considerable speed at which Italy is recognising and certifying this type of disorder, which is acquiring growing visibility and numerical consistency, despite continuing to be inferior (1.6 for every 1,000 students registered in 2014-15) to the incidence of students with disabilities.

While this emersion and growth of the presence of students with disabilities and LD is destined to settle with time, in the coming years it will nonetheless have a significant impact on the university system that, other than optimising its services of welcoming, orientation and specialised tutoring, will be increasingly asked to extend further connections with the secondary school system, more than it is doing at present, with the objective of reinforcing its capacity for inclusion and containing the risk of the dissipation of potential human capital represented by the aforementioned typologies of students.



1.6 Access to Higher Education in Slovakia

The situation in Slovakia in terms of inclusion of people with disabilities in higher education is still not very satisfactory in comparison with other European countries. There are 20 public universities, 3 state universities and 12 private universities in Slovakia. In 2017, the overall number of students at Slovak universities was approximately 130 000. Currently, there are relatively low numbers of students with specific needs¹ at Slovak universities. However, their number is increasing every year. According to the data in Central register of students (as of November 2017), there are **1011 students with specific needs**, which accounts for **0.78%** out of the total number of students studying at public universities. On the other hand, several surveys reflect vested interest of secondary school students with specific needs in studying at universities. This discrepancy is caused mainly due to the insufficient physical and information accessibility of academic environment, and also because of the lack of support centres for students with specific needs.

The issue of accessibility to higher education for students with specific needs in Slovakia began to develop significantly in the 1990s. Some universities systematically supported students with disabilities at that time. The first **specialized centre focusing on the support for students** with visual impairments was established at Comenius University in Bratislava in 1993. Later, the Access Centre was established at the Technical University in Kosice in 2000. Both of the above mentioned centres provide consultancy activities and support services for students with specific needs. These centres also work as the coordination and education centres of nationwide importance. Afterwards, the support centres for students with specific needs were established in several other public universities (8 of them out of totally 20 public universities). In 2008, the research and training Centre of Design for

¹ Slovak legislation (e.g. Higher Education Act) uses the term “*specific needs*” instead of “*special needs*”.

All (CEDA) was established at the Faculty of Architecture, Slovak University of Technology (FA STU) in Bratislava. CEDA members have been dealing with the issues of universally accessible environment and have been organising education programs on inclusive/universal design since 1997.

The major development of accessible higher education in Slovakia started in 2013, which was supported by the Ministry of Education, Science, Research and Sport (Ministry). In 2013, the Ministry established the **Committee to Support of Students with Specific Needs**. Its main role is to deliver systematic solutions for studies of students with specific needs. A new legislation amendment was passed, barrier identification processes were supported and accessibility adaptations with the help of state subsidies began. The overall situation improved after the introduction of the **support service subsidy** for universities according to the number of students with specific needs.

The Ministry elaborated the **Report on the State of Education in Slovakia and on Systematic Steps for its Further Development** (Report) of 2013 that also describes the accessibility situation. In the Report objective, there is a need to create *“school system accessible to everyone”*. One of the fundamental principles is a need to guarantee inclusive educational environment. As the main insufficiency, the Report identifies barriers preventing people with disabilities or social disadvantages from access to education. According to the Report, serious barriers are the **architectural, information and personal barriers**. The role of universities is to actively identify the barriers and take measures for their removal. The next issue in the Report is **lack of the support services** and their underrated personal and financial coverage, as well as lack of study resources in suitable formats for students with visual impairments.



1.6.1 Slovak National Documents on Accessibility of Education

The first comprehensive document on improvement of social inclusion of persons with disabilities was passed by the Government of the Slovak Republic in 2001 as: National Program for Development of Life Conditions of Persons with Disabilities in All Areas of Life.

The new **National Program for the Development of Life Conditions of Persons with Disabilities for the years 2014-2020** (National Program) was created in accordance with UN Convention on the Rights of Persons with Disabilities (CRPD), which was ratified by the Slovak Republic in 2010. The National Program defines roles and measures leading to implementation of particular requirements stipulated in CRPD. One of the fundamental requirements is provision of accessibility to the built environment, transport, information, services and products and to education. The National Program defines the following roles related to accessibility to higher education:

- *To pass National Action Plan for Creation of Accessible Academic Environment and Suitable Conditions for Students with Specific Needs;*
- To systematically support networking and education of coordinators for students with specific needs;
- To propose and introduce a system for evaluation of a number of students recognized as persons with specific needs in Central Student Register.

Accessibility to higher education is emphasized as one of the objectives in the **Program Declaration of the Government of the Slovak Republic for 2016-2020:**

"The strategic objective of the Government is an effective higher education system as the stable part of the EU higher education system and

of the EU research area which provide higher education on a high level of international standards, accessible for all citizens who demonstrate preconditions for its successful completion". (Program Declaration, p. 35)

The Government is also committed to taking measures for support of students with specific needs, especially committed to foster of establishment and development of the support centres for these students.

In November 2016, the Government of the Slovak Republic approved the **Long-term Plan for Education, Research, Development and Other Creative Activities for the Higher Education for 2016 – 2021**, which provides for one of the basic priorities for the coming years to ensure accessible higher education, underlining the need to promote active policies to remove barriers to access to higher education. It is very important to create conditions for students according to their needs (flexible organization of study, availability of support services, etc.), emphasizing the need for universal accessibility of educational environment.

1.6.2 Overview of Slovak Legislation

Related to Accessibility of Higher Education

The fundamental right to education is enshrined in the **Constitution of the Slovak Republic** No. 460/1992 Coll. Code. The equality principle and discrimination prohibition is stipulated in Article 12. The right to education is defined in Article 42: *"Citizens shall have the right to free education at primary and secondary education level, and depending on the abilities of the individual and the potential of the society also at higher education level".*

The **Antidiscrimination Act** (No. 365/2004 Coll.) prohibits any kind



of discrimination on the grounds of disability principle and stipulates an obligation to maintenance of equal treatment in education.

Following the ratification of **UN Convention on the Rights of Persons with Disabilities** (CRPD) in 2010, the Slovak Republic is legislatively obliged to execute inclusive education on all levels of education and accessibility to the built environment, products, services, information and communication.

Accessibility to higher education is stipulated in Act No. 131/2002 Coll. on Higher Education (**Higher Education Act**). In compliance with the Act, as of 1 January 2013, universities in Slovakia (Sec.100, Item 1) are obliged to create generally **accessible academic environment** also by creating suitable conditions for students with specific needs without decreasing requirements for their education output. Higher Education Act (Sec.100, Item 2) defines **students with specific needs**² as students who have:

- a) Sensory, physical and multiple disability/impairments;
- b) Chronic illness,
- c) Health impairment,
- d) Mental disorder,
- e) Autism spectrum disorder or other pervasive developmental disorders;
- f) Specific learning disorder.

Students with specific needs are entitled to **support services** according to Higher Education Act (Sec. 100, Item 4), e.g. to specific educational methods and individual educational procedures. In order to provide adequate support for students with specific needs, there are coordinators or support centers (Sec. 100, Item 7) at universities.

² Note: in 2012, in Higher Education Act, the term "student with disability" was replaced by the term "student with specific needs".

The details on **minimum requirements for a student with specific needs** are stipulated by Decree No. 458/2012 Coll. of Ministry of Education, Science, Research and Sport, effective as of 1 September 2013. The Decree specifies minimum spatial, material and other requirements related to education of students with specific needs. The Decree does not provide a comprehensive overview on requirements of particular groups (according to the types of disability) of students with specific needs.

Legislation Related to the Accessibility of Information and Study Resources

Decree No. 458/2012 Coll. on minimum requirements for student with specific needs is a significant document, which stipulates also requirements for **access to information and study resources** for students with specific needs (especially for students with sensory impairments).

The annex to the Decree No. 458/2012 Coll. defines minimum requirements in details, for example for the student with sensory impairment:

- Access to study-related information (with use of assistance technologies);
- Making accessible work possible in academic information system;
- Access to information and resources of academic library (with use of assistance technologies);
- Provision of support for access to basic study resources, lecture documents and exercise assignments;
- Provision of support for access to study resources in accessible form.



Making information systems accessible to persons with specific needs is stipulated in **Act No. 275/2006 Coll. on Information Systems of Public Administration**. Based on the Act, **Ordinance No. 55/2014 on Standards** for Information Systems of Public Administration was issued by the Ministry of Finance of the Slovak Republic. The Ordinance specifies the standards on accessibility of websites in detail in Annex 1.

Act No. 211/2000 Coll. on Free Access to Information, empowers persons with sensory impairments to request public institutions to provide them information in accessible formats. Communicating with each other and communicating with hearing persons is guaranteed to the deaf people through the sign language interpreter also by Act No. 149/1995 Coll. on the Sign Language for Deaf People and Act No. 448/2008 Coll. on Social Services.

Legislation Related to the Accessibility of the Environment

The basic requirements for accessible built environment were incorporated into modifications and amendments of **Act No. 50/1976 Coll. on Land-use Planning and Building Order (Building Act)**. The first decree concerning the accessibility to the built environment was passed in 1994 (Decree No. 192/1994 Coll.), which took into account especially requirements of persons with physical disabilities.

The current legislation related to accessible built environment is stipulated by the **Decree No. 532/2002 Coll.**, which specifies details on technical requirements for the construction and on general technical **requirements for buildings used by persons with limited mobility and persons with limited orientation ability**. In contrast to the previous Decree, the current Decree partially takes into account requirements for persons with limited ability of spatial orientation (e.g. persons with sensory impairments). However, the Decree does not specify requirements on accessible solutions for school buildings; it only focuses on general requirements for accessibil-

ity of public buildings, e.g. accessible entrance solutions, sanitary facilities, circulation premises (lift, stairs, and ramp) and basic requirements on the solution of assembly premises.

The Slovak building legislation has not yet welcomed the issue of universal accessibility and has not created a complex document, which would comprehensively specify requirements for particular typological kinds of buildings, taking into account a wide spectrum of users. The Slovak building legislation is currently going through the process of legislative amendments. Therefore, it is essential to urge fulfilment of commitments emergent from CRPD and to implement the principles of Universal Design into legislation. The Slovak Republic has signed Optional Protocol to CRPD whose aim is to monitor compliance with provisions in CRPD in particular contractual countries. Due to these tools, life and social conditions of persons with disabilities are meant to improve significantly.

1.6.3 Summary of Current Status

The first phase of the UNIALL project was focused on the monitoring and evaluation of accessibility to higher education. In Slovakia, the team CEDA FA STU conducted on-site surveys of selected 14 public universities (including 43 school buildings and 10 student dormitories) in 2015 – 2016. The students of the Faculty of Architecture STU were involved in **monitoring and evaluation of the physical accessibility** of higher education institutions.

The research results pointed out the unsatisfactory condition of accessibility to higher education in Slovakia because none of the evaluated school buildings and none of the student dormitories meet the overall ac-



cessibility criteria of the physical environment. The worst situation was documented in the accessibility of student dormitories, of which 90% of the total number of evaluated buildings did not meet the accessibility requirements, notably there were no accessible rooms and bathrooms for person in a wheelchair. The situation with accessibility of school buildings in comparison with student dormitories is better; the unsatisfactory conditions were evident in the case of 46.51 % buildings of the total number of evaluated objects (Ceresnova et al., 2017).

Within the UNIALL project, the Support Centre at Comenius University realised the **accessibility testing of information and communication systems** of selected Slovak universities (websites, online library catalogues and academic information systems) in 2016. They tested 47 websites, including 43 school websites, and 4 on-line catalogues of university libraries. Moreover, they tested 5 types of academic information systems used at Slovak universities.

The main reasons/barriers that currently prevent access of students with specific needs to Slovak higher education include (Ceresnova et al., 2017):

- Existence of physical/architectural barriers at many universities (46.51 % of school buildings and 90% of student residences were not universally accessible in Slovakia);
- Insufficient accessibility of information and communication systems (94% of Slovak academic websites and information systems had a very low accessibility level);
- Lack of the support centres for students with special needs (60% of Slovak higher education institutions had no support centre);
- Absence of strategies, development programs and action plans related to the improvement of the conditions for the study of students with special needs;
- Lack of well-trained staff – university teachers and the coordinators for students with special needs;

- Lack of inclusive pedagogical strategies based on the student-centred approach
- Attitudinal barriers of the academic staff not able to accept students with disabilities in some cases.



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2

INCLUSIVE METHODS

2. Inclusive Methods

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Some recent demographic and social phenomena require the need to develop new design approaches that foster social inclusion and enhance human diversity. A synthetic definition of these phenomena contextualizes the description of the most widespread design approaches for inclusion, highlighting their common points and differences.

Inclusion: Why?

The social theme of inclusion in recent years has assumed increasing value. This is also due to social and demographic phenomena that appear to be emerging, sometimes even with dramatic implications, precisely because of their size and speed of development.

We refer, for example, to an **aging population**. This is a phenomenon that manifests itself above all, but not only, in Western societies. Some data in this regard are even alarming. The world population of 9 billion people expected for 2050 (UN, 2009), in fact, will consist of about 2 billion from “over 65” (Lee, 2003). In particular, it is estimated that in Europe and in China in 2050 the “over 65” will reach 30% of the population, while in Japan the “over 80” will represent even 40% of the population (Lee, 2003). This phenomenon, internationally known simply as “aging” (Magnus, 2008), is fundamentally due to two factors: on the one hand, the increase in life expectancy, which will increase from the current 65 years, as a world average, to 74 years in 2050 (In Italy, first country in Europe, it is already 82 years); on the other, the parallel decrease in the average global fertility rate, which will fall from the current 2.7% to 2% in 2050 (Lee, 2003).

The drastic reduction of people of working age that will derive from this demographic dynamic will entail the need to revise the traditional welfare systems widely to support a growing “old” society, in search of new solutions to favour the temporal extension of active living conditions. The second consequence of aging will be the increase in pathologies, even partially disabling, linked precisely to the aging of the population (chronic degenerative diseases and mental illnesses, reduction of sensory capacities, reduced mobility, etc.). In fact, most observers³ expect a society marked by disability for the coming decades: a great increase in non-self-sufficiency, with all the economic, social security, welfare and anthropological consequences that this entails.

A second **demographic and social phenomenon** that is being witnessed on a global scale is the migration from the poorest to the richest areas of the world. The greatest effects are felt especially in strongly urbanized areas, where the concentration of individuals favours the formation of multicultural and multi-ethnic social groups. In this context, diversity of religions and life styles, as well as ethnic and linguistic ones are emerging, and that often are also a source of strong social tensions, especially if they occur in times of economic crisis. Moreover, foreign immigrants in the rich-

³ “The demand for assistance is destined to increase exponentially in the coming decades with significant impacts not only on welfare systems but also directly on citizens” (Italian Ministry of Labor, 2010).

est countries will also probably be the main agents of the new urban development dynamics that in the coming decades will be able to upset even the micro and macro economic and social structures of the entire planet.

Finally, a third but important demographic phenomenon now widely known is the depopulation and abandonment of rural and mountain areas and, more generally, of areas without those infrastructural systems that technological development associated with well-being would require. In fact, more and more new generations are struggling to find incentives and interests in these territories for real life and professional investments, and therefore there is a strong tendency towards professional and often also housing migration, as soon as they drop out of school. This takes away vital resources to the populations of specific territories, depriving them of the capacity for endogenous economic and social development, and therefore in turn promoting, in a dangerous chain effect, also the slow decline of their already fragile and limited local infrastructural systems.

Aging, disability, multi-ethnicity and multiculturalism, migration and abandonment of territories without infrastructure: these are therefore some of the most relevant phenomena that characterize contemporary society and which will presumably increase in intensity in the coming decades, especially in countries with more mature economies.

Moreover, the economic crisis of recent years has in many cases exacerbated the effects of the underway socio-demographic phenomena, highlighting tensions and conflicts between groups, cultures and territories.

The sociologist Bauman (2000, 2005), on the other hand, has for some time proposed a different (and in some respects positive) interpretation of contemporary society, characterized by what he calls "social liquidity"⁴, which more and more probably will be expressed as multiculturalism, multi-ethnicity, multi-ageing, multidimensionality, multitasking, in which social inclusion will be a necessity, if not a new opportunity, to develop new visions, new strategies, new tools and approaches aiming at health and wellbeing.

⁴ See, from Zygmunt Bauman: *Liquid Modernity*, 2000; *Liquid Life*, 2005.

Therefore, it can be assumed that the issue of inclusion has primarily **political implications**: President Obama already a few years ago, during his mandate, proposed the fight against social inequalities as a necessary step also to relaunch the economy; the European Union, in the Horizon 2020 program, has assigned a central role to the strategies aiming at strengthening the equality and participation of all people in society, as well as the accessibility to environments, products, services and opportunities of everyday life.

Design for Inclusion: How?

In this complex and sometimes contradictory framework are placed the **different design approaches** related to and aimed at social inclusion. Actually, the expression "Design for Inclusion" was used for the first time just in 2016, for the "First International Conference on Design for Inclusion"⁵, when they were looking for an expression to collect all these different approaches (Di Bucchianico and Kercher, 2016). Being inspired from the difficulties and therefore the needs expressed by people with disabilities (which in large part still today are satisfied by extremely specialized design areas referred to aids, prostheses and adapters for specific disabilities), they have developed with their own identities, starting from early 80s of the last century, to enhance human diversity, considering it a resource rather than a constraint, useful to obtain solutions that are richer, innovative and therefore more attractive.

Actually, the interest in this issue began as early as the 1950s, with a new sensitivity towards disability. In Europe, Japan and the United States, attention has been paid to the "barrier free" design, i.e. the removal of those barriers that represent real obstacles to the autonomous use of the built environment for people with physical disabilities, who finally started to exit from institutional structures (mainly marginalized) to integrate into wider social contexts. So, in the 1970s, parts of Europe and the United States began to overcome the idea of developing "special and disabled" design solutions,

⁵ AHFE 2016 First International Conference on Design for Inclusion, July 27-31, 2016, Orlando, FL, USA.



focusing instead on integrated and standardized solutions. In fact, in those same years, an American architect, Michael Bednar, introduced the idea that the functional capabilities of each can be improved when the environmental barriers are removed, suggesting that it is necessary to introduce a new, broader and **“universal” concept of accessibility** (Bednar, 1977).

So, if the **Universal Design and Human Centred Design** were the first approaches to be developed with respect to the expanded accessibility theorized by the 1970s, a subsequent extension of those same principles allowed the subsequent development of new design approaches, such as the Inclusive Design and Design for All. They, on the whole, define a rather articulated system of principles, methods and tools, but aimed at a common goal: the wellbeing and dignity of individuals, communities and peoples, considered a strategic and indispensable topic for the sustainable development of contemporary societies, in which everyone should have the same possibilities for using environments, products and services.

These are approaches that have evidently had different evolutionary paths, and therefore have numerous points in common (especially in the objectives and goals) but also different and distinctive features and characteristics, not only for their geographic location, but above all for the relationship that through them are established between the designer, the development of the design process, the project stakeholders and, obviously, its final recipients.

2.1 Human-Centred Design

The Human Centred Design (HCD) can actually be considered as the most important goal achieved by the scientific community of ergonomics for what concerns the design of environments, products and systems. This is primarily a concept, but it has been ratified in its meanings and application protocols also by a series of ISO standards, which are the result of an evolution that has been historicized in almost thirty years.

Since the end of the 1980s, in fact, thanks to the scientific community of ergonomics, a true methodology has been developed, defined precisely as **User Centred Design** (UCD). It was useful to design taking into account the point of view and the needs of product users. The UCD proposed a structured process based on the use of different tools for analysis or observation, planning and subsequent verification of the results achieved.

The process, initially defined and described by various research groups in the context of international ergonomics conferences, has been standardized successively through some standards. Among them is the famous ISO13407 (Human-centered design processes for interactive systems), defined in 1999, and initially referred mainly to the IT development of digital products, but later also extended to the design of industrial products. Basically, the ISO 13407 articulated the **UCD process in four main activities**:

1. Understand and specify the context of use;
2. Specify the user and organisational requirements;
3. Produce designs and prototypes;
4. Carry out user-based assessment.

The importance given by the standard to two phases of analysis before the development of design solutions is evident. The context of use is in fact considered necessary to identify who will use the product, in what way and under what conditions; the product requirements, on the other



hand, focus on both the tasks that users will have to complete and, on any business, and marketing objectives. Only at this point the traditional design activity begins, through a series of steps ranging from early brainstorming and sketches on paper to models and prototypes.

But the really innovative concept introduced in the UCD design process is the verification of the product, in particular with real users, through usability tests, which can be articulated in rather complex activities that use **different techniques and tools**, such as interviews, questionnaires, inspections, cognitive simulations and observations in the field or in the laboratory, often requiring the involvement of special skills for each of them.

It is only recently, with the standard ISO 9241-210: 2010, entitled "Ergonomics of human-system interaction - Part 210: Human-centered design for interactive systems" (published in 2010, but reviewed and confirmed only in 2015) that the transition from the "User" to the "Human" Centered Design is carried out.

The new standard defines the **Human Centered Design** as *"... an approach to interactive systems development that aims to make systems usable and useful by focusing on the users, their needs and requirements, and by applying human factors/ergonomics, and usability knowledge and techniques. This approach enhances effectiveness and efficiency; improves human well-being, user satisfaction, accessibility and sustainability; and counteracts possible adverse effects of use on human health, safety and performance."*

In particular, from the first notes of ISO 9241 it is specified that: "the term 'human-centred design' is used rather than 'user-centred design' in order to emphasize that this part of ISO 9241 also addresses impacts on a number of stakeholders, not just those typically considered as users. However, in practice, these terms are often used synonymously."

Apparently, therefore, the new standard (ISO 9241) is officially considered only as a technical revision of the previous one (ISO 13407). Actually it is not like that. If, on the one hand, it takes up the structure, making mainly changes in terminology, sometimes seemingly derisory and formal, on the other hand such changes are the result of a substantial cultural change: from

the terminological point of view, in fact, moving the focus **from the user to the person**, it means considering the recipient not only as a user, but as a carrier of needs, desires, emotions that go beyond the most functional aspects.

2.2 Universal Design

Both the UCD approach and the next HCD, in their laws declinations are not explicitly and programmatically focused on inclusion issues. On the contrary, by their nature, they tend to refer to the “standard” user/individual, unknowingly putting partially aside the value and the opportunities that can derive from an appreciation of human diversity.

In the same years, however, a basis of awareness began to be formed on the need to deal with this concept, which only in recent years has assumed a central, strategic and transversal role in all project practices.

The first steps in this direction have taken place with the **Universal Design** (UD): that was coined in 1985 by architect Ronald L. Mace, coordinator of a research centre at the North Carolina State University that took the name of “Center for Universal Design”. His research group consisted of architects, designers, engineers and researchers in the field of environmental design⁶. With this term, Mace intended to summarize the concept of ideal design of all artificial products and environments, such that they are enjoyable and usable, as far as possible by everyone, regardless of their age, ability and/or social condition. In fact, he defined Universal Design as “... *the design of products and environments that can be used by everyone, in the greatest possible extension, without the need for adaptations or special aids.*” Mace also pointed out that Universal Design “... *is not a new science, a style, and it is not unique. It requires only knowledge of the needs and the market and a common sense approach because we all design and produce goods that can be used by as many people as possible.*” (IHCD, 2016)

Actually, Universal Design emerged from the slightly earlier concepts promoted by the US “barrier-free” movement mentioned before, referring to the accessibility of living environments and new technologies that in those years began to spread to all levels of daily life.

⁶ Among the main collaborators and colleagues of Ronald Mace are mentioned: Bettye Rose Connell, Mike Jones, Jim Mueller, Abir Mullick, Elaine Ostroff, Jon Sanford, Ed Steinfeld, Molly Story and Gregg Vanderheiden.

The initial methodological approach, thanks to a loan from the US Department of Education's National Institute on Disability and Rehabilitation Research, assumes in 1997 its own structuring, with the definition of **Seven principles of Universal Design** (NCSU, 1997) developed within the research centre at the North Carolina State University, coordinated by Mace. Each of them can be associated with a group of design guidelines:

- **Principle 1 – Equitable Use:** the design is useful and marketable to people with diverse abilities:
 - a. Allows the same use to all users: identical when possible, otherwise equivalent;
 - b. Avoids exclusion or penalization of any user;
 - c. The conditions of privacy, security and safety should be equivalent for all users;
 - d. Makes the project attractive to all users.
- **Principle 2 – Flexibility in Use:** the design accommodates a wide range of individual preferences and abilities:
 - a. Allows the choice of the method of use;
 - b. Allows access and use with left hand and right hand;
 - c. Facilitates accuracy and precision of the user;
 - d. Provides adaptability to the characteristics of the user.
- **Principle 3 – Simple and Intuitive Use:** use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level:
 - a. Eliminates unnecessary complexities;
 - b. Corresponds to the expectations and intuition of the user;
 - c. Provides a great variety of reading and comprehension alternatives;



- d. Structures the information consistently with their importance;
- e. Provides suggestions and signals during and after user actions.

- **Principle 4 – Perceptible Information:** the design communicates necessary information effectively to the user, regardless of ambient conditions or the user’s sensory abilities:

- a. Uses different methods (visual, verbal, tactile) for a redundant presentation of the essential information;
- b. Provides adequate differentiation between essential and secondary information;
- c. Maximizes the readability of essential information;
- d. Differentiates the elements so that they can be described (facilitating the issuance of instructions and directives);
- e. Provides compatibility with a variety of techniques and devices used by people with sensory limitations.

- **Principle 5 – Tolerance for Error:** the design minimizes hazards and the adverse consequences of accidental or unintended actions:

- a. Places the elements to minimize risks and errors: the most used elements are more accessible; the most risky elements are eliminated, isolated or protected;
- b. Provides warnings on risks and errors;
- c. Provides elements of protection;
- d. Discourages unintentional actions or requiring alertness.

- **Principle 6 – Low Physical Effort:** the design can be used efficiently and comfortably and with a minimum of fatigue:

- a. Allows to maintain a neutral position of the body;
- b. Requires a reasonable activation effort;

- c. Minimizes repetitive actions;
- d. Minimizes the physical effort supported.

● **Principle 7 – Size and Space for Approach and Use:** appropriate size and space is provided for approach, reach, manipulation, and use regardless of user's body size, posture, or mobility:

- a. Provides a clear view of the important elements for any seated or standing user;
- b. Makes comfortable achieving all the components for any user sitting or standing;
- c. Allows variations in the size of the hands and the handle;
- d. Provides adequate space for the use of assistive devices or personal assistance.

Starting from the North Carolina State University, Universal Design has rapidly spread, especially in the Pacific Rim Countries⁷, both for the strong message that it brought with itself, and for the apparent simplicity of application, through the limited and clear series of design "principles", applicable in the widest number of design areas and verifiable through a checklist.

Universal Design therefore expresses a fundamental objective of good theoretical and design practice: responding to the needs of the greatest number of possible users. In fact, this design methodology does not express a set of dimensional requirements, conforming to codes, norms or special characteristics of specific users with disabilities, but expresses the tension to a "value" objective, to general principles of design, which are simple to be applied and verified. Universal Design, in fact, does not focus only on people with disabilities, but for the first time it defines the user extensively and suggests to make all products and spaces accessible and usable by people to the greatest extent possible. Not everything must necessarily

⁷ "Pacific Rim" is a term used by political geography to indicate the set of all states and dependent territories whose coasts are located along or within the "edges" of the Pacific Ocean.

be completely usable by everyone: the term “universal” refers more to the methodological attitude than to a rigid and absolute assumption.

Universal Design provides pragmatic solutions. The didactic reduction of the approach to seven design principles is of simple application and therefore of rapid diffusion throughout the world. Universal Design is criticised that sometime it tends to schematizing of the design activity and above all not to take into account participation of the individuals in the design process. Moreover, the definition of project verification tools, often constituted by simple checklists, if on the one hand are useful for guiding the design process and for educating designers on the characteristics that products and environments should have, on the other hand they prepare to a simple action of evaluation and verification “a posteriori”, on existing projects or in any case already in an advanced stage of development, rather than representing an inspiring concept. Architects and designers also tend to consider that Universal Design is something ancillary and not integral part of the concept. Ostroff (2011, p.34) emphasizes that: *„Contrary to the assumption that attention to the needs of diverse people limits good design, the results of imaginative designers around the world reveal a wide range of applications that delight the senses and lift the human spirit when “universal design” is integral.“*

Steinfeld (2014), together with his colleagues, believes that a stronger acceptance of Universal Design in practice can be achieved by placing greater emphasis on social participation, focusing on health and well-being, recognizing the role of the context of the environment, and conceptualizing universal design as a process rather than as a set of rules. Therefore, they propose the following definition: *“Universal Design is the process that empowers diverse people by improving their performance, health, well-being and social participation in the environment.“*

2.3 Inclusive Design

The term Inclusive Design was used for the first time in 1994, during the Ergonomics congress in Toronto, Canada (Coleman, 1994) and since then widely used mainly for the design implications deriving from the aging of the population and disability, where these are considered as mainstream for new design challenges oriented towards unprecedented market opportunities.

Actually the **Inclusive Design** has its main centre of development in the United Kingdom and indeed its first steps coincide with the establishment of a major research centre in London, the Helen Hamlyn Centre of the Royal College of Art. Subsequently, this approach has widespread especially in the countries of English influence, with major research centres in Canada and Australia.

Unlike Universal Design, Inclusive Design does not set specific design principles, but defines a careful approach to human diversity and is based on the idea that no criterion, principle or guideline can be absolute but must always be confronted with the multiplicity of users, contexts and objectives. Inclusive Design, in fact, considering the widest range of skills, languages, cultures, genres, age and all the other possible forms of difference between users, bases its approach simply on **three “dimensions”**:

- **Dimension 1 – recognize diversity and uniqueness among individuals.**

Inclusive design always considers the diversity and uniqueness of each individual. The statistics has made us generally refer to the average values of a given parameter, but the same statistic actually teaches us that considering a given population, those that correspond exactly to the average value represent only a small minority: it is also true that, if we consider the set of needs and desires that a community can express as a whole, most people move away from the average in some aspect of their needs or aspirations. This means that a “standard” design solution can actually satisfy only a few individuals. On the contrary, **flexible or adaptable solutions** respond better to the needs expressed by human diversity. However, this does not



mean pursuing individual and specialized solutions (with the risk of being segregating as well as expensive and inefficient). In fact, inclusive design pursues self-determination and the enhancement of self-consciousness, in the idea that diversity is a value.

- **Dimension 2 – inclusiveness of design tools and methodologies.**

The design process and the tools used in it are inclusive. Diversity is the strength of inclusive design teams, which should **include individuals** with the experience of “extreme users”⁸ (Donovan, 2012) which the projects are intended to. People with disabilities must therefore play an active role in the design process (also with reference to the motto “nothing about us without us”), and not limit them to the task of research subjects or symbolic participants in design exercises (Eikhaug et al., 2010). To facilitate the diversified and at the same time proactive **participation** of everyone in the design process, design and development tools should also become as accessible and easy to use as possible without reducing or limiting the professional role of the designer.

- **Dimension 3 – extent of the impact in terms of benefits.**

Being aware of the real application context of an inclusive project, it makes possible to extend its positive impact and benefits well beyond the target to which the project initially is referred. Inclusive Design, in fact, should trigger a virtuous circle of inclusion, eliminate any physical and cultural limits and enhance the **interconnection between users and systems**. Extending the principles of Inclusive Design to all dimensions of the project and to all aspects of society contributes to making the society itself richer and healthier (Wilkinson and Pickett, 2009).

On this basis, however, various bodies and organizations have defined their own set of project principles to be followed. For example, the UK Commission for Architecture and the Built Environment defined the following **Inclusive Design Principles** (CABE, 2006):

⁸ Term was coined by Rich Donovan, a world expert in business economics related to disability.

1. Inclusive Design places **people at the heart of the design process**: in order to design spaces and environments accessible to entire dynamic and sustainable communities, the greatest number of people involved in the planning phase must be involved. This will help to promote personal well-being, social cohesion and enjoyment for all.

2. Inclusive Design acknowledges **diversity and difference**: good design is achieved only if the environment created satisfies as many people as possible.

3. Inclusive Design **offers choice** where a single design solution cannot accommodate all users: an inclusive environment does not try to satisfy every need. However, considering the diversity of people, it is possible to break down barriers and exclusion and often to obtain more interesting and beneficial solutions for everyone. Taking account of the needs of people with disabilities within the design process, even in their lack of homogeneity, it is possible to guarantee benefits for everyone.

4. Inclusive Design provides for **flexibility in use**: satisfying the principles of inclusive design requires an understanding of how the building or space will be used and who will use it. Places must be designed so that they can adapt to changing uses and demands.

5. Inclusive Design provides buildings and environments that are **convenient and enjoyable** to use for everyone: making environments easy to use for everyone means also considering signage, lighting, visual contrast, materials, referring to all parts of the building or space, including access roads and entrances.

Following these principles, in the perspective of the inclusive design, it will be possible to identify solutions that are:

- **Inclusive**, in the sense that everyone can use them safely, simply and with dignity.
- **Reactive**, compared to what people say they actually need and want.
- **Flexible**, to be used in different ways by different individuals.



- **Suitable**, to be used by everyone without too much effort or marginalization, regardless of age, gender, ethnicity, motor skills and cognitive or momentary conditions.
- **Welcoming**, that is without disabling barriers that could exclude some people.
- **Realistic**, in the sense that offering more than one solution allows us to intercept the needs of all and therefore recognize that a single solution may not work for everyone.

2.4 Design for All

Design for All (DfA) has been briefly defined as the “*design for human diversity, social inclusion and equality*” (EIDD Stockholm Declaration, 2004). It represents the concrete application both of a philosophical, social and **political assumption** (according to which everyone must have equal opportunities for participation in every aspect of society), and of a **scientific assumption** (“Good design enables, bad design disables”, P. Hogan). DfA, in fact, intends to improve the quality of life of individuals through the enhancement of their specificity and diversity. Therefore, DfA proposes a **holistic approach** to the processes and methods of the design of environments, equipment and services, usable “in conditions of autonomy” by people with diversified needs and abilities.

A first innovative aspect of DfA is certainly not the passive application of design rules and regulations, which respond to a pure performance logic, but which risk generating further and more subtle discriminations. Instead, it is up to the designer to face the design challenges using these rules in a creative and inclusive way, to pursue the quality of the performances and the design innovation. In this, and therefore in the rejection of design principles or dogmatic and absolute guidelines, DfA can be considered extremely close to the approach and practice of Inclusive Design.

Even the transition from an interest in “use” to an attention to the “fruition” of environments, products and services can be considered a second innovative aspect shared by DfA and Inclusive Design. The **transition from the user to the individual**, in fact, aims to pursue above all the satisfaction of aspirations and desires, as well as basic needs and needs. Not only, therefore, the search for simple accessibility/usability/enjoyment of environments and products (which remains the “starting” basic condition), but also the pursuit of **well-being for all**, through active, comfortable and enjoyable use by the most a wide variety of individuals, different in social and cultural terms as well as perceptive, motor and cognitive skills.



The origins of the DfA are practically contemporary with those of Inclusive design. They can be traced back to at least December 1993, when the United Nations General Assembly adopted the “Standard Rules on the Equalization of Opportunities for Persons with Disabilities”. In fact, although they were not a legally binding instrument, the “Standard Rules” represented a strong moral and political commitment by governments to act to achieve equal opportunities for people with disabilities. In addition to representing a useful tool as a basis for technical and economic cooperation and for defining policies of equality among all individuals, the “Standard Rules” defined by the UN have in fact inspired the development of the principles of the DfA, which therefore puts before any design action the need for development of a cultural, social and political process.

So already in April 1993, in parallel with the drafting of the “Standard Rules” that would be officially adopted a few months later, the EIDD (European Institute for Design and Disability) was set up in Dublin on the initiative of Paul Hogan. However, they immediately realized that it was necessary to overcome the barrier, especially cultural, of “disability”, in order to extend the design action to the multiplicity of the human race, with its physical, cultural and abilities and attitudes.

Shortly after its establishment, the EIDD aims to “*improve the quality of life through the Design for All*”, which becomes the claim of the association (1998) and finally in 2006 the name of the association is transformed directly in “EIDD – Design for All Europe”. Its Member Organizations are still different bodies and organizations (universities, research centres, professional associations of designers, public administrations and NGO’s, etc.) established in most European countries. Meanwhile, already in October 2003, the Commission of the European Communities, in a communication to the Council of Europe and the European Parliament on “Equal opportunities for peoples with disabilities”, for the first time included the **concept of “accessibility for all”** with a direct reference to the principles of “Design for All”. A few months later, in May 2004, during the EIDD General Assembly in Stockholm, the “Stockholm Declaration” was drafted. It provides a precise definition of the DfA and describes its purposes:

“Design for All is design for human diversity, social inclusion and equality. This holistic and innovative approach constitutes a creative and ethical challenge for all planners, designers, entrepreneurs, administrators and political leaders. Design for All aims to enable all people to have equal opportunities to participate in every aspect of society. To achieve this, the built environment, everyday objects, services, culture and information – in short, everything that is designed and made by people to be used by people – must be accessible, convenient for everyone in society to use and responsive to evolving human diversity. The practice of Design for All makes conscious use of the analysis of human needs and aspirations and requires the involvement of end users at every stage in the design process.” (EIDD Stockholm Declaration, 2004)

In the following years, it was also possible to define some methodological principles for DfA, which however have only an orientation and clarification character. Thus, for example, the DfA Italia Association, which during its annual meeting held in Rome in May 2009, defined **eight inspiring principles**:

- Enhance human diversity;
- Promoting social inclusion and equality;
- Making the use of products, environments, systems or processes easy and pleasant for all possible end users;
- Avoid psychological and physical stigmas;
- Making products, aesthetically “beautiful”;
- Produce products, environments, systems or processes socially, environmentally and economically sustainable;
- Enhance the quality of life of end users;
- Include potential end users in the design process.

On this basis, the same Italian association has been able to start a virtuous process of dissemination of the DfA approach between companies and some institutions more sensitive to the issues dealt with. This led to some



initiatives involving clusters of companies belonging, for example, to the Milan Chamber of Commerce, or to the Confartigianato (General Federation of Italian Artisans and Craftsmen) of Vicenza, and above all led to the assignment of the **“DfA Quality Label”**, which every year, on request of companies that apply, after a severe evaluation of a jury of specialists, is assigned with a public event to those products or achievements that meet the guiding principles of DfA. With the same spirit of dissemination, other initiatives in Europe have arisen during the last years, such as, for example, the annual **“Innovation for All”** event in Norway, organized by the DOGA (Design and Architecture Norway) or the annual **“Design for All Foundation International Awards”** in Barcelona, Spain. These are initiatives of public dissemination of the philosophy and principles of DfA, which often directly involve political or economic decision makers, both private and public.

This is probably the most distinctive and innovative feature of DfA which distinguishes it from other design for inclusion approaches: extreme and obsessive attention to the **“process”** that is, to the design development path, up to the last stages of promotion and dissemination, during which all the actors of the “design chain”, such as designers, architects, producers/developers, users and, above all, “decision makers”, participate in various forms and moments. This is the idea that in order to carry out truly “inclusive” projects, the designer’s skills and experience are not enough and the project can not be limited to a simple comparison between the client, the designer and expert collaborators, but the solution must come from a widespread social conscience of participation, involving in different ways also other social, economic and above all political “decision makers”.

Therefore, a DfA project can be defined as such when it foresees or even relies on moments of official comparison and dissemination of results, even partial, in order to encourage the development of a collective growth through public events (conferences, debates, etc.) which, starting from specific occasions, offer the pretext to promote social progress on the themes of inclusion, equality and human diversity.

2.5 Inclusive Methods for Higher Education

All the above-mentioned inclusive methods are not focused merely on the application of accessibility standards and legislation, but their aim is to provide effective tools that lead to the creation of an accessible, safe, and people-friendly environment for a wide spectrum of individuals. Moreover, these methods enable **all people to participate actively** in the creation, monitoring and assessment of the environments, as well as their active involvement in education process.

Some of the methods provide a more social and policy approach, while others focus on the definition of concrete steps that need to be implemented in order to achieve inclusive environments, products, information and communication technologies and services. Usually, the building design requires implementing more legislative requirements, standards and other strict rules, while product design provides greater opportunity to participative planning and reflection of individual needs. Therefore, when designing environments for higher education we can consider the Seven Principles of Universal Design as a good tool to draw attention to many aspects that should be applied by architects and civil engineers to create universally accessible environments that are flexible and adaptable to various people.

Also, when renovating the buildings, there is necessary to **identify the barriers** at first, and then to propose solutions. Therefore, some guidelines with specific requirements need to be worked out that will help to identify all obstacles and unsatisfactory solutions, so to prepare such project that will not create discriminative solutions. Of course, **participatory planning** should be included in urban planning and building design as well, so that various people with different needs, views and limitations are included in the design process.



To achieve inclusive higher education, there is a need to create an inclusive environment, not only physical/architectural, but also to take into account other aspects such as inclusive study materials, services, information and communication technologies, as well as inclusive educational strategies.

2.6 Universal Design for Learning

Nowadays, higher education embraces a big diversity of students with various characteristics and differences that should be reflected in the teaching and learning processes. Burgstahler (2008a, p. 5) summarizes **student differences** as follows:

- Physical differences,
- Visual differences,
- Hearing differences,
- Learning differences,
- Attention differences,
- Communication differences.

Students also have differences in the pace of their work and learning. Some people achieve significantly better results when they have enough time to deal with the tasks rather than be forced to work quickly, so it is necessary to respect the differences in learning and working abilities of individuals. Therefore, the **student-centred methods**, such as **Universal Design for Learning or Universal Design for Instruction**, should be applied in the learning and teaching processes.

At the end of 20th century, the theory of Universal Design extended from the architectural and design scope to the field of education with aim to provide inclusive educational methods for heterogeneous group of people with different skills and capabilities (Scott et al., 2008, Ostroff, 2011). According to Erkilic (2012, p. 199), Universal Design *“shares the similar vision of valuing diversity with inclusive education, relies on the ideas of design for all diverse users, and underlines the issues of equality, inclusion, and social justice through design.”* Moreover, he states that teaching program must address the diverse learner needs by offering students to choose the best way



to express themselves in a flexible way, which respects a variety of learning styles, sensory demands, background knowledge, and skills (Erkilic, 2012).

In the United States, **student-centred methods** for education, such as Universal Design for Learning (UDL) and Universal Design for Instruction (UDI), have been developed. UDL is stipulated in **Higher Education Opportunity Act**, approved by US Government in 2008. This Act (Sec. 103, Item 24) **defines UDL** as “scientifically valid framework for guiding educational practice that:

A) provides flexibility in the ways information is presented, in the ways students respond or demonstrate knowledge and skills, and in the ways students are engaged; and

B) reduces barriers in instruction, provides appropriate accommodations, supports, and challenges, and maintains high achievement expectations for all students, including students with disabilities and students who are limited English proficient.”

UDL method was developed by Rose and Mayer in connection with cognitive psychology, taking into accounts various learning and communication styles, abilities and needs of students (Burgstahler, 2008a, Edyburn, 2011, Hehir and Katzman, 2012). UDL method is based on understanding of individual differences connected with three **networks of human brain activities** (Hehir and Katzman, 2012, p. 103):

- *Recognition network* – serves to receive, identify and interpret the various information perceived by the sensory organs (vision, touch, hearing, smell, etc.),
- *Strategic network* – determines how we plan, implement, and monitor our activities,
- *Affective network* – relates to motivation and interest in the activities.

Based on these three networks, Rose et al. (2008, p. 46) propose three **basic principles of UDL** method to achieve accessible pedagogy:

- *Multiple means of representation* – by using multisensory ways of presentation to reflect various sensory perception abilities,
- *Multiple means of expression* – by providing students to choose mode of elaboration and presentation of the tasks and outputs (e.g. written, oral, audio-visual, graphical, etc.),
- *Multiple means of engagement* – by using different forms of engaging students in various activities, for example in the form of individual or group work, hands-on and interactive work, etc. (Behling and Hart, 2008, Edyburn, 2011, Ceresnova and Rollova, 2015, Ceresnova et al., 2017).

UDL method provides solutions that are **flexible and adaptable** to various abilities or disabilities, sensorial limitations and learning style preferences of each student. Every person prefers a certain learning style, sometimes a combination of multiple learning styles, depending on sensory preferences or dominant type of intelligence based on Gardner's theory of multiple intelligences (Burgstahler, 2008b). Learning outcomes are closely related to the level of how teaching instruction respects various learning styles. Therefore, it is important to use **multisensory and interactive forms** of presentation of the subject, including several ways of sensory perception and **active involvement** of individual participants. In this way, it is possible to include a number of learning styles and to enhance the quality of teaching and learning.

The progress in education and enforcement of UDL method can be achieved also by using ICT that provides greater flexibility and adaptability to diverse requirements and individual abilities, for example by enabling the transformation of visual formats into audio or tactile formats, enabling the multisensory presentations and outputs. Interactive technologies can also help to achieve more active engagement of learners by using interactive whiteboards, models, simulations, and other innovative methods. The goal of the UDL method is to involve and activate all participants in the educational process in order to achieve the efficiency, attractiveness and accessibility of education for all (Ceresnova and Rollova, 2015).



Testing the UDL Method

The UDL method has been tested and implemented at the Faculty of Architecture, the Slovak University of Technology (STU) in Bratislava, mainly within the subject Universal Design (UD). Teaching UD at STU has a long tradition (since 1995) and UDL method has been implemented mainly from 2011. The framework of UDL method consists of the selection of tasks and the elaboration forms, as well as the active engagement of students by using empathetic exercises to simulate selected types of disabilities, such as physical disability or visual impairment (Ceresnova, 2014, Ceresnova and Rollova, 2015).

Within the UNIALL project we tested UDL method during the winter semester 2017. At the beginning of the semester, students passed the **VARK questionnaire** on modal preferences of learning, based on sensory perception. The VARK was developed by Neil Fleming (Fleming and Baume, 2006) and VARK is an acronym for Visual, Aural, Read/write and Kinaesthetic. According to Fleming and Baume (2006, p. 4): *"VARK above all is designed to be a starting place for a conversation among teachers and learners about learning... thinking about strategies for teaching different groups of learners can lead to more, and appropriate, variety of learning and teaching."*

Some students have **preference** for written information, others prefer graphic information (maps, charts, diagrams, pictures), and some of them are **multimodal** as they prefer to use several perception/communication modes. The test results of the modal preferences of 96 students of the Faculty of Architecture STU are as follows:

- **V**isual = 20.75% of students,
- **A**ural / Auditory = 38.68% of students,
- **R**ead/write = 5.66% of students,
- **K**inaesthetic = 34.91% of students.

To reflect this diversity, the various tasks in different modes of presentation and elaboration were offered to students. Moreover, there was a possibility to choose individual or group work when elaborating the selected

tasks. The active involvement of students was based on simulation exercises at the beginning of the semester. These exercises provided the students with the opportunity to experience the built environment from the position of persons with disabilities.

According to **UDL principles on multiple modes** of presentation and expression, there were three tasks to be chosen: (1) a graphic poster that represents Universal Design, (2) a written essay on selected topics, and (3) a video-document of accessibility survey from the position of various users, including people with disabilities. The first task is suitable for students with visual modal preferences, and second task fits to students with read/write and auditory preferences. The third task reflects the kinaesthetic preferences of the students, who learn more by using a body movement. Therefore, UDL method is very useful and effective in responding to this variety of perception and communication to achieve better students' motivation and finally better learning outputs.



2.7 Universal Design for Instruction

The seven principles of Universal Design, defined by the Center for Universal Design at the North Carolina State University in 1997, were transformed to educational process by the method Universal Design for Instruction (UDI) and supplemented by two additional principles (Burgstahler, 2008b). Then, the **nine principles of UDI** are as follows: (1) *equitable use*, (2) *flexibility in use*, (3) *simple and intuitive use*, (4) *perceptible information*, (5) *tolerance for error*, (6) *low physical effort*, (7) *size and space for approach and use*, (8) *a community of learners*, and (9) *instructional climate* (Scott and McGuire, 2008, p.137,138).

Equitable use provides instruction that is equally accessible to students with diverse abilities. *Flexibility in use* makes instruction flexible and adaptable to individual requirements and offers choice in methods of use (e.g. differentiated forms of learning). *Simple and intuitive use* is focused on the solutions that eliminate unnecessary complexity and respect wide spectrum of skills, experiences and state of attention. *Perceptible information* recommends to use multisensory information and to maximize their legibility. *Tolerance for error* means to provide feedback to identify errors to be corrected and to anticipate variations of learning pace and skills. *Low physical effort* considers the best way to sustain student attention and to eliminate exhaustive physical effort. *Size and space for approach and use* provide all students with sufficient space, comfortable reach distances and good visibility and sightlines in learning spaces. *Community of learners* promotes interactions among students together with the instructor. *Instructional climate* provides welcoming and inclusive learning environment that respects diversity of students (Scott and McGuire, 2008, Ceresnova and Rollova, 2015).

The aim of UDI method is to prefer inclusive teaching methods for a wide range of users rather than simply apply a support service model designed exclusively for students with special/ specific needs (Ostroff, 2011). UDI method builds on the basic principles of Universal Design, emphasizing

the need for accessible learning for all students, as well as promoting **interaction and communication** among students and teachers to achieve optimal learning outcomes (Scott and McGuire, 2008).

2.8 Monitoring and Evaluation Methods

Monitoring the accessibility of the higher education environment is one of the steps to be taken in the process of improving the conditions for the study of students with special needs (SN). The aim of monitoring is to identify existing barriers and limitations in the accessibility of physical environment, educational programs, services for students, but also the accessibility of various social and sporting events to all students.

In the academic environment, the following basic groups of barriers which need to be gradually eliminated can be identified:

- **architectural barriers** that are characterized by the restriction of free movement of persons in the building environment – in the outdoor environment of campuses, school buildings, accommodation facilities, libraries, sports facilities and other facilities where the services are provided to students,
- **barriers to education process** that do not accept individual differences of students, such as their dominant learning style and perception mode, dominant type of intelligence, type of temperament, personal work pace, and other characteristics, in line with inclusive education strategies,
- **information barriers** limiting access to information provided by the university to students, applicants for studies and the public; mainly related to information at the university's web site or in the academic information system,
- **communication barriers** that limit student communication, for example, with teachers and service providers for students, but also barriers in social, cultural or sporting events by not accepting different ways of perception and communication of people with sensory impairments,
- **barriers in people's attitudes** that are related to reluctance, low empathy or lack of willingness of people to accept diversity and create an inclusive environment.

People who perform monitoring and evaluation must understand correctly the consequences of barrier existence to the use of the environment, products and services, so it is important to **involve students and teachers** in a real situation related to the context of use in accordance with the principles of participatory planning. For example, field studies, interviews, web-based communication, workshops, user trials, and observations are the suitable methods (Eikhaug, 2010, Nussbaumer, 2012). Active student participation methods (including students with SN) can provide a better understanding of barriers in real contexts.

Methods can be grouped according to their purpose (Aragall, Montana, 2012, p. 52):

- monitoring use, wishes and needs,
- monitoring complaints,
- monitoring reputation and satisfaction.

According to Edelstein (2016, p.271), **two basic methods** for the building evaluations exist: (1) **pre-design research evaluation (PRE)** to test and experience the design before build begins, e.g. using immersive virtual simulations, and (2) **post-occupancy evaluations (POE)** to assess and evaluate the efficacy of built solutions by users/experts with various abilities and limitations. POE is used to assess completed projects (Nussbaumer, 2012) through on-site surveys or questionnaires to collect data concerning the usability, accessibility, and safety of new products or space.

As an example of creation of **accessibility monitoring systems**, the following are the basic principles for creation of accessibility audits of the building environment and the website environment.



Access Audit System – Built Environment

Auditing of building accessibility is not new in building practice. However, the quality of existing systems needs to be distinguished. Many of the access audit systems examine only basic information which provides an overview of whether the accessible spaces or building elements exist in a building, however, they do not provide detailed information about the details and the correctness of each solution. In order for spaces to be really suitable for persons with disabilities, emphasis must be placed on every detail. Therefore, it is not enough when an accessibility audit of dormitories reveals that an accessible bathroom exists, it is also necessary to examine whether it is well-designed and user-friendly. For example, if bathtub, shower or toilet is incorrectly placed in the space, or if the space is not equipped with the required accessories in the reach of the sitting person, this is an imperfect solution and, finally, the bathroom can only be used by the person with an assistant. In creating the environment by human-centred method, it is especially important for students, including students with SN, to use all the spaces and building elements comfortably and as much as possible independently.

When creating a system for assessing the accessibility of the university environment, it is necessary to compile the **evaluation checklists** so that they are as clear as possible and that even the evaluators without a building education are able fill in the checklists. The aim of the checklist is to highlight all the details to be met in order for the environment to be used by students with disabilities without dependence on other person (in terms of ability).

CEDA FA STU (Rollova et al., 2015) has created the Access audit system based on the results of several years of research in collaboration with various groups of users. CEDA FA STU has compiled the structure of the evaluation checklists into tables according to the particular types of spaces, and in the particular rows of the table, there are the sentences – statements to be filled in (see Tab. 2.1). These sentences must be clearly answered (4th column of the table). The help for correct evaluation of the answer is the clue in the third column of the table. The fifth column of the table provides space for notes, which are a useful tool for drawing up the final report, which should be supplemented by photographic documents. To illustrate

the accessibility requirements for classrooms to be used independently by the students with physical and sensory limitations, an example of the part of the table follows (see Tab. 2.1).

	Requirements	Clue	Conclusion	Notes
E1	Learning spaces are accessible to persons using a wheelchair.	<input type="checkbox"/> lecture halls <input type="checkbox"/> classrooms <input type="checkbox"/> laboratories <input type="checkbox"/> others	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> partially	
E2	In classrooms with fixed built-in furniture, a place for a student on a wheelchair is reserved (e.g. lecture hall, laboratory).	<input type="checkbox"/> table height 75 cm <input type="checkbox"/> maneuvering space in front of the table Ø 150 cm	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> partially	
E2	The space for the lecturer is also accessible for the person using a wheelchair.	<input type="checkbox"/> entrance from other floor <input type="checkbox"/> access using a ramp <input type="checkbox"/> access using a platform lift	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> partially	
E3	The passages between furniture are at least 90 cm wide or there is movable furniture in the classroom.		<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> partially	
E4	The door to the classrooms is well designed and equipped.	<input type="checkbox"/> width of the wing is min. 80 cm <input type="checkbox"/> threshold height is max. 2 cm <input type="checkbox"/> the handle is placed from the corner min. 40 cm <input type="checkbox"/> easy opening of fire doors <input type="checkbox"/> room signage with embossed lettering	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> partially	
E5	The classroom is equipped with a sound amplification system for persons with hearing impairment.	<input type="checkbox"/> built-in induction loop <input type="checkbox"/> portable induction loop <input type="checkbox"/> FM system or others	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> partially	

Table 2.1 Access Audit Checklist – table examples E – Classrooms

After completing the evaluation checklist, the evaluation committee (composed of experts and users) will prepare a final report. It is recommended to invite an expert for the accessible built environment as well as different users for the preparation of evaluation checklists and for the evaluation process.



Access Audit System – Web Applications

The web application is considered accessible when can be used by every user without help from other person. Regardless of the amount of users, it is necessary to take into account their medical condition and specific needs. Currently, the technology level is so much advanced that people with disabilities are able to fully **access web content** and are able to **use web applications**. The process of creating websites and web application assumes conformance of the website with valid standards. Failure to comply with the valid standards results in a decrease of accessibility level of the websites and/or the application.

Persons with disabilities use various **assistive technologies** depending on their medical condition. The most frequent users of assistive technologies are persons with visual or hearing impairments, persons with physical disabilities and persons with specific learning disorders.

The testing of the web application accessibility of Slovak universities was done in 2016 by the Support Centre for students with special needs at Comenius University in Bratislava. The objective of testing was to identify the situation of information accessibility⁹ at selected higher education institutions in Slovakia. Identification of the situation on the information accessibility was conducted by fulfilling partial objectives (Stankovicova M. et al., 2016, p.7):

- to identify situation on accessibility to various components of an application by the screen reader (assistive technology for blind users),
- to verify intuitiveness and logical arrangement of components of the application when operated by a keyboard,
- to propose recommendations in cases with decreased level of information accessibility.

⁹ In testing the information systems, WCAG (Web Content Accessibility Guidelines) and „Standards on accessibility to and functionality of webpages stated in Annex No. 1 to Ordinance of Ministry of Finance of the Slovak Republic on Standards for information systems for Public Administration were the key documents.

The situation on information accessibility was verified by testing the websites of selected universities and libraries and by testing the academic information systems of the higher education institutions. The testing of the websites did not require access privileges creation. The selected webpages of the faculties were first tested by automatic tools:

- web interface <http://wave.webaim.org/> (Google Chrome web browser)
- Web Developer Toolbar (add-on for Mozilla Firefox web browser).

In case of need, the automatic testing results were verified manually using the assistive technology (screen reader NVDA 2016.1).

The testing results were logged in a form whose items were created following rules stated in the Standards on accessibility to and functionality of webpages. In case of failure some of the rules, penalty points were awarded. Their number depended on point occurrence frequency. The system for assessment of the rules is defined as follows:

- **Significant failure** does not allow access to information for users with disabilities in the same extent and quality as for users without impairments. Practical user accessibility is breached.
- **Minor failure** has no major influence on practical accessibility. It is usually technical insufficiencies of standard failure without major failure of information access.
- The assessment conclusion **complies**, means compliance with the monitored point and no identified discrepancy with its interpretation.
- **No failure** means that there is no identified discrepancy with the compulsory point, as the assessment subject on the webpage does not exist.
- For optional points (standards), the assessment conclusion is **not assessed**, whereas these standards are not included in accessibility ratings.



Personal cooperation with university employees expanded awareness on information accessibility. However, the disadvantage was the time limitation and impossibility to repeatedly verify some actions.

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3

SUPPORT SERVICES AND REQUIREMENTS OF THE STUDENTS WITH SPECIAL NEEDS

3.1 Diversity of Students in Higher Education

Michaela Hanousková

With regard to the focus of the entire publication, also in this chapter we will address the specific needs arising from disability, so we will not take into account the possible social or economic aspects of the given term.

Typology of students with special needs¹⁰

Foundations for the typology:

(1) The classification of disabilities is based on aspects relevant to studying at higher education institution (HEI) and takes into account their financial impact¹¹. Medical point of view is used as input information to sup-

¹⁰ As a resource for the stated typology built on the functional principle served a methodical document of the Czech Ministry of Education, Youth and Sports: "Rules for providing support to public universities" (see Rules, 2018) as a part of Rules for Financing Increased Costs Related to the Study of Students with specific needs.

¹¹ The cited document was originally developed as a methodology for calculating the financial subsidy provided by the Ministry to public higher education institutions. So naturally it took into account the financial demands of the study with a certain type of special needs, rather than strictly with a specific medical diagnosis.

port the basic objectivity of the claims but not as a decisive aspect for classification into individual subcategories. The subcategories are based consistently on the functional principle of the classification, even if their names can imply medical diagnosis.

(2) A functional principle of the classification is an approach where the decision is not based on the medical diagnosis itself but on its practical impact regarding working and communication procedures, which need to be employed during the study at HEI. Therefore, classification does not include some of the categories that are naturally separated in medical classifications (e.g. Cerebral Palsy – CP) because it is possible to project their functional impact (e.g. related motoric or neurological disability) into one of the existing categories.

The above described classification results in the following scale:

A. Student with visual impairment

A1. Partially sighted person / screen user: A person whose visual impairment enables the use of sight (and also text), with common document formats, including the visual ones. The modification is based on zooming and other changes of optical character, it is not necessary to use a screen reader.

A2. Legally blind person / Braille or speech output user: A person who works either with tactile print documents or screen readers (in combination with tactile display and voice output), which requires an editable text document format or a document adapted in content and form. This category includes also persons who are commonly described as severely visually impaired, blind, or practically blind.

B. Student with hearing loss

B1. Hard-of-hearing person / spoken language user: A person who spontaneously receives and produces spoken language (in speech and writing). This category includes also persons who are from the medical point of view described as deaf (or deafened), but who are primarily spoken not sign language users.

B2. Deaf / sign language user: A person who spontaneously receives and produces sign language, or another form of nonverbal communication.

C. Student with mobility impairment

C1. Impairment of lower limbs (paraplegia): A person who – with regard to his/her mobility impairment – requires and uses various personal equipment for independent movement, such as walking sticks, or mechanical or electric wheelchairs. This category includes also persons whose medical diagnoses states only the cause (e.g. CP) and not the effects on the function of the locomotor system.

C2. Impairment of upper limbs (fine motor skills): Fine motor skills are disturbed to such extent that a person is not able to operatively and effectively carry out activities, which are common during study – taking notes in hand or on keyboard, manipulation with objects and equipment which are indispensable for the fulfilment of study obligations (physical books, stationery, instruments etc.), or manipulation with objects of daily use.

D. Student with specific learning disorder: A person who objectively cannot fulfil study obligations in the standard manner due to dyslexia, dysorthography, dyscalculia, dyspraxia, often parallel with ADHD (Attention Deficit Hyperactivity Disorder). The disability can appear in inadequate development of specific academic, language, and speech skills (reading, writing, mathematics).

E. Student with autism spectrum disorder: A person who objectively cannot fulfil study obligations in the standard manner due to a neurodevelopmental autism spectrum disorder, including Asperger's syndrome, and requires psychological, pedagogical and organizational measures from the side of the educational institution.

F. Student with other difficulties: A person who objectively cannot fulfil study obligations in the standard manner due to another mental disorder or disease including neurodevelopmental disorders, i.e. disturbed language, speech and other communication skills, or chronic disease, and requires organizational measures from the side of the educational institution.

3.2 Support Centre – Model and Services

There are several organizational models that can be used in practice to ensure access to higher education and it is not easy to stipulate whether one of them is significantly more effective than another because too many aspects determine this – the size and diversified nature of the school (centralized vs. decentralized institution), the degree of autonomy of the individual parts of the school, the tradition of providing the given service, the professional focus of the institution and the like.

In general, it is possible to name two to three main models (with partial modifications), or approaches to providing services to students with specific needs:

1) Centralized approach A

The higher education institution will create one workplace with an all-university effect, responsible both in organizational and executive respect for the entire related agenda, is in direct contact with other central or centrally managed workplaces (such as study departments, deans' offices etc.), communicates directly with students, teachers, guarantors of individual specializations and with its own forces provides such a service that meets the special needs of individual students.

2) Centralized approach B

The higher education institution establishes a workplace that acts as a coordinator of the given services and authorizes contact persons, or other executive units at faculties / sub-workplaces, with synergy and performance of required services if they are not naturally outsourced to external subjects (e.g. library services provided centrally at national level).

3) Decentralized approach

Individual parts of the university (e.g. faculty) set up a sub-office providing only certain services, or only to students with some specific needs. Another service is either not provided, or is being managed by external suppliers.

The advantages and disadvantages of the individual solutions are certainly obvious: Although option 1 allows relatively efficient management, communication and management of the whole agenda, at the same time – if such a workplace also fulfils the role of the executive component of all services – it places higher demands on securing personnel, or technical and spatial background.

Whichever model the school will eventually use, it will have to deal with the same content. If we take as the basis the current legislation (European or national, which is based on the international model, see previous chapters), which defines the general right to study irrespective of the state of health, it is clear that universities necessarily face a situation where the candidate with specific needs will show interest in the study, or is properly enrolled in the study. The concrete specific needs of the student may, during the study, give rise to entitlement to various, to a certain extent, personalized services, but universities should ensure their operations in such way that the basic requirements of accessibility of the environment (physical or virtual) are solved continuously and regardless of a concrete individual – that is with account of the **human-centred design** (e.g. Universal Design, Design for All). In such a case universities should ideally be able to guarantee:

1) minimum technical and technological facilities:

a) **accessible premises**, or such technical provisions which enable overcoming the barriers without improvised temporary solutions;

b) interior and furnishings of the institution (and if necessary also accommodation) must be **adaptable** according to the objective needs of students with particular disabilities (e.g. adjustable working tables for students with motoric impairment of lower limbs, possibility of modifications of lighting conditions for students with visual impairment: shading

– adding light to work spaces, possibility of changing dispositions of study rooms according to the needs of students with hearing loss – with regard to the arrangement of interpreters, etc.);

c) **assistive information technologies** (own hardware and software), which represent the basic guarantee of technical accessibility of the study and study materials and also the objectivity of the fulfilment of study requirements, including testing; such equipment is not that which serves primarily for personal use of individual students (e.g. as a long term loan) but that which is accessible for students and academic employees during instruction, training of study and working strategies, including testing; professional employees of HEI provide for its technical support and functionality;

d) basic **technological equipment** (hardware and software) to ensure standard services guaranteed by the HEI (e.g. for processing study literature: scanners, OCRs, printers – including printers for dot print and so on);

e) providing **accessibility of internal information systems** of the HEI or the systems commonly used for instruction (e.g. administration or e-learning environments). At the same time, introductory technical and organizational training is provided for the students whose disability does not allow for an independent orientation in an unfamiliar and structurally demanding environment;

2) that it is able to guarantee the **provision of services** which satisfy special needs and demands of students:

a) HEI provides personally, technically and organizationally such interventions which satisfy special needs of students with regard to their disabilities;

b) HEI establishes/designates a specialized office, the staff of which is able to provide services in the required extent and quality, or when the HEI is temporarily, or for certain activities, not able to guarantee staff (and therefore also services in the required extent and quality), it provides the services via third parties.

3) that HEI took and permanently follows basic **organizational measures** (defined also by internal guidelines)

a) HEI defines rules unitary for the whole institution or its part which clearly define the way of the provision of services for students with specific needs through a specialized office or existing technical facilities in accordance with the agreed standards including the obligation to publish the outcomes where the public availability of the outcomes is an integral part of the minimum standard;

b) HEI is obliged to accept a student with specific needs when the prospective adaptation of the study conditions do not prevent the completion of the study program in the extent given by its accreditation, only formal (technical and organizational) modifications are allowed.

3.3 Requirements of the Students with Special needs and Support Services

By providing the above general framework, however, in many cases, accessibility of each study will not be achieved for each student with specific needs. The extent and nature of the specific needs of university students are given by far not only by health condition (see functional approach above) and thus cannot always be satisfied by universal measures. Specific needs, as will be discussed below, mainly reflect the demands that higher education studies in sub-areas (communication, work with written text and technology, etc.) have on students of various disciplines.

Thus, it is possible to **define a group of needs** which, to varying degrees and with a certain probability, will be present for each of the above-mentioned categories of students and which the HEI can also a priori calculate with, adapt to them currently provided services and also add them to their stable operation and framework concept of learning environment (whether physical or virtual).

An overview of essential special needs in HE practice:

1. Special needs in social and oral communication – with regard to sensory, or motoric deficit of some students it is expected that the school will, in the organization of teaching, or other activities related to the study, take into account both the suitability of the place and the length of the communication (e.g. physically accessible, with suitable light conditions for lip-reading, etc.) and its desirable form (oral, written), see table¹².

¹² Specific needs are always named in the headings of the tables and their occurrence is marked by a coloured field for a specific group of students. The footer lists the services and measures that satisfy concrete parts of the specific needs of the students. Their detailed description follows in the next chapter.

	Special needs	
	[1] time and space	[2] speech accessibility
[A1] Screen user		
[A2] Braille / speech output user		
[B1] Spoken language user		
[B2] Sign language user		
[C1] Person with lower body impairment		
[C2] Person with upper body impairment		
[D] Person with specific learning disability		
[E] Person with autistic spectrum disorder		
[F] Person with other disability		
	Time compensation	Interpreting services Note-taking/ transcription services
	Service measures	

Table 3.1 Special needs in social and oral communication

2. Special needs in writing and reading – with regard to possible sensory impairment (visual, auditory) or, the lack of fine hand movement, it is expected that the school takes into account both longer time when working with texts, and the need to have texts in accessible formats (see the table).

	Special needs			
	[1] extended time	[2] editable digital texts	[3] non-editable digital texts	[4] tactile documents
[A1] Screen user				
[A2] Braille / speech output user				
[B1] Spoken language user				
[B2] Sign language user				
[C1] Person with lower body impairment				
[C2] Person with upper body impairment				
[D] Person with specific learning disability				
[E] Person with autistic spectrum disorder				
[F] Person with other disability				
	Time compensation	Making study literature accessible		
	Service measures			

Table 3.2 Special needs in writing and reading

3. Special needs at work with graphics and symbolics – with regard to possible sensory impairment (visual, auditory) or, the inadequacy of fine hand movement, it is expected that the school takes into account the need for accessible graphical formats as well as symbolic texts, such as mathematics, music, etc. (see table)

	Special needs			
	[1] extended time	[2] editable digital texts	[3] non-editable digital texts	[4] tactile documents
[A1] Screen user				
[A2] Braille / speech output user				
[B1] Spoken language user				
[B2] Sign language user				
[C1] Person with lower body impairment				
[C2] Person with upper body impairment				
[D] Person with specific learning disability				
[E] Person with autistic spectrum disorder				
[F] Person with other disability				
	Time compensation	Making study literature accessible		
	Service measures			

Table 3.3 Special needs at work with graphics and symbolics

4. Special needs at work with multimedia – with regard to possible sensory impairment (visual, auditory) it is expected that the school takes into account the need for alternative format replacing or supplementing eventual multimedia used in classes (see table).

	Special needs	
	[1] video data	[2] audio data
[A1] Screen user		
[A2] Braille / speech output user		
[B1] Spoken language user		
[B2] Sign language user		
[C1] Person with lower body impairment		
[C2] Person with upper body impairment		
[D] Person with specific learning disability		
[E] Person with autistic spectrum disorder		
[F] Person with other disability		
	Making study literature accessible Interpreting services Speech-to-text-reporting service	Making study literature accessible
	Service measures	

Table 3.4 Special needs at work with multimedia

5. Special needs at work with technologies and manipulating with physical objects – with regard to possible sensory impairment (visual, auditory), insufficiency of fine hand movements, or other limitations of the locomotive apparatus, the school is expected to take into account the need for study assistance in working with various technologies and when handling physical objects in classes, or the need for individual instruction (see table).

	Special needs		
	[1] extended time	[2] study assistant	[3] pedagogical assistant
[A1] Screen user			
[A2] Braille / speech output user			
[B1] Spoken language user			
[B2] Sign language user			
[C1] Person with lower body impairment			
[C2] Person with upper body impairment			
[D] Person with specific learning disability			
[E] Person with autistic spectrum disorder			
[F] Person with other disability			
	Time compensation	Study assistance	Individual instruction
	Service measures		

Table 3.5 Special needs at work with technologies and manipulating with physical objects

6. Personal assistance – with regard to possible sensory impairment (visual), physical disability etc., it is expected that the school takes into account the need for personal assistance in orientation in space, in handling personal needs objects etc. (see table).

	Special needs	
	[1] personal assistant	[2] space orientation
[A1] Screen user		
[A2] Braille / speech output user		
[B1] Spoken language user		
[B2] Sign language user		
[C1] Person with lower body impairment		
[C2] Person with upper body impairment		
[D] Person with specific learning disability		
[E] Person with autistic spectrum disorder		
[F] Person with other disability		
	Personal assistance	Orientation in space
	Service measures	

Table 3.6 Personal assistance

A summary of standardized service measures provided by an institution of higher education for fulfilling special needs of individual types of disabilities¹³

Time compensation

The student is provided with longer time for a specific study activity than is the standard for the same purpose and this depending on his/her specific needs and the nature of the task that is to be accomplished.

Interpreting services

Interventions mediating communication between speakers of sign and spoken language, and that through a sign language interpreter.

Note-taking services

Measures compensating for physical limitations in the written record of spoken speech in the case of students with physical disabilities, sensory limitations of students with hearing impairment, or other limitations of students with specific learning disabilities. The output is content record (as a form of study notes).

Speech-to-text-reporting service

Measures compensating for the sensory limitations of students with hearing impairment, especially users of spoken language, or also sign language. Its essence is simultaneous transcription (as a way of visualizing spoken speech) to mediate communication between hearing users of spoken language and hearing impaired users of the spoken language, or also sign language.

¹³ The list was based, among others, on the experience of higher education institutions in the Czech Republic and is part of the Methodological Instruction of the Ministry of Education, Youth and Sports (see Rules, 2018).

Making study literature accessible

A summary of technical measures and procedures that result in study literature in an accessible format – reflecting standard work methods and students' technical and sensory abilities. Typically, this is a process of digitization or adaptation, resulting in an accessible electronic document or print in Braille alphabet, or a process of voice or character interpretation of a work resulting in an audio recording, or video recording in sign language (for more details see Chapters 3.4 and 3.5).

Individual instruction

The measures, which in justified cases, provides sensory or physical accessibility of education for students with special needs. It can be both one-to-one lessons and lessons for small group of students with the same specific needs, or with the same working methods:

- in the case of **students with visual impairment**, these may be cases where the educational and working methods used with students without specific needs are incompatible with the physical or technical requirements of a student with specific needs and would lead to the student not only being unable to follow the lesson, but he or she should not even be able to adopt specific working practices that in his or her case enable professional inclusion (such as the use of electronic data instead of commonly available visual data, the use of tactile documents); another aspect followed and taken into account is the rate at which normal lessons are taking place;
- in the case of **students with hearing impairment**, it is e.g. language learning, or subjects whose nature (the learning environment, the pace of teaching, the speaking habits of the lecturer, the simultaneous combination of several sources of information, etc.) could complicate, or prevent the provision of another appropriate measure within the framework of standard lessons;
- in the case of **students with physical disabilities** these may be

instances of physical inaccessibility of the environment in which the standard instruction takes place, or the choice of completely different teaching methods with respect to the students' physical specificities (e.g. physical activity);

- in the case of **students with specific learning disabilities** this can be e.g. individual learning of foreign languages;
- in the case of **students with autism spectrum disorder**, or students with other difficulties, this can be cases where participation in standard lessons is not possible due to the manifestations of the disability (frequent loss of concentration, behavioural disorders etc.).

Study assistance

Measures compensating for the limitation of a student with specific needs during the lessons, during work with study materials, or during research and work with technologies necessary to accomplish the study tasks. Study assistance includes above all:

- mediation of the facts accessible during the lessons purely through sight (for students with visual impairment);
- technical assistance for orientation in unknown document with a non-trivial structure (for students with visual and hearing impairment and specific learning disabilities in the field of languages);
- in necessary cases formal language editing for students with hearing impairment and with specific learning disabilities;
- assistance in physical handling of machines, instruments and laboratory specimens (for students with visual impairment and movement disabilities);
- assisting with sports activities within the classroom (for students with visual, auditory and physical disabilities).

Personal assistance

Measures compensating the physical limitation of a student with specific needs in self-service and other physical activities related to the study or to the activities forming part of the educational program, including accommodation and dining at HEI premises or events organized outside the school premises. Personal assistance mainly includes:

- guide services (performed by a trained assistant) – escorting or arranging transport to unknown or hard-to-reach places, or to occasional events organized by the school; adequate assistance in an unknown or physically, mentally or orientation challenging and hostile environment;
- the handling of personal items and self-care for direct participation in lessons;
- services of an administrative nature – assistance during work with written materials, the nature of which and the timeframe of the activity do not allow to use standard technical measures when making them accessible, or standard ways of making the materials accessible (e.g. digitization) would be ineffective;
- editorial services – technical assistance with final editorial modifications of the documents required for fulfilling study duties (typographic formatting work for students with visual impairment and for students with upper limb disabilities etc.).

Orientation in space

Intervention, the purpose and result of which is to ensure a safe spatial orientation of the student and, if possible, his or her independent effective movement in the places in which the student is studying, or the places directly related to the study (administrative and social facilities of the school, dormitory accommodation facilities). Typically, this concerns students with visual impairment, autistic spectrum disorders, or students with locomotor disability of lower limbs or other difficulties.

3.4 Accessible Information and Communication Systems

In order to organize studies, related administration and general operation, universities commonly use web interfaces, internal and external applications and systems which are hoped to be used by students effectively based on their needs. Therefore, it is vital that not only the content offered through these platforms (see chapter 3.5) but also the interface itself should be designed in such a way so it would not create unwanted barriers excluding some users and prevent them from using these platforms.

With regard to objective limitations of individual categories of students, one can claim that the ability to effectively work with these tools is dependent on technical design of the virtual interface (on the coding level) and on the overall graphical and language user interface of the systems. Students with visual impairment are the most sensitive group when it comes to technical correctness, whereas graphical and language user interface ensuring readability and clear information flow concerns students who have difficulties navigating in complex structures (students with hearing impairment and students with learning difficulties).

The principles which ensure the highest possible accessibility of persons with disabilities to any digital study material as soon as it is created are, to a large degree, identical with requirements in general:

- exact and clear course structure corresponding to a clearly expressed educational aim,
- clear and correct standard language, which is complicated in correspondence with the educational aim (thus not more complicated than it is necessary for the given aim),
- proper technical solution, i.e. one in correspondence with valid norms for the source code.

In order to define principles of accessible virtual interface, which go beyond the above stated general principles, it is necessary to comment on the standard working procedures and technical possibilities of the mentioned user groups (see also Clark, 2007). The information will be used in chapter 3.5 as well (Accessible study materials).

A. Student with Visual Impairment

Screen users: visual impairment still allows them to work with normal document formats using sight, image modification is limited to enlargement or other optical changes.

Braille users: works either with printed Braille documents or with a screen reader (in combination with a Braille display or speech synthesis) requiring an editable text format.

Persons with visual impairment rely on an assistance of a supportive software: screen reader or software for enlarging text.

1. **Voice and tactile outputs** are both linear and textual; it is never possible to follow more pieces of information at the same time, only sequentially so, one sign after another. This way of perceiving may be in conflict with:

a) cases, where it is necessary to simultaneously follow two parts of a text when working with a material (for example, in linguistic exercises aimed at filling gaps with listed answers or, in mathematics when comparing an expression before and after modification), see fig. 3.1a;

b) an extensive, non-symmetrical table (i.e. such that is not defined by a simple distribution of columns and rows), charts, pictures, see fig. 3.2a, 3.2b;

c) Information arising only from layout and formatting are not accessible and of any use (see fig. 3.1b), e. g. information following from the colour or a mere closeness of words or objects on a screen (a seeing person automatically interprets objects which are displayed closely together or on the same level as related, parallel, equivalent, and so on, without any verbal commentary).

READING ■ What are you into?
I can understand a text about people's interests.

My interests

ALEXIA
I love pop music and I've got a lot of CDs. My friends are mad about Black Eyed Peas, but I can't stand hip hop. I really like sport, especially volleyball and tennis, but I hate cycling. One of my interests is art, but I'm not very good at it!

DAVID
I'm into skateboarding and swimming. I'm good at martial arts, especially taekwondo. My friend Steve likes taekwondo too, but he hasn't got a green belt. We've got a computer at home, but I don't really like computer games. I prefer chatting on the internet. I like books, especially books about animals. I really like animals, but we haven't got a pet.

SARAH
I'm interested in sport, especially football. I'm a Manchester City fan and I've got photos and posters of the team. I'm not mad about books, but my friend Lily and I love watching TV. Lily has got a TV in her room. One of my interests is photography. I haven't got a very good camera, but my photos are really good.

1 Look at the photos. What do you think Alexia, Sarah and David are interested in?

2 108 Read and listen to the texts. Check your answers in exercise 1.

3 Read the texts again and choose the correct answers.

- Sarah is not into ____
a football. b photography. c books.
- Lily has got a ____
a camera. b TV. c photo of a football team.
- David is good at ____
a swimming. b taekwondo. c computer games.
- David isn't interested in ____
a computer games. b books. c swimming.
- Alexia is into ____
a hip hop. b cycling. c pop music.
- Alexia isn't good at ____
a art. b tennis. c volleyball.

4 BUILD YOUR VOCABULARY Find these sentences in the text. Then complete the sentences with the words in blue.

- I'm ____ books.
- I ____ chatting on the internet.
- I really like sport, ____ volleyball and tennis.
- I'm ____ Manchester City ____
- I'm ____ martial arts.
- I ____ hip hop.

5 ABOUT YOU Complete the sentences for you. Then compare your answers with a partner.

- I'm into books, especially books about ____
- I'm mad / not mad about ____
- I'm good / not good at ____
- I'm a ____ fan.
- I'm interested in ____, but I prefer ____
- I can't stand ____

I'm into books about animals. What about you?
I prefer comics.

■ Your interests

Figure 3.1

a) The green rectangles mark the parts of page which student needs to be combined when fulfilling the task. Students see only a part of the page (that is only a line) when using a screen reader (whether in combination with a Braille display or speech synthesis). Therefore, student who uses only the screen reader when doing the task needs a far more time to fulfil it, or he/she needs additional instructions in the source document.

b) Student has the right to work with words highlighted in blue, which makes the task virtually impossible to solve to those whose technology is not capable (or with great difficulties) of acquiring the font colour.

Interval of coefficient of correlation	Character closeness of the connection between the factors			
	existing classification	scale for technical measurements	scale for precision measurements	scale for genetic engineering and ranks of the whole simple numbers
1	strong connection	unambiguous	unambiguous	unambiguous
0,999...1,0000		the strongest	almost unique	almost unique
0,99...1,000			super strong	extremely strong
0,95...0,99			the strongest	super strong
0,90...0,95		strong	strong	the strongest
0,7...0,9	strong		strong	
0,5...0,7	weak connection	average	average	average
0,3...0,5		rather weak	rather weak	rather weak
0,1...0,3	no connection	weak	weak	weak
0,0...0,1		weakest	weakest	weakest
0		no connection	no connection	no connection

Figure 3.2a Sample of a non-symmetric table. In the columns, there is a different number of rows – that causes technical and perception difficulty especially when using screen readers.

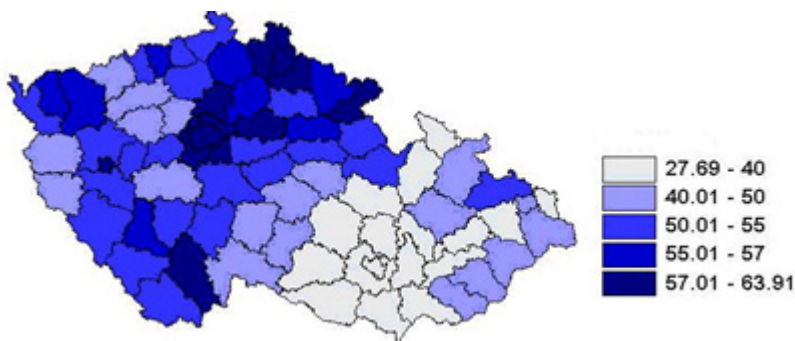


Figure 3.2b Intensive map for presenting election results.

The accessibility of a) can be solved by an appropriate labelling of structures (a beginning of a list of entries and a beginning of a text) by keywords or headings, which a user can use for quick navigation; it is possible to solve the case of b) by an adaptation of a table into a symmetrical form (the same number of columns and rows at all times) with a newly formulated cells in the head; and c) may be solved when words or objects with a corresponding content are not visually connected with technical means that in fact separate them (frames, columns, and others).

2. Neither voice nor tactile output can be used to grant access to graphical objects (including specialized symbols, see fig. 3.3a, 3.3b) or, by no means, to objects whose understanding is based on spatial imagination (see fig. 3.3c). A description or verbal commentary of such objects can partially

substitute for them on an informative level. But if the aim of work with such material is to give a person with a visual impairment a similar effect as to others, it is inevitable to make a two-dimensional model (a sheet with tactile graphics) in the case of two-dimensional graphics and a three-dimensional model of an object in case of graphics visualizing spatial objects.

Leaving aside the unrealistic nature of a large number production of such copies, working with them rarely creates an identical psychological impact (a perception of such objects is more complex than the perception of words).

$$\sqrt{\frac{(x+1)^2}{(x+1)(x-1)} + \frac{x^2}{x-1}}$$

Figure 3.3a Mathematical formula, which cannot be read with the screen reader and needs to be modified into another form (for details see e.g. Teiresias, 2014).

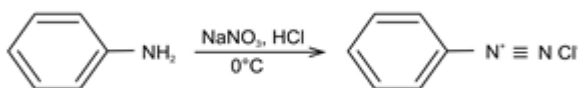


Figure 3.3b An example of a chemical equation – for the legally blind students the text should be transformed into another form. The most appropriate one can be physical document embossed in braille.

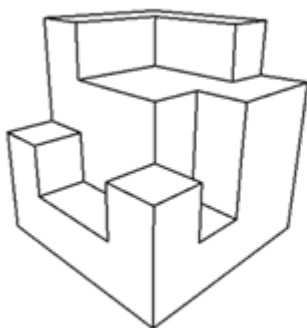


Figure 3.3c: A part of spatial imagination test.

B. Student with Hearing Loss

Limitations on the psychological and perceptual level in case of sign language users can affect the ability to learn spoken language or to use it effectively. As a consequence, the language deficiency can reduce ability to get oriented in extensive texts. As a compensation there are some adjustments recommended to be taken:

- **Textual parts** must have a rigid structure (e.g., use lists and similar textual organizing elements) and its crucial parts must be highlighted relatively to others.

- In case a text includes marginal vocabulary expressions (historicism, poeticisms, colloquialisms) or low frequency scientific terms which are not explained as part of the course, it is suitable to include some form of dictionary into the course. **Linguistic elements** mainly used in spoken communication (social conversation, telephone calls), high frequency of adjectives and others create a serious barrier.

- It is recommended to provide a study material with **visual and interactive elements**. Graphs, animation, pictures, and interactive presentations supplement the main part of the material and they have an irreplaceable role in the didactics and teaching methods of students with hearing impairment. These elements illustrate meaning of words and make a conveyed information more interesting and, first of all, easier to understand and accept; this actually holds for the hearing people, too. On the other hand, this usually presents an insuperable obstacle for people with visual impairment, so there is no format suitable for both types of impairment.

- **Inductive method of instruction** should take priority over deductive methods where this is possible according to a topic and nature of a subject matter; also, it is necessary to build definitions of abstract terms on concrete ones. It is also a good idea to double check the orientation in vertical structure of terms in use (hyponyms and hypernyms) as the hierarchy of terms need not be a priori clear to a sign language speaker.

- A course should include more parts devoted to **practising acquired knowledge**, its following testing and regular repetition. Given the

effort a deaf person must make to understand a text and the structural difference of the code spontaneously worked with, the pedagogical impact of information in spoken language is never as permanent as in the case of hearing students.

- Key passages in a text (for example definitions and propositions in mathematics) and extended text passages should be accompanied with a **translation to a sign language** (i.e. with a video recording of an interpretation of a given text into sign language by an interpreter). This is similar to the situation when audio files are included.

C. Student with Mobility Impairment

In case of students with mobility impairment (esp. impairment of upper limbs), the capability to perceive texts in commonly used formats is usually not influenced. However, limitations in the use of hands (shaking and damage of finger motor capacities cause that manual control can be reduced) or their complete exclusion may radically modify their possibilities to use computers. Such cases mostly need to be taken care of by supportive hardware devices (adapted mouse, keyboard, and eye-typing). But, as far as the accessible form of digital documents is concerned, we can claim that there is no special need which goes beyond the general principles mentioned above and these users can also benefit from the documents prepared for another target group.

D. Student with Specific Learning Disorder

When compared to healthy population, persons with dyslexia have significantly lower reading skills and further specific disadvantages in their profile related to a number of cognitive functions can be found among them as well. People with dyslexia could be compared in some cases to users with hearing impairment, especially when it comes to psychological and perceptual issues. However, some technical solutions are mainly based on users with visual impairment.

From the above more detailed rules follows, which should be taken into account when creating accessible virtual interface and its content in HTML, XHTML, and CSS formats or when creating accessible documents in other formats (see chapter 3.5).

Key Principles of Accessibility

(Teiresias, 2014 and OU, 2016)

1. Keyboard operation

The ability to operate applications fully via the keyboard.

This means supporting the standard keyboard shortcuts available for the operating system, such as Alt+F4 to close a window of a Windows application, and F1 to open the Help file. It may also be useful to provide special shortcuts for the application, such as the spacebar to toggle the 'play' and 'pause' buttons of a media player.

2. Compatibility with assistive technology

Compatibility with screen readers and text readers, screen magnifiers, voice input, switch input. This may mean implementing the application for a widely used environment, such as Windows, Mac or UNIX, and adopting the accessibility standards of that Operating System (OS).

For screen magnifiers, this means providing text as pure text, rather than as images, so that the text is not distorted when it is magnified. It also means controlling the quality of pictures so that they do not distort when magnified.

3. Screen reader access

Allowing interface objects and other content to be read by a screen reader, and to be read in a meaningful way. This means providing appropriate text labels on all buttons, menus and menu items, icons, sliders, and all other interface objects. In order for these objects to be read in a meaningful way they need to be placed in a logical order, and the order needs to be consistent across different screens.

4. Descriptions of visual content

Description of visual material may be required, depending on the application or the purpose of the content. In an educational context a multimedia package should provide text descriptions of important visual information. For example, data shown in a graph or a photograph of a sculpture may need to be described. The need for a description depends very much on the purpose of the visual information, i.e. pictures used for decoration may not need to be described, but pictures that convey meaning may need to be described. See e.g. the Open University "Guidelines" (OU, 2016) or the Masaryk University "Guidelines" (Teiresias, 2007).

5. Customisation

The ability to inherit operating system settings for colours/fonts, or the ability to customise display.

Inheritance of users' settings: the ability of software to inherit operating system settings. People with dyslexia and partially sighted people may make changes to the operating system display settings; e.g. making all text one colour and all backgrounds another colour. In practice, this means designers and developers should not override operating system settings with software settings. An alternative approach can be to provide users with a choice of fonts and colours to be used as the default settings. However, a drawback of the latter approach is that it is difficult to provide a range that accommodates the needs of all partially sighted or users with dyslexia. It is, therefore, preferable to inherit the user's existing settings.

6. Control over audio output

The ability to adjust volume and tone and to link hearing aids to amplifiers, speakers or induction loop systems.

In practice this applies more to interactive devices located in public areas, such as libraries or shopping centres, where the relevant controls and connections need to be provided. For PC-based software this requirement will be met by the operating system and the users own equipment.

7. Alternative to speech input

People who cannot speak may require an alternative to speech input facilities such as audio conferencing. In practice this would probably mean the provision of text-based facilities in addition to the speech input.

8. Alternative to text output

Deaf people who cannot read or write text because sign language is their primary language may require an alternative to text output or text entry. In practice this might mean the provision of pictorial information as output or in a menu, or even the provision of a signing avatar (software that creates an animated sign language interpreter).

9. Alternative to colour

Colour-blind people may require information that is conveyed through colour to be conveyed in another way. In practice this may mean giving coloured objects text labels or differentiating their appearance in other ways. For example, if important information is presented in red, it could also be labelled as 'important' or highlighted in another way.

10. Clear, consistent design

This means using common navigation tools, such as menus, meaningful icons and so on, and applying them consistently throughout the site. This helps those using assistive technology and students with dyslexia.

These principles are included in general methodological documents with international validity – Guidelines of W3C (World Wide Web Consortium):

- Web Content Accessibility Guidelines (WCAG, 2017)
- WAI – Accessible Rich Internet Applications (ARIA, 2014)
- Authoring Tool Accessibility Guidelines (ATAG, 2013)

3.5 Accessible Study Materials

One of the most important tasks of a university, when it comes to ensuring accessible studies, is providing access to the information that are vital for successful completion of studies. That does not just mean providing access to studies in the broader sense, that is by removal of physical barriers so students could actually attend classes, by formation of accessible virtual study interface (e.g. e-learning platform, see above on HTML formats etc.), or by providing access to communication in classes (e.g. through an interpreter or transcriber), but by ensuring a specific content – study materials – are provided in such a form that student can effectively use them with regard to his/her (e.g. perceptual, physical) limits. It is not possible to assume that student with perceptual disabilities will be able to modify the form and technical format of the materials provided by university on his/her own. Since the technical aspect of accessibility deals mainly with students with visual impairment – as it has already been stated – the main focus will be on documents designed for this group of students. Some attention will be given to solutions for students with hearing impairment and students with learning disabilities.

Commonly Used Formats of Study Materials:

- hard (printed) copies (textual and graphical);
- electronic text materials (with editable text layer – e.g. TXT, DOC, DOCX, RTF), with non-editable text layer – HTML, two-layer PDF, without text layer – PDF with only graphical layer etc.);
- electronic images (static images – e.g. JPG, GIF, PNG, BMP; dynamic – e.g. Macromedia Flash, SWF; video-documents – AVI, MP4 etc.);
- electronic spreadsheets (e.g. XLS, XLSX etc.)
- analogue or digital audio-documents – e.g. MP3, WMP etc.

The following list of formats and files most frequently used for a presentation of study materials is accompanied with brief commentaries about their accessibility. Accessibility of various formats is considered primarily from a technical perspective, i.e. such techniques of use of a given format are mentioned which eliminate basic barriers for working with them disregarding psychological and perceptual limitations of a disability. This list of formats is by no means complete; it is necessary to consider possibilities and limits of accessibility of the less frequent ones individually.

Plain Text

It is often used for publishing technical data where further formatting does not make sense, for example program source codes. In case of texts of other characteristics, these do not create a fundamental barrier for a person with visual impairment when the content structure is simple and there is only insignificant semantic information about the text, which this format cannot keep with the text.

MS Word Document and Compatible Formats

The vast majority of accessibility technologies (screen readers, magnifying programs) primarily emphasizes the level of accessibility of the MS Word application and its documents among word processors. From the perspective of technical accessibility, no fundamental barriers appear for a vast majority of files in this format when a document is correctly structured (for example, styles with an appropriate level are used for structure labelling, bullet and number lists and footnote functions are used to label objects of the given type, and so on) and graphical objects are equipped with a textual label (see WebAIM, 2016). A further limitation for an MS Word format file accessibility may result from a psychological and perceptual limitation of a person with visual impairment; his/her knowledge of and experience with possibilities of supportive technologies in accessibility of the MS Word application is a factor which is no less important because it influences the accessibility of documents individually.

MS Excel Table and Compatible Formats

From the point of view of accessibility, it is always more appropriate to present data with table structure in the table format rather than attempt

to interpret them in another way, such as a purely textual one where, for example, there is no unambiguous information about the current cursor position, the cursor navigation does not respect cell areas, and data can only be followed by rows. It naturally holds that a document cannot express information in a graphical form, such as through various colours in the cell background. The accessibility condition for MS Excel format is the same as in the case of the preceding one — personal experience with possibilities of supportive technologies for work with the MS Excel application.

Adobe PDF Document

Although, this format is often considered as utterly inaccessible for people with visual impairment, it is possible to eliminate its basic technical barriers by observing the rules which are explained in detail in literature (Clark, 2005, Adobe, 2005 and WebAIM, 2014). PDF documents are often protected against copying and cutting of their content or, moreover, content cutting allowing accessibility may be disabled. Such security settings present the first barrier of accessibility for people with visual impairment and should not be applied for this reason. When these criteria are not met, which is a more frequent case with published files, blind users can follow the content in the PDF format with great difficulty and at most the textual component void of structural information is accessible. Furthermore in practice, only some supportive applications are able to make the content of PDF documents accessible which excludes a certain user group from the use of PDF and requires advanced user knowledge and experience from the rest. Except for very simple documents where there is usually no principal reason to use the PDF format for publication, the PDF format cannot be recommended due to the above mentioned facts.

PostScript document

Most of what has been said about the PDF format is valid for the PostScript document and, furthermore, programs working with this format are not as widespread. PostScript is often used to publish documents created in TeX and, in such cases it may be considered whether the source file could be useful for blind students in a course, who could use it to have at least a general idea about the document content.

Macromedia Flash, SWF

A publication of content in this format creates a barrier for the blind as well as other users who cannot or do not wish to enable this format on their computers. This format primarily serves to present graphical effects which are useful when the subject matter needs to be enlivened but a course should always offer the possibility to turn off these effects without the loss of information. Although, it is possible to create an accessible document in the Flash format (WebAIM, 2013), it is not easy. For the reasons given above, a creation of a user interface and interactive elements in the Flash format or SWF cannot be recommended.

Audio File

All audio formats present no fundamental barrier for the blind if they meet the requirement that an accessible application for opening a given audio format is available (see the second point in the introduction to this chapter). However, it presents a fundamental barrier for people with hearing impairment.

Video

Blind users can only follow an audio component of a video recording. A visual component needs to be substituted with a sound track describing it or at least a textual summary of the whole video file.

Taking into account the above stated information, the following could be considered as **accessible formats** (that is, in addition to commonly provided formats of study materials):

For students with visual impairment:

- electronic text/spreadsheet documents, whether editable or not,
- audio-documents (standalone or complementary audio track to a video recording)

- tactile documents (textual and graphical),
- hybrid documents (hybrid books¹⁴, DAISY books¹⁵;

For students with hearing impairment:

- textual documents with clear structure,
- video documents in sign language, video documents with subtitles (possible technologies: YouTube “Transcribe and Auto-Sync”, Amara.org, Subtitle Edit¹⁶)
- hybrid documents (Teiresias, 2018),

For students with upper-body disability:

- electronic textual, or graphical documents

For students with learning disabilities:

- editable electronic document

Taking the above listed overview into account, it is apparent that university has the obligation to create and offer such documents which are accessible on their own or the university has to ensure the creation of alternative accessible forms, which could be distributed in parallel.

¹⁴ Hybrid Book is a multimedia application which enables the user to follow its content simultaneously in the form of text, audio recording and image. It is designed primarily for users with severe visual or hearing impairment. The content of the publication can be viewed either as a text, an audio recording of this text or a video recording of the text translated into sign language. (Teiresias, 2018)

¹⁵ Digital Accessible Information SYstem. DAISY digital book format is designed to be a complete audio substitute for print material and is specifically designed for use by people with print disabilities, including blindness, impaired vision, and dyslexia. Based on the MP3 and XML formats, the DAISY format has advanced navigation features in addition to those of a traditional audio book. (DAISY, 2018)

¹⁶ <http://www.nikse.dk/subtitleedit/>

An Accessible Document/a Course – A summary

Main target group	General principles	Extended accessibility
[A] students with visual impairment	1. A proper technical solution , in correspondence with valid norms for the source code, or using standard tools of a text editor.	<ul style="list-style-type: none"> - comprehensive adaptations for users of screen-readers - textual or audio description of the visual parts - tactile materials if needed
[B] students with hearing loss	2. Clear and correct standard language. 3. An exact and clear structure of the material.	<ul style="list-style-type: none"> - captioning for users with hearing impairment - sign language (SL) interpretation (at least significant parts) - glossary feature - graphic and interactive items
[C2] students with impairment of upper limbs		
[D] students with spec. learning disorder		<ul style="list-style-type: none"> - graphic and interactive items - reading support tools - spelling and grammar checking tools – synonym dictionary

Table 3.7 Principles of an accessible document – a summary

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4

**INCLUSIVE
UNIVERSITY
CAMPUSES**

4. Inclusive University Campuses

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The university environment has a great impact on shaping the personality of a young person. Students acquire new life experience; they become members of a new community, and establish new contacts. Many of them are active and engaged; on the other hand others may feel misunderstood or excluded. Students suddenly find themselves away from home, without family and friends, and when there is a pressure to master new academic and social responsibilities, it is not surprising that some students may struggle. Creating a good community of students is crucial because it helps them to adopt into a new lifestyle and positively contributes to their development.

Similarly, the physical environment of university campuses is one of the factors that can positively or negatively affect students' lives. The community life of students is influenced and maintained through various social and sports events, as well as through social activities at student dormitories. The **well-designed physical environment** of campuses is motivating for learning and mutual collaboration of students, while the academic environment must be broadly coherent. If the individual parts of the campus are improperly designed and inaccessible to a particular group of students, it may lead to segregation, stress and discomfort.

The role of campus management is to create a strong support team which values the inclusion, engagement, respect and excellence, and helps students master challenging tasks. A good tool for achieving the optimal model of community functioning is the use of **participatory planning tools**, for example through surveys of student satisfaction, by involving students in the process of creating an exterior and interior environment. These surveys can help to identify potential shortcomings, and to acquire innovative ideas while helping students to activate and shape their sense of fellowship with the **social and physical environment** of the campus. The most important element of campus building design: university space must work in a social sense.

When creating outdoor and indoor campus environments, it is necessary to apply human-centred approach (such as Design for All, Universal Design, and Inclusive Design) that responds to the needs and requirements of various users.

4.1 University Campuses – Urban and Landscape Planning

According to the university curricula, the study and research programs and the social programs, there are various concepts of spatial organization of university buildings and campuses. There are solitary university buildings located directly in the urban environment or university campuses in sub-urban areas. These are usually a larger group of facilities that provide not only education, but also housing and leisure activities for students.

The urban planning of the university campus focuses mainly on the layout of buildings on the site, their interconnection with pedestrian areas, cyclists and car traffic, parking, as well as connection to the infrastructure. The urban planning also includes the creation of green areas, sports places or other recreational areas. The campus zone must be connected to the existing public transport infrastructure.

An integral part of the particular types of colleges, universities and campuses are also outdoor areas which must be accessible and user-friendly to all students, academic staff and visitors. They should provide enough opportunities for social interactions of students, as well as a space for recreation and enjoyable leisure activities. The exterior spaces of campuses are both representative and social spaces and therefore have the ability to express their character. There are formal and informal functional areas that are combined within the campus. The particular spaces are supplemented with greenery, which helps to clearly define individual zones and to create visual links or boundaries. When applying human-centred principles in campus development, attention is mainly focused on the accessibility, safety and overall comfort of campus users.



Figure 4.1 The campus of Masaryk University situated in Bohunice – suburban area of Brno, architects A-PLUS (source: <http://www.stavbaroku.cz/printDetail.do?Dispatch=ShowDetail&siid=767>)

Traffic Accessibility of the Campus

From the point of view of the urbanization of campuses, the issue of transport accessibility, for example, **adequate walking distance** for public transport stops as well as accessibility of particular areas of the campus for cyclists are very important. From the point of view of accessibility by car traffic, it is necessary to consider the access roads for the passenger transport, goods supply, fire and rescue service as well as the location of the car parks at an accessible distance from the main facilities. Some students with mobility impairments prefer individual transport, which implies the need to park in reserved parking spaces located near the entrance to buildings. It is also necessary to ensure accessibility of campus facilities through **accessible routes** (including their connection to public transport stops) so that the facilities can be fully utilized by all users. The routes, including pedestrian crossings, must provide a comprehensive guidance system also for people with visual impairment. Important wayfinding elements are the **guiding**

lines, embossed pavements, but also correctly graphically designed information and **orientation plans**, pictograms, embossed maps, etc. (see chapter 5.4, 5.5).

Accessible Routes

In planning process of a campus, the configuration of terrain must be taken into account while creating **pedestrian pavements**. If the terrain is down-slope, the pavements should preferably be situated in the direction of the terrain contour lines so that they do not have a steep inclination. The pavements with a slope greater than 1:20 should already be designed as **ramps**, which are interrupted by horizontal landing and equipped with handles on the both sides. Greater elevation differences can also be overcome by **exterior lifts**. Ramps and lifts can create interesting spatial divisions in the exterior environment, thus enriching it aesthetics and comfort. Dimensioning the width of pavements depends on the frequency of use (often set out in national legislation); however, the main routes should be at least 150 cm wide for passing people in a wheelchair or the pedestrians along each other smoothly. Furthermore, the pavement surface must be anti-skid. If the pavements are made of cobblestones, wood or stone, the joints between the pieces must not exceed 1 cm. Pavements made of crushed materials are harder to maintain and are often difficult to be used by parents with baby-carriages, people in a wheelchair, or persons with other walking aids (Rollova, 2010).

Pavements must provide a system of **wayfinding elements** for persons with visual impairments. The basic element is natural or artificial **guiding line**, which help to keep the direction of a person moving by the white cane technique. The natural guiding lines include, for example, a lawn curb at the sidewalk, an elevated line of flower beds, and so on. In case of large space (e.g. squares) and the absence of natural guiding lines, it is necessary to create artificial guiding lines, such as embossed and coloured contrasting tiles.



Figure 4.2 Exterior lift helping to overcome height differences at Masaryk University in Brno (photo: Z. Čerešňová)



Figure 4.3 Tactile orientation plan with Braille and embossed lettering, WU campus in Vienna (photo: Z. Čerešňová)



Figure 4.4 Artificial guiding line (embossed tiles) leading to the main entrance to Kolding Campus, University of Southern Denmark, Henning Larsen Architects (photo: Z. Čerešňová)

From the point of view of user safety, care must be taken to ensure regular pedestrian area maintenance in order to prevent pedestrians from injury or slip. For example, growing greenery must not interfere with the routes, and the appropriate head clearance under the trees must be maintained on the routes. The root system must not interfere with pavement surfaces and create obstacles for movement. In the creation of pavements, recreational and sports areas, emphasis is placed on the proper use of **surface materials**, their illumination, the perception of users with visual impairment, but also on the design of fixed elements such as benches, waste containers, way-finding maps, and so on.

Urban Furniture

Urban furniture is an integral part of the campus outdoor environment. The furniture elements are not only used for relaxation, they could be also a meeting place for students. When creating these elements, it is always necessary to consider the diversity of students and their various demands, so it is recommended to offer various furniture elements, which allow the possibility of choice according to individual needs and abilities. For example, **various combinations of seating elements** (with backrest, with armrests, etc.) or tables are suitable.

Benches should have different seat heights; some benches with a 45 cm seat height should have armrests to facilitate sitting down and standing up. In close proximity to the benches, there should be a clear space area for person in a wheelchair or a baby-carriage which should be situated outside the clear circulation width of the walkway, so it is recommended to create nooks. Persons with hearing impairment need to have visual contact with discussing persons, so it is advisable if the bench arrangement is opposite to each other or at a 90 ° angle orientation, eventually in arches or circles.



Figure 4.5 Various combinations of seating elements (with backrest, with armrests, different heights), WU campus in Vienna, BUSarchitektur (photo: Z. Čerešňová)

The refreshment **tables** in a standing position must be supplemented with a table at a standard height which can be used in the seated position, including person in a wheelchair. If summer **terraces or podiums** are in elevated position or elevated terrain, access must also be ensured through the access ramp. For persons with visual impairment, it is important that the elements of urban furniture are well perceptible, that is, contrastingly colour-differentiated from the surrounding environment and identifiable by the white cane technique. All public areas and furniture elements must be designed to take into account the diversity of users and their various demands.

Park Greenery

People perceive surrounding environment through multiple sensory perceptions: eyesight, touch, smell and sound. Based on a combination of these sensory modes, we can create a thoughtful **way-finding system** which helps improve way-finding not only for people with visual impairment (see chapter 5.4, 5.5). Using **different varieties of vegetation** along the pavements and at resting places, the environment can be modified by different colours, textures, sounds or scents. The appearance, texture, colour, and variety of greenery contribute to the visual quality of the environment, such as plant aroma and the sound of fountain-flowing water or the passing of wind through tree tops, are among the most important elements, especially for persons with visual impairment, however, they can also positively influence the senses of other users and help to regenerate the body or to reduce stress, to help relieve emotions (Hazreena, 2006).

High-quality natural environments have multiple effects, it can contribute to the regeneration of human body or reduce stress, while at the same time improving the social integration as well as improving the environment. Trees and shrubs planted along busy roads reduce noise and filter smog. It is also important to choose and select appropriate trees and plant species. Planting of poisonous plants as well as plants with allergenic pollen must be excluded. Plants having the risk of injury should not be placed immediately adjacent to the pavements and areas for rest and recreation.

Leisure-Time Areas

An important factor that must be considered in the urban and landscape planning process of the academic environment is also the creation of areas for **active leisure** time for students. Just engaging in leisure activities involves cognitive, emotional and behavioural efforts of the individual person to achieve self-sufficiency, improve the quality of life, help in assessing, problem solving, decision making, which influences student thinking and behaviours.

Contemporary academic institutions are therefore working hard to create recreational and sporting outdoor areas and spaces which are ac-

cessible to all students. These areas are often located in campus grounds. Engaging students in extracurricular activities also enables them to develop various social skills such as increased self-esteem, fellowship, positive atmosphere for developing human relationships and emotional relations to the university itself. It has also been shown that these activities are an important aspect in the assessment of the university and the recruitment of new students.

A range of **sport outdoor activities** is wide; therefore campus sport grounds can be designed for athletics, volleyball, basketball, football, yoga, tennis, swimming, outdoor recreation, table tennis, chess, bowling, etc. Students with health impairments can also perform all these activities, therefore it is important to take this into account when designing these spaces. Sport facilities must be accessible in all areas, including dressing rooms, sanitary facilities and stadium seating that must be accessible. For dressing rooms and sanitary facilities of students with health impairment, for example, enlarged dressing room spaces and enlarged sanitary facilities spaces are proposed (see chapter 4.3). When creating sight lines, the reserved seats for persons in a wheelchair are mostly located at the bottom part of the stadium seating. Sport areas themselves must be panoramic, checkable, safe and well illuminated. In addition to the above, sports help students improve physical and psychological well-being, promote good and effective use of leisure time, provides opportunities for healthy competitiveness and communication with teammates, spectators, and helps to develop social interactions. Participants improve their self-discipline; have better organizational skills and a sense of responsibility towards themselves and others (Devine, 2013).

In the existing campus environment, it is not always possible to design all exterior spaces so that they are fully accessible to all users, but this can not excuse the possible segregation of people with specific needs. Alternative solutions are always required to enable them to participate in all the activities offered by the campus. **Security** and protection issues can not be underestimated. A comprehensive combination of the above-mentioned design strategies makes it possible to create exterior spaces that will be accessible, friendly, safe, and comfortable for all users and will become an inherent part of the everyday life of all students.

4.2 Student Residences

An accessible and comfortable environment in student residences (SR) can be created by combining different architectural creation tools. Applying human-centred approach and participative planning can achieve the required quality standards for all users. According to Vrablova (2014, p.70) *"Today's residences offer a wide variety of progressive approaches to creation (amorphous shapes, progressive systems of constructions) with the clear aim of creating a quality and original environment that respects the diversity of student requirements."* On the other hand, individual students' requirements can be achieved through adaptability concepts and flexibility elements.

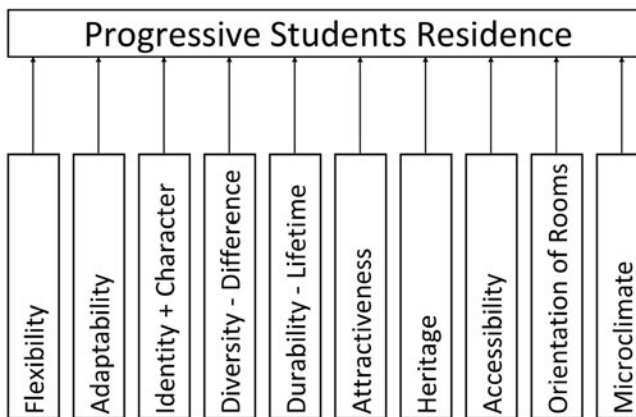


Table 4.1 Aspects of the creation of progressive student residence (source: Vrablová, 2014, p. 71).

Designing a high-quality and accessible SR or revitalizing an existing building is not easy, as it is necessary to find solutions which take into account the demands of various users, including students with motoric, visual, hearing impairments, or other health impairments. Heitor et al. (2014, p.93) state that *"a failure of accessibility would become a barrier that effectively isolates many groups of people; preventing them from meeting others and holding them back in social, educational and working activities."*

For every person, such an aesthetic environment is motivational that everyone can customize according to his or her own ideas. The environment should not be sterile and should not be disturbed by anaesthetic accessible modifications. For this reason, it is necessary to apply **human-centred approach** (e.g. Universal Design) already when creating the **building concept**, when optimal solutions can be achieved to make the elements of accessibility imperceptible. If accessible elements are inserted into a finished construction project or into a completed construction, there are additional solutions which cannot exclude non-aesthetic elements such as staircase lifts. With additional solutions, it is very difficult to achieve optimal accessibility for all people. It is advisable to consult individual solutions with the expert on design of universally accessible environment who has a very good knowledge of the various possibilities on accessibility adaptations as well as of the specific requirements of people with disabilities.

To achieve universal accessibility of student residences, the seven principles of Universal Design (UD), set up by Mace and his colleagues (Froyen, 2012, p. 124), should be applied according to the following recommendations.

UD Principle 1 "Equitable Use"

In accordance with the principle of equality, it is necessary to create conditions for the independence of students with health disabilities in all spaces without the necessity of assistance (depending on their abilities). All exterior and interior spaces must be accessible without barriers. When creating a layout concept, emphasis is placed on a clear system of horizontal and vertical circulation routes and on the location of common spaces (study rooms, clubs, catering areas, etc.) in order to maintain adequate walking distances. The lift must be used for vertical connection of the levels. Lifting devices can be used only for the reconstruction of SR buildings, with vertical lifting devices being preferable to staircase lifts.¹⁷

¹⁷ Staircase lift is not suitable solution, because it is not universally accessible to all people and usually is locked. Vertical lifting devices are more comfortable and usable for all people.

The accommodation spaces (consisting of rooms, bathrooms, shared areas and kitchens or balconies) must meet the space requirements of the persons in a wheelchair and at the same time they should be adaptable to suit individual users' demands (see the second UD principle). This solution excludes segregation and supports the principles of equality, inclusion and "visitability", which enable students with disabilities to establish social contacts with classmates. According to Froyen (2012, p. 76): "*Visitability assumes that all possible visitors... can enter the residence without barrier, can use the toilet, and can participate in all activities in the living and dining areas...*"

UD Principle 2 "Flexibility in Use"

The principle of adaptability and flexibility can be applied mainly in design of the common spaces, but also in the creation of interior elements of accommodation cells. The creation of adaptable spaces and flexibility elements reflects the individual demands of students and thus increases the overall quality of SR.

Meeting rooms, study rooms, dining room can be used for various activities if they are adaptable and adequately equipped. The condition is that there are movable furniture elements which can be arranged depending on the actual needs.

The spatial adaptability of the **accommodation cells** can be achieved by easily removable walls (made by dry assembly), which allow for quick changes with low financial costs. Removable walls can be placed between rooms, sanitary areas, storage areas, and so on. The option of minor modifications of the layout increases the comfort of residing in the SR because it responds to the actual needs of the students. Rooms can be merged or divided, or modified according to the individual requirements of a student with a disability in any accommodation cell. The condition is that the fixed structural elements of the accommodation cell meet the space requirements of the students in a wheelchair (see the seventh UD principle) and that the showers are on floor level. An important element of flexibility is **adaptable furniture** which can be modified and moved according to the individual needs of the student.



Figure 4.6 Example of spatial adaptability of the accommodation cell (source: L. Rollová)



Figure 4.7 Example of spatial adaptability and flexibility – furniture can be arranged in rooms according to the individual needs of the user (source: L. Rollová)

UD Principle 3 “Simple and Intuitive Use”

In the creation process of SR, it is very important to ensure legibility of the exterior and interior spaces in order to provide the simple and intuitive use of the spaces, also in relation to the wayfinding in the space. The main circulation routes should be straightforward; the entrances to the building and to each operational unit must be sufficiently **distinctive and perceptible**. The concept of horizontal and vertical circulation routes should be designed to eliminate long walking distances. It is appropriate to colour the individual floors or accommodation sections in order to better identify the spaces.

UD Principle 4 "Perceptible Information"

All the important information must be communicated to students through **various ways of sensory perception**. For example, basic information about the accommodation facility can be visually presented in the booklet or on the web site (alternatively text with enlarged font), in the tactile form of a booklet in Braille or acoustically by means of a sound transcription of the brochure text, by reading software from website¹⁸, and so on. Transmission of information on the location of the particular space in the building provides a wayfinding map which should be embossed or may also be equipped with audio description about the space or the route on the searched space. Spoken information at the reception desk can be transmitted to students or visitors with hearing impairments through a sound amplifier (for example, a portable induction loop).

UD Principle 5 "Tolerance for Error"

When creating and operating SR, it is necessary to eliminate any risks that may endanger the health of students or cause injury. There can not be any obstacles in the corridors that would restrict the movement of users. The reason for injuries could be **glazed wall**; therefore, they must be made of safety glass and at the same time visibly marked (especially at the eye level) in the form of symbols, signs, or other design elements that will improve their perceptiveness.

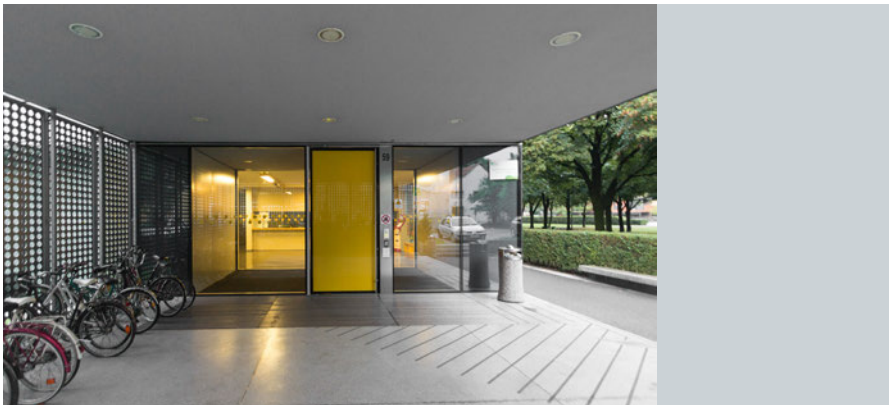


Figure 4.8 Glass wall with the highlighted entrance door to the Student residence in Ljubljana, Bevk Perovic arhitekti (photo: M. Kacej)

¹⁸ The rules for creating accessible websites must be followed.

Safe floors must be made of all-surface floorings or of floor coverings with anti-slip surfaces. If carpet floor coverings are used, the low pile carpets must be used to facilitate movement with wheels (wheelchairs, suitcases, trolleys ...); high mats in the entrance areas (e.g. wooden, plastic) must be embedded in the floor for the same reason.

Accidents in **staircase areas** can be prevented by appropriate staircase design, staircase shape, choice of a suitable railing, as well as colour contrasting solutions.

For persons with limited mobility and wayfinding, the **evacuation of the building** is a very tricky situation. In case of a fire, the lifts are not working (unless they are designed as fire lifts), which makes it impossible for students with physical disabilities to escape. Students with visual impairment may have trouble finding an escape route. Lifts and evacuation staircases should provide a space for gathering people waiting for evacuation assistance. However, these spaces must not interfere with escape routes in order to prevent free escaping process of other users. Each building must have an evacuation plan developed for persons with disabilities, which should also be available in an embossed version.

UD Principle 6 "Low Physical Effort"

In order to increase the user quality of student residences, it is recommended to use different elements or mechanisms to facilitate the use of particular spaces or objects. The most difficult problems with hard-to-reach areas or hard-to-control objects are encountered by persons with disabilities. For example, people with muscular dystrophy or paralyses have insufficient physical strength and can not perform rotational movements.

Fire doors are hard to open, so automatic door opening systems with movement sensor or using simple impulse are preferred, i.e. the door opens automatically when the button is pressed or automatically closes after activation of the smoke detector. The advantage is that such fire doors can remain open and thus do not create an obstacle when moving in the space.

All objects and **controls** which are firmly embedded must be fitted

to the reach of the seated person, or the design of these objects must allow their height adjustment. The optimal height for embedding electrical switches, sockets and controls is 80 cm from the floor level because this height corresponds to the reach height of the person in a wheelchair and also it allows to be used by students having muscular dystrophy. Moreover, switches at this height can be controlled by all users.

Nowadays, many smart devices are available on the market to facilitate the use of daily necessities, for example, electric systems for pulling a window blind, height adjustment of a bed, table, toilet bowl or washbasin, kitchen countertop, or height adjustment of the kitchen cupboards.

UD Principle 7 “Size and Space for Approach and Use”

The largest space requirement is for the persons in a wheelchair, so when designing a concept of the spatial solution of a building, these requirements must be taken into account. The main measure for verifying space accessibility is the **size of the manoeuvring space** that corresponds to a circle of a diameter of 150 cm (about 60 inches). When examining the accessibility of the premises, the project documents ask whether this circle can be drawn, for example, in front of the lift or the entrance to a room. The manoeuvring space in the rooms must be preferentially created where some manipulation is expected, i.e. in front of the table, the furniture, in sanitary spaces, the kitchen, and so on.

For the smooth movement of all users, all doors in the building must have a width of at least 80 cm (and each wing of a two-wing door) and the entrance door in important spaces (including the main entrance) and the accommodation cell must be at least 90 cm wide (35.5 inches). It is also desirable that all the door handles are fitted from the corner of the room (at least 30 cm); because the person in a wheelchair does not reach the handle placed in the corner, as the person does not have the space for retraction of the leg rests. The interior doors should be threshold-free and the doors to the exterior (e.g. to the terrace or balcony) can have a threshold of not more than 2 cm. Emphasis is also placed on the layout of the accessible bathroom (including the toilet), the selection and height of the embedded elements.

Common Spaces

The common area of student residence is an appropriate means for networking; various **shared and individual activities** can be done here – cooking, eating, teaching, games and parties. In this space, kitchen, table furniture for work activities, various kinds of seating furniture (upholstered sofas, sitting bags), shelf furniture, information sharing boards or teaching materials, etc., can be located. Due to the architectural concept of a student residence, the shared spaces can be **located in different parts** of the building – on each floor of the building or in each accommodation cell. If the spaces are used by a larger number of students, they can be divided into smaller zones where students can perform activities in smaller groups. There should be toilets in the vicinity of these social spaces, of which at least one toilet must be designed as accessible to people in a wheelchair.

In the interior design of social spaces, it is also recommended to use elements that allow the **variable layout** of furniture elements. Lightweight height-adjustable tables and mobile furniture elements such as stackable chairs, container cabinets, light partition walls (partitions, curtains, blinds ...) are suitable. The interior design and colour solution is designed to create a pleasant and welcoming atmosphere, warm colours and touch-sensitive materials are preferred.

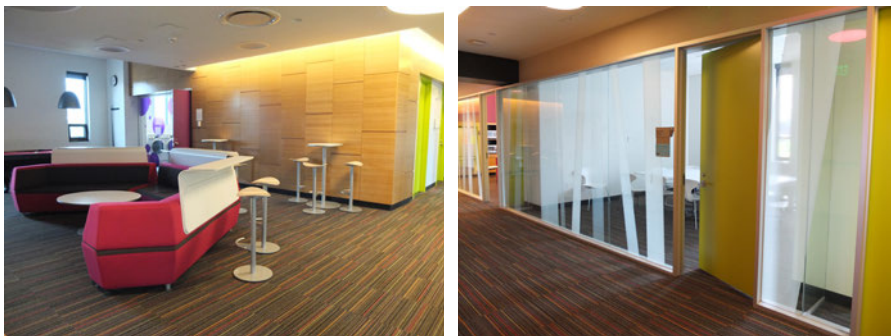


Figure 4.9 Common spaces – seating area and study room at the Student residence, Massachusetts College of Art and Design – MassArt in Boston, architects ADD Inc. (photo: Z. Čerešňová)

From the point of view of users with limited mobility and in accordance to their needs, at least some of the **seating furniture** must be equipped with armrests. For example, when choosing chairs, it is advisable to choose chairs with and also without the armrests. When choosing the upholstered furniture, it is necessary to prefer harder fillings. To make it easier to stand up for persons, also the upholstered furniture should have armrests and a seat height of about 45 cm.

The Kitchen

Kitchen can be designed as a separate room, or a kitchen unit may be part of a common spaces. Kitchen is designed to be used by students with limited mobility. In front of the kitchen unit, sufficient space for manoeuvring a person in a wheelchair must be provided. An accessible cupboard should provide a convenient access to a person in a wheelchair with the sufficient **knee-space under the counter**, the sink and the hob. It is a good idea to use movable base cabinets that can be deployed or retracted underneath the countertop. The baking oven must be installed in an elevated position about 80 cm above the floor to be in the **reachable distance of seating person**. If the upper cupboards or shelves are mounted on the walls, they should be fitted lower than the standard (up to 120 cm), or height-adjustable cabinets (rail-sliding, pantograph systems, etc.) can be used.

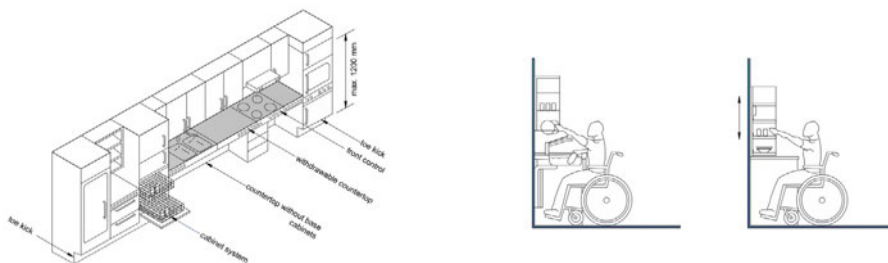


Figure 4.10 Accessible kitchen unit (source: L. Rollová)

Table furniture should be located in the kitchen area or in the common space. Table should be walked around, at least on one side must be a free space for manoeuvring with a wheelchair. The height and design of the table must allow the wheelchair armrests to be placed underneath of the table board. For the persons in a wheelchair, small cocktail tables with one leg are not suitable due to lack of knee-space.



Figure 4.11 Accessible kitchen unit with height-adjustable upper cabinets and movable base cabinets with knee-space under the counter, the sink and the hob, kom.fort Bremen (photo: Z. Čerešňová)

Rooms for Students

Nowadays, students prefer to be housed in single-bed rooms. If two students share the room, two rooms using a removable wall can be merged into one. Location and equipment of the room is to ensure privacy and comfort, good connection to sanitary facilities and it must meet the demands of students with disabilities. The students in a wheelchair must be able to use space, so the arrangement of the furniture in the room must allow manoeuvring with the wheelchair in front of the bed, wardrobe, work table, chest of drawers, and so on.

When choosing or creating interior furnishings, it is advisable to prefer **movable furniture** elements to allow their residents to move them

around the spaces according to their own ideas and needs. If a person in a wheelchair uses a student's room, there should be a **sufficient space** (150 cm diameter circle) to manoeuvre with the wheelchair in front of the table, the storage space, and next to the bed. The minimum clearance width between the furniture is 90 cm. If a balcony/loggia is available from the room, must be accessible for person in a wheelchair.

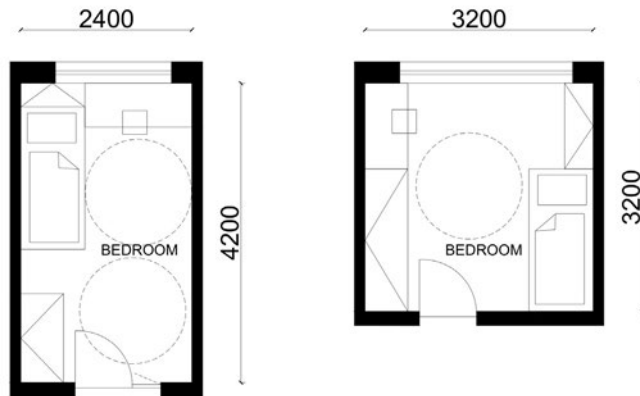


Figure 4.12 Minimum dimensions of a single-bed room for a student in a wheelchair (Source: L. Rollová)

From the point of view of fulfilling individual student demands and ergonomic requirements, height-adjustable **tables and chairs** are preferred. It should be remembered that electric wheelchairs often have a seat area and armrests located above the normal seating height. Under the table, it is advisable to place a container for storing writing supplies. The storage space at the table must be within the reach of the seated person, from this position a shelf can be reached from no more than 120 cm from the floor. For students with reduced mobility, higher **beds** (approximately 45-50 cm) are more suitable to make their standing up easier.

When choosing the furniture for the persons in a wheelchair, it is necessary to consider the frequent damage of furniture at the height of the wheelchair footrests (about 25 cm from the floor). The furniture should be protected against abrasion up to a height of 30 cm. It is recommended, for example, to design furniture on an elevated skirting board, legs, or to allow furniture elements (cabinets, chests of drawers, shelves) to be hung on the wall to leave space under the furniture.

Bathroom and Toilet

Emphasis must also be put on the **spatial bathroom solution** and the correct placement of the embedded elements. In order for the space to be accessible to all students, the following principles must be respected:

- door must opens outside of the bathroom or toilet,
- **shower** must be placed at floor level and its size must correspond to the size of the manoeuvring area with the wheelchair; low shower trays are appropriate, or the floor of the shower is inclined into the floor drain or drain canal,
- **toilet** bowl must be installed in the space so that there is a free space for insertion of the wheelchair 80 cm wide and a space of at least 120 cm in front of the bowl; free space next to the bowl can be merged with the shower area,
- **washbasin** must provide knee space for people in a wheelchair; therefore, cabinet can not be firmly mounted under the washbasin; the washbasin should not be placed on the same wall as a toilet bowl,
- items hanging on the walls must be within reachable distance of the seated person (shelves, towels and clothes hooks, mirror above the washbasin, etc.), and electrical sockets and switches must be within reach.

The bathroom space designed in this way is suitable for all users without the need for any construction adjustment. However, the user with a physical disability must have a possibility of additional mounting the handles according to individual needs; the designer must anticipate this possibility, because the handles can only be mounted on a sufficient load-bearing wall or on the load-bearing structure. By the appropriate design of the sanitary cabin, the image of the bathroom of a normal household can be achieved.

4.3 Sports and Recreational Facilities

This chapter outlines the basic requirements for designing sports facilities to be accessible and usable by all people, including persons with disabilities. Sports activities have a positive impact not only on improving the physical fitness and endurance of students, but also on creating social contacts. Sport is one of the factors that can shape the community life of students. Sports activities can be developed through outdoor sports (see chapter 4.1.) and indoor sports that take place in sports halls. It is optimal if the sports halls **are multi-purpose and offer more types of sporting activities** “under one roof”. The sports hall should provide adaptability and flexibility to change the choice of sports programs, depending on the actual interest of the students. Moreover, it is also advisable to apply the principles of participatory planning and to select the offer of sports programs based on the interest of the students.

Existing sports halls, which are part of the school environment, often do not meet current accessibility requirements for all students. Frequently there are architectural barriers, both for sportsmen as well as for spectators. In the design process of sports facilities, the human-centred methods are harder to apply in existing facilities – an improper building structure or layout for the dressing room and the tribune can be a barrier. Optimal solutions that meet today’s sustainable architecture trends can often only be achieved in new buildings. An optimal solution is to create a building that is inclusive and does not create special spaces for students with health disabilities. For building renovations, minimum accessibility standards can often be met by the use of specific solutions, for example by creating a separate dressing and sanitary cabin for people in a wheelchair, or by creating reserved seats only in the defined part of the tribune.

Sports Hall

Sports halls can provide a variety of sporting activities; their main spaces are gyms for practicing ball sports or gymnastics, or swimming pools with swimming and relaxation pools. Students with health impairment attend gyms and swimming pools both passively as spectators and actively as athletes. The basic requirement is to ensure the accessibility and usability of all operating parts of sports facilities.

Tribune

Sports events are often attended by students in a wheelchair with their friends, family members or assistants, so there must be a space for the **accompanying person** next to the **reserved seat**, the parameters of which correspond to the usual seating space. In places reserved for people with visual impairment, it is advisable to install aids through which an accompanying commentary can be heard and an inductive loop should be incorporated for the spectator with hearing impairment. Furthermore, it is also appropriate to install a digital display in a visible place on which basic information about the event is displayed.

Reserved seats for spectators should be located in several parts of the tribune so do not create segregated spaces from classmates or friends. It is suitable if the reserved area for spectators in a wheelchair is accessible from the same floor level as escape routes, accessible toilets, refreshment stalls and the first aid room. If the reserved seats are situated at a higher level than the terrain level is, the possibility of evacuating spectators with limited mobility by fire lifts or evacuation ramps should be solved quickly and without problems.

If seats for other spectators are placed in front of the reserved seats, a good view for spectators sitting in a wheelchair must be provided even in the case of spectators standing in front of them. In such a case, the reserved seats should be in **elevated area** of about 1.2 meters.

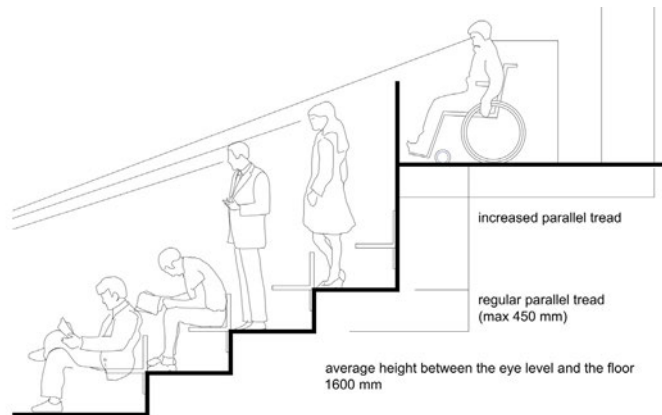


Figure 4.13 Stadium seating with reserved seats at the elevated area at the back of the tribune (source: L. Rollová)



Figure 4.14 Stadium seating with reserved seats in the front area of the tribune, Singapore University of Technology and Design (photo: Z. Čerešňová)

Gyms

Insufficiencies of large spaces of gyms and pool halls are often caused with poor acoustic qualities and inappropriate shading of the windows (blinding the players and spectators). They reduce the communication skills of sportsmen with sensory disabilities. Likewise, high-gloss sports surfaces are unsuitable as the reflection from the floor weakens the legibility of the lines that define the size of the play area and worsens the spatial orientation. Floor materials in gyms must have an easily maintainable and anti-skid surface.

Pools

The biggest obstacle for visitors with physical disabilities is often inaccessible changing room, shower and transfer to the swimming pool. Due to the diversity and the degree of disability, they can enter the pool independently or are dependent on the assistant's help. Therefore, when designing an access to swimming pools, multiple options and **aids of access to the pool must be created**. Each pool facility must have a **fixed or mobile lifting device**, which is a necessary aid to enter the pool for persons with severe physical disabilities. Persons with a lower degree of physical disability, as well as some visitors in a wheelchair can use the specific transfer stairs to enter the pool. It is optimal if the stairs are full width of the pool, equipped with handles on both sides at different height levels. At the stairs to the pool and at the lifting device, a parking space for wheelchair must be provided which does not interfere with the circulation area.

A strip of different texture should be created around the pools, serving as a warning line. If there are glazed walls in the swimming pool hall, they should be labelled at the eye level with a coloured strip or graphics to avoid accidents.



Figure 4.15 Swimming pool with multiple options to access the pool (transfer steps, fixed and mobile lifting devices), Jedlička's institute in Prague (photo: L. Rollová)

Fitness Centres

Entrance doors to the fitness centre must be threshold-free and their width should be at least 90 cm. The clearance width of at least 90 cm must be provided between the fitness equipment and, in case of equipment suitable for people in a wheelchair, a space for manoeuvring and parking area for the wheelchair must be provided if it is necessary to sit on the equipment.

The floors in the fitness centre must be solid and protected against slipping. The fitness centre walls must be protected against the abrasion caused by tools and wheelchair footrests by means of using a suitable wall tiles up to a height of 40 cm or a guidance rail 20 cm from the floor.

Dressing Rooms and Sanitary Spaces

Dressing rooms and sanitary spaces for sportsmen should be on the same floor as the play area, the gym or the heated pool hall. In sports halls where is a greater frequency of sportsmen, there should be at least one accessible women’s dressing room and one men’s room to provide space for changing and leaving clothes for sportsmen with disabilities. There must be **enlarged lockers** for clothes and prosthetic aids, a lying-down bench for changing clothes and hooks for hanging the clothes in a lowered position.

The sanitary unit attached to the dressing room must be equipped with the **accessible washbasins and the showers** on the floor level. The showers should be designed in the form of a shower without dividing walls and with drainage into a floor drain or a grate. **Accessible toilet** should be located in the sanitary unit, or there must be at least one accessible toilet for men and women that are accessible from the “clean corridor” of the sports hall.

Accessible changing room with sanitary facilities serves for sportsman with disability (or families with small children) to change clothes and use the sanitary equipment at the same time. This type of changing room is also suitable for small sports facilities for outdoor and individual sports (such as tennis, fitness, golf).

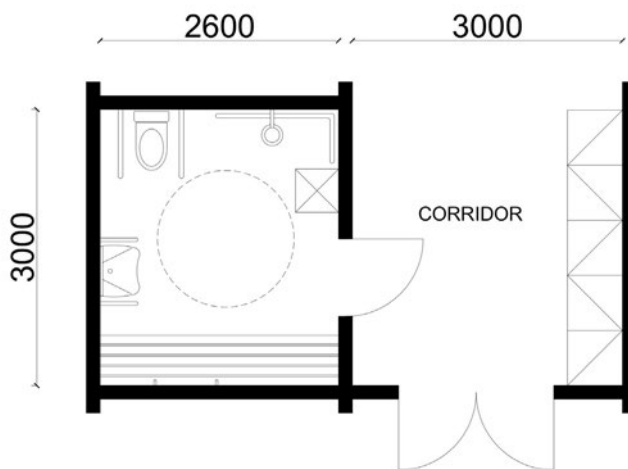


Figure 4.16 Accessible changing room with sanitary facilities (source: L. Rollová)

The minimum sanitary facilities include: the washbasin with knee space, the floor-level shower, the toilet and the bench for changing clothes. The space with lockers is located in the immediate vicinity of this room. The lockers are not designed inside the changing room to make them accessible even when the room is occupied.

Changing rooms of pool facilities are mostly equipped with changing cabins, so at least two cabins should be enlarged so that a wheelchair or a baby carriage can be maneuvered inside of them. The enlarged cabins can also be used as family cabins.

In many swimming pool facilities, there is an accessible changing room, which consists of an enlarged changing cabin, a locker room and an accessible sanitary point through which user directly enters the space of the heated pool hall. The space of the accessible changing room unit can have multiple ways of arrangement as it is necessary to separate the operation for men and for women. A suitable solution is, for example, the creation of lockable enlarged changing cabin and a lockable shower cabin with a toilet, which will allow the shared use of these spaces.

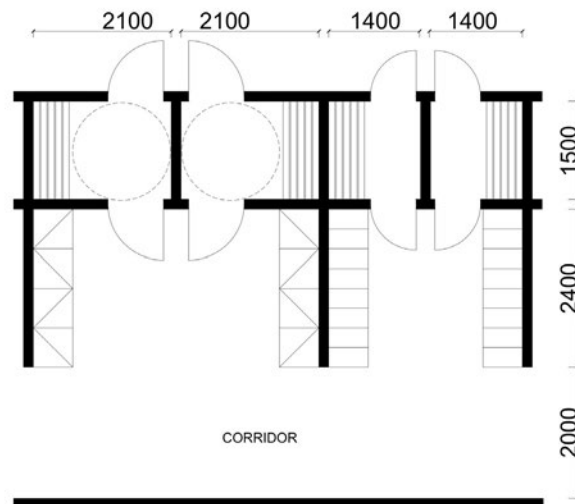


Figure 4.17 Accessible changing unit (source: L. Rollová)

Wellness

Sauna must provide sufficient floor space to allow manoeuvring of a person in a wheelchair. The doors of the sauna must be open outwards from the room space and must be at least 80 cm wide with a door threshold of not more than 2 cm high. Handles are installed around the perimeter of the sauna room, which can be held when changing the benches. The protection rails must be installed in front of the heating source to prevent the visitors from getting burned.

For cooling after the sauna, users with mobility impairments are more comfortable with a cold shower or water from a ceiling tank. Many people with severe mobility problems can not benefit from the cooling pool effect. The shower for body cooling after the sauna must be placed at the floor level, draining water into a floor drain or into a floor canal (roll in).

There must be sufficient space between the deckchairs in the relaxation room for the passage and manoeuvring with the wheelchair. Suitable are the height-adjustable and position-adjustable deckchairs which have a contrasting colour against the wall and the floor.

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5

**INCLUSIVE
SCHOOL
ENVIRONMENT**

5. Inclusive School Environment

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Learning spaces are not intended only for learning activities, but they provide space for people, therefore it is necessary to integrate human factors and new learning strategies to learning space design. According to Brown and Long (2006), new learning paradigm emphasizes active learning, social engagement, participation, interactions, mobility, and multiple ways of presentations. Brown and Long (2006) define three major trends in current learning space design:

- 1) Support for **social and active learning strategies**,
- 2) Emphasis on **human-centred design**,
- 3) Expansion of new **technology devices** that enrich learning.

The human-centred design of learning spaces is focused on users and reflects and supports how people learn and what range of space and services they require. This can help to create an accessible and effective educational environment, inclusive for all people. Students and teachers in higher education come with a diverse range of abilities/disabilities, different learning and teaching styles, types of intelligence and temperament, personal working pace, and other characteristics that should be considered. **Acceptance of the diversity** of people and individuality of each person is essential for the creation of an **inclusive learning environment**. All people may experience certain limitations in activities and participation during their lifetime; therefore, it is necessary to recognize the mutability of individual limitations (Fletcher, 2016). The most effective way how to address this diversity is through a human-centred design approach, which covers the different requirements, needs, interests, and abilities of all people.

The **human-centred approach** is applied by various methodologies, such as Universal Design, Design for All, Inclusive Design and User-friendly Design. By including human-centred features during the design process, they become integral part, not something that seems separate, special, or added at the end of the process. According to Herssens and Heylighen (2007), the key to human-centred design methodology is the explicit attention for cognitive human factors in experiencing space. They indicate that the human-centred design process incorporates four **human factors**: (1) the physical, (2) social, (3) cultural and (4) cognitive factors.

The human-centred design is also related to **environmental psychology and neurosciences** that are focused on the psycho-social aspects of the built environment and on the research how the environment influences the people, mainly their health condition and well-being. According to Evans (2003), the basic design features of learning environment that addresses the **psychological well-being** of all people are as follows:

- Allow people to control, monitor and **regulate their surroundings** and use of space;
- Provide wide range of social interaction spaces from small intimate spaces, through medium sized group spaces, to larger, more public **interaction opportunities**; and

- Create appropriate levels of illumination, particularly the amount of **daylight exposure**.

Based on human characteristics and different perception and learning/teaching styles, Gee (2006) defines the four basic **characteristics of the human-centred learning environment** as follows:

1) **Healthful** – based on physical **well-being and ergonomic** considerations respecting diversity of human body;

2) **Stimulating** – offering various **multisensory experiences** (visual, tactile, auditory, and kinaesthetic) that have a positive impact on processing information; and enabling **visual access** (transparency) within the learning spaces as well as in connection with a nature;

3) **Balancing Community and Solitude** – combining wide spectrum of **private spaces** for individual activities and interactive **places for group** activities and socialization; and providing **various informal spaces** for different activities in classrooms, lobbies and corridors;

4) **Adaptable** – supporting diversity of people, different activities and variety of learning and teaching styles, and providing **flexibility** and adequate space for various seating arrangement (single area, small-group space, large-group discussion space) with **adaptable and movable furniture**/technology tools that can be rearranged and manipulated by users.

5.1 Accessibility Requirements and Implementation of Universal Design Principles

In the context of human-centred approach, a broader understanding of the attributes of **universally accessible environment** is applied, for example physical, sensorial and information accessibility, adaptability and flexibility of the environment for a wide range of people. Universal design does not provide “*one-size-fits-all*” solution but highlights the need for flexibility and adaptability of the environment to reflect the individual needs of people with diverse capabilities and limitations. Universal design must also respond to the contextual complexity, such as cultural, social and economic conditions of the society.

According to Erkilic (2012, p. 200), Universal Design offers “*a design approach that supports the ideals of diversity of Inclusive Education and physical environment*”. This diversity in school environment can be facilitated by taking into account the following issues as **multiuse differentiation of diversity** (Young, 1990, Erkilic, 2012, p. 200):

A) **Diversity of Users:** broadening the range of diversity of user type with the principle of equality,

B) **Diversity of Facilities:** serving for both educational and non-educational activities of diverse users,

C) **Diversity of Spaces:** enriching type and quality of spaces by providing flexible, intuitive, perceptible environments available to diverse users and providing safe, well-dimensioned, comfortable spaces.

The **seven principles of Universal Design**, developed by Ron Mace with a group of US designers, architects and educators at the North Carolina State University in 1997 (Froyen, 2012, p. 124), provide a basic

framework for the creation of **inclusive school environment**. These UD principles can be implemented in the school building design as follows:

UD Principle 1 “Equitable Use”

All people should have the same right to move in the space and to use the services and resources intended for the public in a way that does not create barriers to the interaction of people with the built environment. This principle should be applied in all school buildings, including the access and use of the circulation and common spaces, learning spaces, dining rooms, sports and leisure facilities, so that no one user is excluded or segregated because of architectural barriers. Also, this principle emphasizes the **universally accessible solutions** of the main entrance and circulation routes (horizontal and vertical), and not creation of the separate accessible solutions (e.g. side entrance, staircase lift).

Entrance areas	universally accessible main entrance (avoid separate side entrance)
	equally accessible solutions in the building adaptations and renovations (avoid staircase lifts that is only for people in a wheelchair)
Circulation spaces	equally accessible circulation routes (not separate accessible routes) for all
	equivalent position of the staircase and lift in the building layout – visible and usable for all people
Learning spaces	equal access and appropriate space for persons in a wheelchair in classrooms, laboratories, lecture halls (not segregated solutions) and also access to lectern (accessible podium/stage)
Dining spaces	access to the counters (low height) to facilitate self-service for all users
	accessible and comfortable table space also for persons in a wheelchair
Library	access to bookshelves (low height, manoeuvring space) and services

Table 5.1 Equitable use of school facilities

UD Principle 2 “Flexibility in Use”

Essential requirements for designing the educational environment are the adaptability and flexibility of the space and its elements that reflect the way of teaching, wide range of individual preferences and abilities of various users. Flexibility allows in a short time to implement some changes, for example **to connect or divide a space** with sliding/movable partitions, or to **rearrange a seating** in classroom based on current needs. The flexible environment can be adapted to current teaching and learning activities (e.g. teamwork, active learning, etc.), but also to **individual student requirements**, taking into account their anthropometric parameters (e.g. by height adjustable furniture), preferred learning styles and communication ways, as well as sensory limitations (e.g. by modification of lighting conditions).

The flexible environment allows access and movement also for person in a wheelchair as there is no traditional fixed furniture (with narrow aisles), but a plenty of space for various arrangements of **movable furniture**. According to Erkilic (2012, p.202): “Creating mobile and adaptable seating arrangements that can be easily repositioned contributes to efficiency in learning and saves time during alternative teaching situations for individual and group work.” The flexible learning spaces can be differentiated into smaller units, but if necessary, may be combined into larger units. This **differentiation of space** is closely related to differentiation of teaching instruction, which responds to the diversity of individuals, their actual capabilities and capacities (UNESCO, 2004).

Learning spaces	different size types of rooms – flexibility to connect or divide the rooms to provide large or small spaces
	differentiation of space – based on the teaching and learning activities
	modification of lighting conditions
Furniture and interior elements	adaptability to individual needs and various learning activities – ergonomic and comfortable
	height adjustable and mobile furniture (tables and chairs)
Assembly spaces	multipurpose use for various learning and social activities
Circulation and common spaces	multipurpose use for various informal learning, relaxation and social activities

Table 5.2 Flexibility in use of school facilities

UD Principle 3 “Simple and Intuitive Use”

A clear space layout for easy and **intuitive moving and wayfinding** is very important for every user, especially for people with sensory impairments. The **space legibility** (visibility) enables all people to see or predict activities in the space; offers the possibility to preview the destination before entering the premises. This is especially important in areas with multiple circulation routes to predict the next stage of movement, but also in terms of security to identify the obstacles. The solution can be, for example, transparent (glazed) partitions or larger space at the crossing and meeting points. The **previewing** is also very important for people with hearing impairment who need to have a visual overview of the situation in the environment (Bauman, 2010).

Entrance areas	Easy to find the main entrance – colour and tactile contrasts to facilitate the entrance identification also for people with visual impairment
Floor layouts	Elimination of complicated solutions of the floor layouts
	Visibility of all space from the central position (e.g. atrium)
	Clear structure and continuity of the spaces
Wayfinding	Visual and tactile identification of the main circulation routes and learning spaces - colour coding of specific zones in the building
	Previewing of the spaces and rooms (e.g. transparent partitions or doors)
	Pictograms and signs (also in tactile form)
Furniture	User- friendly and comfortable furniture – informal and social spaces

Table 5.3 Simple and intuitive use of school facilities

UD Principle 4 “Perceptible Information”

Basic information should be mediated in an effective way for diverse users, regardless of their current state of perception and attention level, or their sensory limitations. Therefore, it is necessary to use **multisensory systems** that enable multiple sensory perceptions by combining at least two modalities, such as vision and hearing, or vision and touch.

Multisensory elements are very effective tools in the school environment, not only in the orientation and information systems (see chapter 5.4), but also in the teaching and learning processes, as well as in the form of relaxation and therapeutic tools. Multisensory elements should be a natural part of instruction because they enable people with sensory or cognitive limitations to better understand the subject presented, while contributing to a more effective way of learning and perceiving information.

Providing information	Multisensory form – combination of tactile, audible and visual elements
	Emphasize the basic information
	Assistive listening solutions (e.g. loop system) for people with hearing impairment
	Accessible information and websites also for people with visual impairment
Signage	Tactile signage (raised letters and Braille) of the main spaces and rooms
	Visible and legible signage (font size and type) and good position within the circulation routes
Study materials	Multisensory and interactive form
	Accessible in alternative form (audio, tactile, etc.)

Table 5.4 Perceptible information in school facilities

UD Principle 5 “Tolerance for Error”

Safety is one of the key requirements in school buildings. The space and its individual elements must be designed and arranged in such a way as to **minimize the risk of danger**. Appropriate building layout and placement of the elements are especially important for people with visual impairment who can identify the environment using the white cane technique. Therefore, the elements and objects protruding from the walls that cannot be identified by a white cane should be eliminated. If such elements are placed on the circulation paths, it is necessary to indicate their location at the floor level, for example by placing a flower pot or other object directly below the protruding element. Moreover, it is necessary to draw attention to the staircase or ramp; mainly the staircase with no risers and open sides can

be dangerous. Another **hazardous situation** can occur under the staircase or ramp with low head clearance, so this space should be identifiable at the floor level to stop the people enter this space. Especially people with visual impairment are not able to identify dangerous situations; therefore, it is necessary to provide them warnings of hazards by using tactile elements, for example tactile warning tiles at the stairs.

Space arrangements	Elimination of protruding objects at the circulation routes
	All elements and protruding objects should be identified by a white cane at the floor level
Materials	Slip-resistant floor materials without glare
	Anti-allergic and healthy materials
Glazed doors and walls	Colour contrast marking (symbols, graphics, signs, etc.)
Staircase and ramps	Appropriate shape and dimensions of the steps and ramps
	Tactile and colour contrast marking (the first and the last steps)
	Clearly define (at the floor level) low-height space under the staircase and ramps
	Provide railing to prevent slipping and falling

Table 5.5 Tolerance for error and elimination of danger in school facilities

UD Principle 6 “Low Physical Effort”

School buildings should be designed comfortably for the various groups of users, without the need for hard physical effort to move or use the spaces. In order to ensure a comfortable environment, mainly for people with limited mobility, it is necessary to minimize the physical effort in moving and manipulating the interior elements, including the opening of the doors. Moreover, it is necessary to provide **optimal walking distances** and to **reduce vertical differences**, such as big staircases and very long ramps. Ramps must ensure comfortable movement and low effort when used, so they must have a suitable slope (maximum 1:12), anti-slip surface and hand-rails at a suitable height.

Convenient movement in the space can be ensured by correctly selecting **flooring materials** so that people in a wheelchair, or with prosthetic devices, can move smoothly and comfortably through the space.

School furniture must be comfortable and ergonomic for various users, not to cause them any physical deformation and discomfort. Also, it is important to create a lot of seating places in circulation areas and common spaces that should serve for relaxation and socialization of students.

Entrance areas	Easy to move and open the doors (prefer automatic opening)
Floor layout	Minimize walking distances (reduce long corridors)
	Provide informal spaces for relax and social activities
Circulation areas	Provide appropriate and comfortable slope and dimensions of the ramps (avoid long ramps) and stairs
	Provide suitable flooring for safe and comfortable movement
Furniture and interior elements	Comfortable and ergonomic furniture
	Easy to move and manipulate with the furniture and other interior elements

Table 5.6 Low physical effort in school facilities

UD Principle 7 "Size and Space for Approach and Use"

The spatial solution of school buildings must accommodate a wide range of users, including persons in a wheelchair, taking into account the size of the manoeuvring space with wheelchair (Ø 150 cm). Therefore, many spatial dimensions are based on the wheelchair parameters, for example the widths of the doors, corridors, lifts, as well as the furniture arrangements (e.g. aisle widths). The reach distances of people with small stature or people in a wheelchair affect the height of the counters, storage elements and control devices (lift control, lighting, window opening, etc.).

The entrance and circulation areas must allow for the free movement of a large number of students as well as the movement and manoeuvring of

person in a wheelchair. Likewise, the learning spaces (including furniture) must allow sufficient space for manoeuvring of person in a wheelchair and convenient access to interior elements.

Entrance areas	Manoeuvring space for person in a wheelchair or people with baby strollers – at the front of the entrance doors and in the vestibule or doorway
	Appropriate width of the entrance doors
Circulation spaces	Appropriate width of the corridors, doors, ramps and stairs
	Appropriate dimensions of the lift
Toilets and bathrooms	Appropriate dimensions for manoeuvring of the person in a wheelchair
	Appropriate door width and easy opening
	Appropriate height of the toilet, washbasin, mirror, and water tap
Learning spaces	Manoeuvring space for person in a wheelchair or people with baby strollers
	Appropriate space near the table and between the furniture
	Access to lectern and podium in lecture hall also for person in a wheelchair
Dining rooms	Accessible height of the counters and tables
	Sufficiently wide aisles between the tables
Library	Accessible height of the counters, bookshelves, information kiosks and services
	Sufficiently wide aisles between the tables and bookshelves

Table 5.7 Size and space for approach and use of school facilities

5.2 Entrance, Circulation Areas and Common Spaces

Entrance

The entrance area serves as the circulation, waiting, meeting and relaxing areas for a large number of people. Therefore, in front of the entrance to the school building it is necessary to create sufficiently **spacious areas**. Access to the school building should be solved equally to all people. When designing new buildings, it is necessary to create the **main entrance accessible** at the same level as the walkway. New buildings must be universally accessible; in any case, the main entrance with stairs and staircase lift is not acceptable.

When renovating buildings with a staircase, it is necessary to **adapt the main entrance** to be accessible and not to create a separate accessible entrance, which is located very far from the main entrance. A universally accessible solution can be a wide and comfortable ramp providing the main access route to the building for all people. Directly in front of the entrance door, a sufficiently large horizontal area (clear space Ø 150 cm) must be dimensioned to allow the person in a wheelchair to open the door.

Glass doors and walls at the entrance areas should be marked with **colour contrasting signs or graphics** to be visible, mainly for people with low vision. Moreover, this is also important for the wayfinding, for example, by using the big letters to provide identification of the buildings within the campus. When there are large areas in front of the building, it is necessary to provide **tactile guiding lines** for people with visual impairment to help them identify the entrance to the building.



Figure 5.1 a, b Colour contrasting signs on the entrance doors and tactile guiding lines in the entrance area (Photo by Z. Čerešňová)

Entrance Hall

Typically, the entrance hall provides a large space for waiting areas, coffee breaks, information desks and kiosks. All these spaces should be **accessible to all users**, so that the **lower height of the counters** and the manoeuvring space for person in a wheelchair are necessary. In spacious halls, people with visual impairment may have a problem with spatial orientation, so it is important to provide them **tactile guiding lines** that are part of the comprehensive orientation systems (see chapter 5.4).

When renovating buildings with **height differences** in the entrance hall, it is necessary to overcome these differences by vertical lifting platforms that are universally accessible to various users. Conversely, staircase lifts that are mounted on the stair railings are not suitable as they are intended only for persons in a wheelchair.

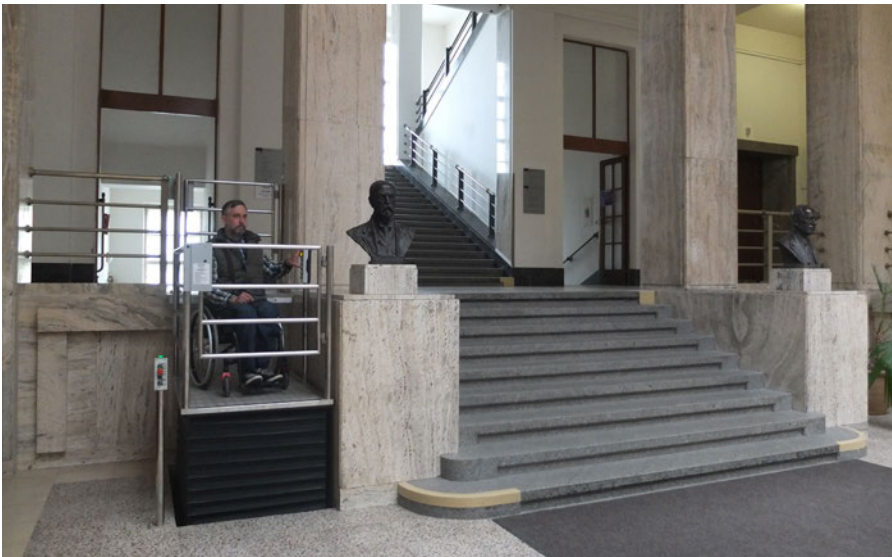


Figure 5.2 a, b Vertical lifting platforms in renovated buildings, Masaryk University in Brno (Photo by Z. Čerešňová)

Waiting areas within the entrance hall should be located out of the main circulation routes so not to block people to move in the space. Small partitions can help to delineate the space and create semi-private places. All seating areas should be accessible for person in a wheelchair.



Figure 5.3 Waiting areas within the entrance hall, University of Copenhagen, Arkitema Architects (Photo by Z. Čerešňová)



Figure 5.4 Clear identification of Reception and IT-helpdesk in the entrance hall, University of Copenhagen, Arkitema Architects (Photo by Z. Čerešňová)



Figure 5.5 Lower height of the counter and the manoeuvring space for person in a wheelchair, Library, Masaryk University in Brno (Photo by Z. Čerešňová)

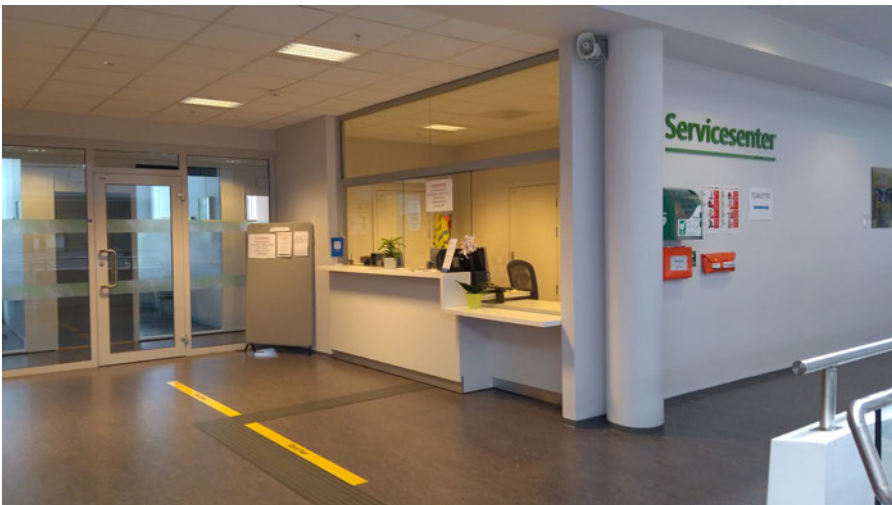


Figure 5.6 Various height levels of the counter with the knee space for person in a wheelchair, NTNU in Trondheim, Norway (Photo by Z. Čerešňová)

Circulation and Common Spaces

The circulation spaces (horizontally and vertically) should provide an equivalent way of use for all people, so separate routes or other segregation elements should not be created in new buildings. A **universally accessible solution** for all people is preferred also in building renovation.

Clear circulation route is one of the most important elements that help people in **orientation within the building**. Well-designed circulation routes not only allow people to connect with the places, but also anticipate what is ahead. The circulation routes should be unambiguous and not to cause the confusion.

In school buildings, **social and relaxation functions** must be taken into account when designing circulation and common spaces. These areas should not be solved as long and narrow corridors but should provide a social space for meeting and relaxation of students.

The corridor **shape and width** should be based on the anticipated number of students, number of classrooms/lecture halls and seating spaces along a path. The width of the main circulation route should be minimum 300 cm, especially when classrooms are situated on the both sides.

Transparent walls in circulation areas can improve visual connections within the whole space, including various learning spaces. Transparency increases awareness of learning activities throughout building as well as social interactions. Transparency is also very important for people with hearing impairment because it allows them an overview of activity in adjacent spaces (Bauman, 2010). Moreover, it provides good lighting conditions to support lip-reading, sign language, as well as wayfinding.

Corridors are a prime place for students to **display and showcase** their achievements, or to provide temporary information. Locating wall-boards and writable surfaces on the walls in circulation areas encourages students and teachers to share ideas and enhance collaborative learning.



Figure 5.7 Glass wall provides overview of activity in lecture hall, University of Copenhagen, Arkitema Architects (Photo by Z. Čerešňová)

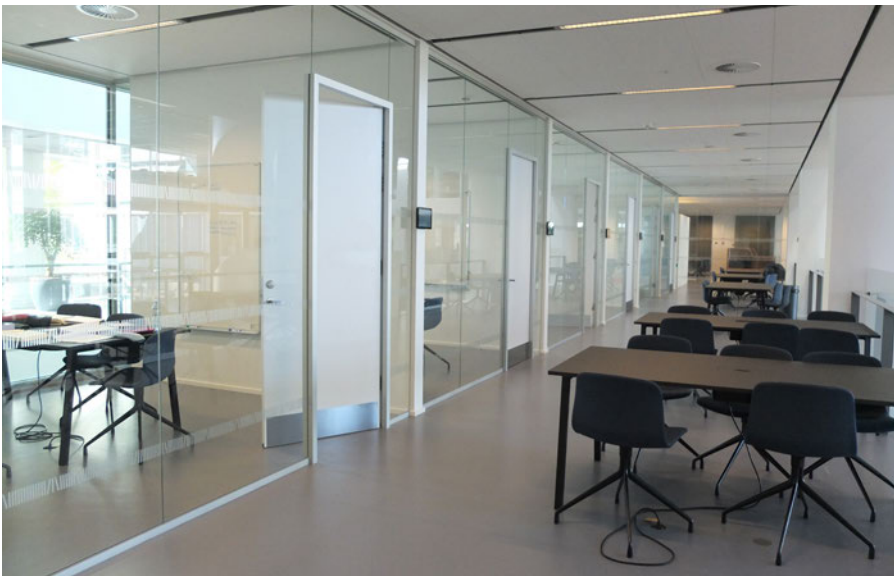


Figure 5.8 Transparent walls in circulation areas allow visual connections within the space, University of Copenhagen, Arkitema Architects (Photo by Z. Čerešňová)



Figure 5.9 Atrium with glass boxes provides overview of activities in the space, IT University, Copenhagen, Henning Larsen Architects (Photo by Z. Čerešňová)



Figure 5.10 Circulation spaces with seating areas with visual connections to atrium and classrooms, IT University, Copenhagen, Henning Larsen Architects (Photo by Z. Čerešňová)

The circulation spaces should serve also as **informal learning and socializing spaces** that provides various choices of individual, semi-private or group seating arrangements with comfortable furniture. These spaces are articulated by architectural elements and furnishings that can be both built-in (fixed) and flexible (movable). Semi-circular or arched seating allows visual contact between individuals, an arrangement particularly advantageous for individuals with hearing limitations who can better identify the person who is speaking (Bauman, 2010, Johnson, 2014). All seating arrangements should also include the spaces for persons in a wheelchair who cannot be segregated.



Figure 5.11 Informal learning and socializing spaces with various seating arrangements, Kolding Campus, Denmark, Henning Larsen Architects (Photo by Z. Čerešňová)



Figure 5.12 Semi-circular seating allows visual contact between individuals, Kolding Campus, Denmark, Henning Larsen Architects (Photo by Z. Čerešňová)

Although informal spaces are part of the circulation path, they must be **well defined**, for example by small partitions and flower pots/walls. Especially, when creating individual or semi-private seating spaces, separation elements are desirable. Also, the floor surfaces such as carpets can help to differentiate informal/relaxing areas within the circulation route (Demos and Čerešňová, 2016).



Figure 5.13 Informal learning and socializing spaces defined by the small partition with writable surface, Kolding Campus, Denmark, Henning Larsen Architects (Photo by Z. Čerešňová)

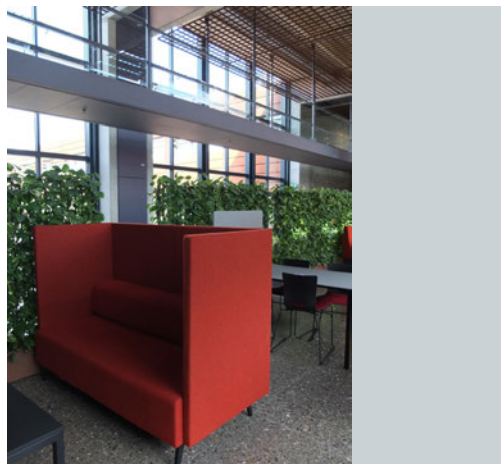


Figure 5.14 Semi-private seating areas with high backrest and armrest, SDU Odense, Denmark (Photo by Z. Čerešňová)



Figure 5.15 Semi-private seating areas protected by the partitions with greenery, SDU Odense, Denmark (Photo by Z. Čerešňová)

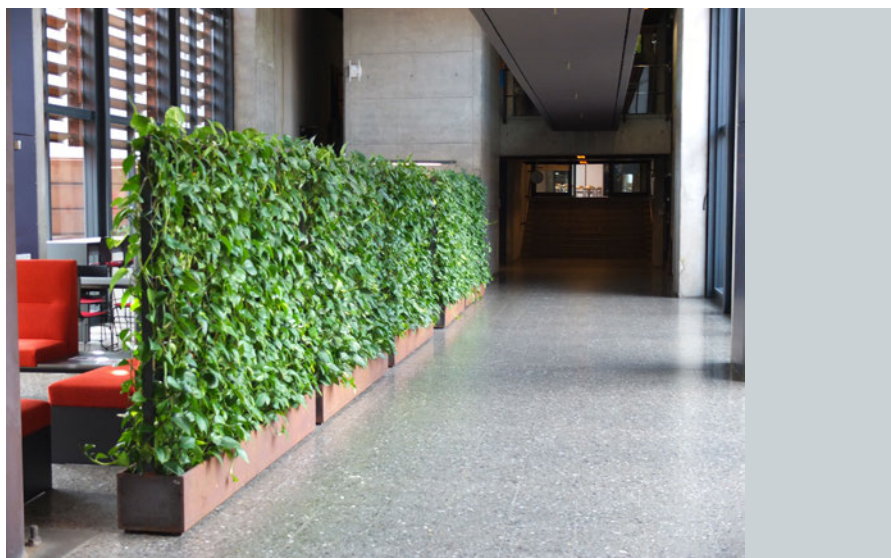


Figure 5.16 Partitions with greenery clearly define the circulation and seating areas, SDU Odense, Denmark (Photo by Z. Čerešňová)

Protruding Objects

Protruding objects, like items projecting into the circulation path, are always a danger not only for people with visual impairment, but also for students while conversing and multi-tasking as they walk (Demos and Ceresnova, 2016). Therefore, these items should be eliminated as much as possible, or these **protruding objects** (projecting over 20 cm into the path) should be identifiable at the floor, for example by placing the flower pot under the protruding object. This is important especially for people walking with a white cane. Other dangerous situations may occur **under the staircase** with headroom lower than 220 cm, so this space should be blocked at the floor line with some architectural feature, such as seating, planting, etc., to stop people from entering this space.

Entrance to the Learning Spaces

The circulation spaces near the primary entrances to the learning spaces should provide sufficient **waiting area** for students before entering the room. Also, **visual connection** with learning spaces is very important because students should have a chance to see what is going on inside the learning space before entering (Demos and Ceresnova, 2016). For this reason, it is necessary to provide a glazed surface in the door or beside the door. The space in front of the doors should provide **easy access to person in a wheelchair**, so when the door is recessed from corridor, it is necessary to provide at least 160 cm for width of recess. Also, the door handle should be situated more than 40 cm from the wall for easy manipulation for the person in a wheelchair when opening the door.

People with visual impairment should be able to identify the primary entrances to the learning spaces, so it is necessary to provide **tactile or acoustical features**, such as a change in tactile and acoustical properties by using different floor surfaces. Also, the colour contrast solutions of the doors, floors and walls are efficient.

5.3 Learning Spaces

According to Goldstein (2008), inclusive higher education spaces should employ **different teaching and learning styles and user requirements** to be accessible, flexible and people-friendly to a broad audience. Learning spaces must encourage an active learning through a group interaction and promote a social and collaborative atmosphere among students. **A student-centred approach** is focused on active student engagement in projects and discussions. Currently, the desired differentiation of learning spaces requires creation of **differentiated zones** of variable sizes with the required flexible equipment and furnishing (Ceresnova et al., 2017).

Learning spaces can consist of formal or informal spaces. Usually, **formal learning spaces** are traditional enclosed rooms, such as classrooms, lecture halls, and laboratories. On the other hand, **informal learning spaces** are casual, sociable spaces scattered within the circulation and common spaces, often not enclosed with the separate walls (Demos and Ceresnova, 2016). Nowadays, traditional models of the classrooms are replaced by **collaborative learning spaces** that are flexible to allow connections among students, professors, and researchers, not only in physical space but also in virtual space (CISCO, 2017).

Inclusive learning spaces should be **equally accessible and usable** to various people, including those with physical or sensory limitations. Accessible solutions should provide the same opportunities to all people with no segregated solutions. For example, in the **lecture halls**, it is necessary to create a suitable space for a person in a wheelchair with the possibility of sitting in a row at the table counter with the other students, not separately in front of the tiered seating. An equal access should also be created for lecturers. Therefore, new and renovated buildings should have a flat floor with convenient access to the lectern, blackboard or projection screen. In case of building adaptations, it is necessary to create **accessible podium/stage** using a ramp or an integrated lifting platform.

Accessible Workstations

Similarly, it is necessary to create an equal access and use of premises in **classrooms and laboratories, including chemical, physical and biological laboratories or technical workshops**, which serve to instruction. These rooms must also be dimensioned for people in a wheelchair, while interior equipment (workstation, fume hoods, sink, etc.) must allow comfortable access and work for people in a wheelchair. Every classroom, work-study area and laboratory with fixed workstations shall have at least one **accessible workstation** with clear knee space at least 70 cm high and clear floor space not less than 90 cm x 150 cm (McGill Standards, 2004). The optimal solution is the type of universal laboratory with workstations that are **height-adjustable with container (mobile) furniture**, which allows efficient use of the space and its possible modification (e.g. creation of a free space under the table top for people in a wheelchair).



Figure 5.17 Height-adjustable workstations, Faculty of Architecture, Slovak University of Technology (Photo by M. Kacej)



Figure 5.18 Different heights of workstations, University Library, Umeå University, Sweden (Photo by Z. Čerešňová)

Room Size and Proportions

Learning spaces should provide **multiple configurations** with a variety of furnishings and technical devices. The most common sizes for formal learning spaces are as follows (Demos and Ceresnova, 2016):

- Small Learning Space: designed for up to 20 people,
- Medium-Sized Learning Space: designed for 20 to a maximum of 49 persons, including the instructors,
- Large Learning Space: designed for 50 to a maximum of 99 persons, including the instructors,
- Lecture Hall: designed for over 100 students.

Room proportions have a significant impact on seating arrangements, sight lines, and the ability of instructors and students to interact with each other, even in small rooms (UC, 2003). Formal learning spaces with square floor plan are easier to provide **good sight lines and flexibility** of seating arrangements, but optimal solution is rectangular shape with width-to-length proportions 3:4 or 4:5 (maximum 2:3). When designing a lecture hall, it is recommended to use a trapezoidal shape with several surfaces that reduce the echo effect caused by the parallel walls (Demos and Ceresnova, 2016).

Seating Arrangements

Learning spaces should be designed to be as **flexible** as possible so that they accommodate all seating arrangements such as: rows, arches, circles, clusters, and so on. Therefore, it is recommended to prefer **movable or portable furniture** (desks, tables, and chairs) in order to allow flexibility and adaptability for various activities and different spatial needs of users. On the other hand, the furniture should be stable to provide a safe use for people with limited mobility and dexterity. Moreover, it is necessary to offer a variety of chairs, with or without armrest, to provide **comfort to all users**.



Figure 5.19 Flexible seating arrangements, Faculty of Architecture, Slovak University of Technology (Photo by M. Kacej)

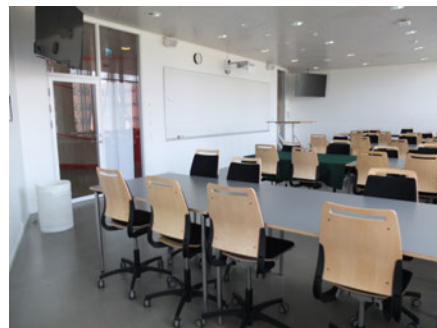


Figure 5.20 a, b Flexible seating arrangements, Kolding Campus, Denmark, Henning Larsen Architects (Photo by Z. Čerešňová)

Lecture halls should also provide more flexibility, for example some movable chairs should replace fixed seats. This solution also **offers more choices** for people in a wheelchair to choose a seating and viewing location in comparison with traditional type of “reserved seats for wheelchair users”. Movable chairs in lecture halls provide more universally accessible solutions, because there are no special or segregated reserved places for a limited number of people in a wheelchair. Arched or semi-circular rows in lecture halls are preferred, as this solution allows more visual contacts, especially very important for people with hearing impairment. When using fixed rows of tables, it is necessary to create sufficient **manoeuvring space** for people in a wheelchair. All accessible spaces must be located near an accessible route and emergency exits.



Figure 5.21 Combination of fixed and movable chairs in Lecture Hall, University of Copenhagen, Arkitema Architects (Photo by Z. Čerešňová)

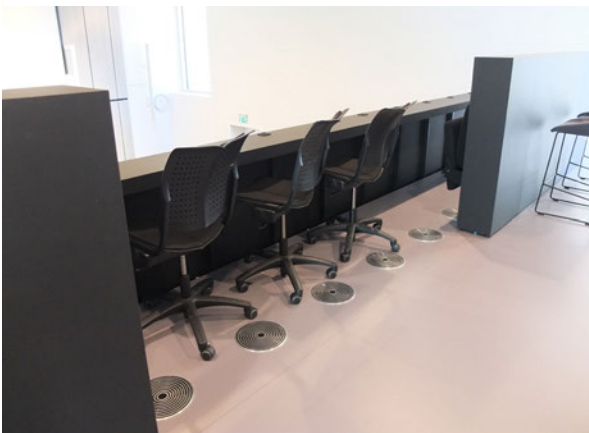


Figure 5.22 Replacement of movable chairs provides space for people in a wheelchair, University of Copenhagen, Arkitema Architects (Photo by Z. Čerešňová)



Figure 5.23 Use of movable chairs offers more choices for people in a wheelchair to choose a seating and viewing location, CASE University, Cleveland, arch. F. Gehry (Photo by Z. Čerešňová)

Classrooms should allow **various seating configurations**, such as a circle or ellipse, single or group tables, and so on.

- **Sitting in a circle or ellipse:** this configuration allows all students to have good visual contact with teacher and all the other students. In addition, it is the best solution for students with hearing impairment, as well as for students with visual impairment. In this configuration, a person in a wheelchair can choose any space to sit.

- **Sitting in a group:** this configuration allows 4-10 students to work together in groups around a table. The tables can be dispersed throughout the room. But simultaneous group projects usually require acoustical separation by movable partitions. This configuration should provide enough space for a person in a wheelchair to join a selected table (Demos and Čerešňová, 2016).

Circulation within Learning Space

Seating configuration and furniture arrangement should provide sufficient space for **manoeuvring of a person in a wheelchair**. Circulation width needs to be widened (approx. 150 cm) along the accessible workstations/tables, wallboards, bookshelves and other storage spaces. In classroom with traditional seating configuration (built-in tables), there should be spacing (min. 90 cm, opt. 120 cm) between furniture that allow movement also for person in a wheelchair.

Materials and Colours

All spaces in school buildings should be designed with materials that **minimize reflection** (glare) off the walls, floors, and other surfaces and furnishings. On the other hand, transparent and translucent materials are very important to allow an overview of activity in the space (Bauman, 2010, Johnson, 2014). These materials (e.g. glass walls) should be marked by colour contrast signs, graphics, or other symbols that help people with visual impairment to identify “invisible” walls.

The materials and colours in learning spaces have a strong influence on attention and distraction of students. Therefore, the wall and floor surfaces in learning spaces should be painted with **neutral colours**, and it is necessary to avoid arbitrary and complicated patterns that can be confusing and also worsening the communication of the people with hearing impairment. When using sign language interpreting, darker colours behind the interpreter are beneficial. Colour and texture contrasts between floor and walls are important mainly for people with low vision.

The acoustic qualities of the walls and other surfaces are also very important; therefore, it is necessary to use **sound absorbent materials** that reduce reverberation time so that the spoken word is more understandable. All lecture halls and large learning spaces shall be equipped with **assistive listening systems** (e.g. hearing loop technology) for students with hearing impairment.

Daylight conditions are one of the building qualities that can improve the mood and productivity of students (Pitts, 2016). On the other hand, direct and bright sunlight can cause glare and reflections that can be obtrusive. Mainly, when the windows are situated behind the lecturer, students can have a problem, especially those using lip-reading. Also, it is necessary to avoid layouts and window locations that result in a high contrast of light levels adjacent to each other (Demos and Ceresnova, 2016).

5.4 Multisensorial Orientation and Information Systems

Wayfinding is the ability to orient in a physical space, to navigate from one place to another. Term was coined in the 1960s by Kevin Lynch, who defined wayfinding as: *“a consistent use and organization of definite sensory cues from the external environment”* (Lynch, 1960, p. 3). Knowing a place means that its location and layout are familiar, if wayfinding system is ineffective, the people feel lost in the space. Environmental psychologists describe this spatial understanding as having a mental or *“cognitive map”* (O’Keefe, Nadel, 1978, p.62), which we can describe as personal images of the relative locations of meaningful places and the routes between them.

Spatial abilities appear to be controlled by several parts of the brain, including frontal lobes, the right hemisphere and the hippocampus. Brain imaging studies by neuroscientist J. O’Keefe (1978) and his colleagues, have shown that hippocampus plays an important role in human navigation. Humans are certainly not the only species able to navigate in space, according to more sophisticated non-human species systems such as echolocation; they may be better way-finders than humans (Carpman, Grant, 2012).

Effective wayfinding system is important part of the human-centred method because it facilitates user access, increases satisfaction, and reduces stigma and isolation of users with disabilities. Understanding a few basic principles of wayfinding design could help to enhance building performance and to provide more inclusive solutions. For example, **vision limitations** make it arduous to read signs and maps and difficult to identify other potentially useful cues, such as colour coding. **Hearing loss** may reduce the ability to ask for spoken directions and make it difficult to understand what is said. People, who cannot hear well, may miss other wayfinding cues, such as elevator bells. Because of these reasons, good design makes **use of all the senses**. Wayfinding should be solved during initial designing stages, not just added as signage, when building is done.

One of the main goals of wayfinding design is to provide an environment rich in **distinctive features** that allows people to create the cognitive map intuitively. Properly designed spatial concept, landmarks, unique features and appropriately chosen colours and materiality could help in understanding a building and space.

Spatial Organization

According to human-centred principles, layout of the building should be **simple and intuitive, easy to understand**, regardless of the users' experience, knowledge, language skills, or current attention level. Comprehending spatial layouts helps to predict the characteristics of the area, while interacting with it.



Figure 5.24 Atrium allows views into adjacent spaces, Singapore University of Technology and Design, designed by UNstudio, (Photo by Z. Čerešňová)

Linear and simple layouts are intuitive, while circular and complex layouts are the most confusing, because of a lack of landmarks, so users cannot locate themselves in the space. It is important to understand two-dimensional shape of the floor plan and also the overall spatial layout of the building. **Clear and perceivable** arrangement of the space, such as **open volume or atrium**, allows views into adjacent spaces as well as above and below, so it is possible to see how the floors are arranged (Carpman, Grant, 2012). Multiplying the atrium in the building makes the layout confusing. It is necessary that all buildings have a clearly distinctive front entrance, and main doors are accented to be visible. Ramps, stairs, elevators, or escalators, should be seen from the entrance areas, or if not seen, the path to them should be intuitive.



Figure 5.25 Contrasting materials help to identify edges between path and adjacent area, Singapore University of Technology and Design, designed by UNstudio (Photo by Z. Čerešňová)

Light and Materials

Light and materials are mutually dependent on each other. Materials are the key to understanding light in architecture because they directly affect the quantity and quality of the light. Two qualities of materials – their finish and their colour – are the most important in this regard. Using **contrasting colours** is effective way to define paths for most people, mainly for people with cognitive disabilities, and even for people with low vision. Contrasting colours can be used to separate the elements within a space. According to Smithsonian Guideline for Accessible Exhibition Design, colour contrast of 70% between a path and the adjacent area or along a path's edge is recommended as an effective wayfinding tool. Glossy and highly reflective surfaces can confuse people with mental disorders or visual impairments, while interacting with space. Equally useful for wayfinding are **haptic contrasting textures**, particularly on the floor, but also on the walls, doors



Figure 5.26 Tactile guiding lines and colour contrasts in circulation spaces, Masaryk University in Brno, architects: A PLUS (Photo by Z. Čerešňová)



Figure 5.27 Tactile guiding lines and colour contrasts in circulation spaces, University of Copenhagen, Arkitema Architects (Photo by Z. Čerešňová)

and ceilings. Contrasting floor textures help to identify edges and spaces by touch, reflected light and acoustics.

Acoustic properties depend on the material's density and surface regularity. Echo of sound absorbing materials such as carpets or rubbers, may be undetectable, while echo of flat sound reflective materials such as concrete or metals, will be sharp and unvarying. For irregular **textured surfaces**, the echo may pulsate and vary in intensity. People with limited vision use these echoes to find out when they have entered a different space and to identify how far away from a wall they are.

Light in its natural or artificial form determines our perception and affects people and the environment quantitatively (contrasts in space), qualitatively (enough light for function of space) and emotionally. The basis for every lighting concept is an analysis of the project and each space in it. Corridor can have lower intensity than learning spaces, but at the same

time, it is necessary to gain as much information as possible from the environment. Therefore, it is important to **increase lighting levels at the decision points** in the circulation path, at the room entrance to facilitate reading the room number and so on. According to the wayfinding system, it is more important to create sophisticated lighting concept, not just choose exact lamps or fixtures.

Multisensorial Wayfinding Requirements (Tactile, Visual, Audible Elements)

Everyday navigation can be difficult for an enormous range of people of all ages, conditions, and abilities. Some disabilities and impairments are obvious and permanent, while others are invisible or temporary. It is necessary to implement multisensory elements, which combine tactile, auditory, and visual cues to assist with wayfinding.

Multisensory systems include firstly **tactile elements**, such as Braille and embossed lettering, diagrams, maps, floor plans, tactile guiding and warning lines, and so on. Secondly, **visual elements** include contrasting colours to identify important building elements. Signage, if it has contrasting colours, big letters, and pictograms, is other useful visual element and is the most important element used by people for wayfinding. Thirdly, **audible elements**, perceivable by hearing, such as sound beacons or sound signals, possibly combined with voice information, are very important elements mainly for people with visual impairment. Beacons are small devices, which could be installed one for each room or general area. When people walk into or approach a room, an associated application will use the broadcasted beacon information and provide auditory and visual information to user. Smells, olfactory elements help to delineate spaces, but there are not often included as a part of strategy, because smells are usually not specific enough to enable people to locate themselves exactly.

5.5 Signage and Orientation Plans

One of the major requirements for school building is to be easily accessible for all potential users and afterwards to be clearly organised. The accessibility part mostly covers the national legal requirements. On the assumption that all the physical processes and construction works are properly done according to the national legislation, it is crucial to clearly map the environment and mark routes, permanent rooms and spaces to help users to orientate without any problems.

Two main categories in the field of **signage** requirements are as follows (SEGD, 2012):

- 1) Signs **identifying** permanent rooms or spaces; and
- 2) Signs and orientation elements **giving directions** to or information about permanent room or space.

This part explains the signs and orientation plans giving directions to or information about permanent rooms or spaces. Signs identifying a permanent room or space ("**identification**" signs) are more minutely explained in the following part of this chapter about signs. Orientation maps and floor plans however need to combine the requirements of both categories. The main requirement of orientation plan is to be well legible for all and to highlight the necessary aspects.

All orientation maps and signs are required to have a non-glare finish and both **Raised and Visual Characters** are required to contrast with their background. In case of interior orientation maps and floor plans with several rooms and corridors, it is necessary to simplify the basic floor plan as much as possible to improve its legibility for all. Different functional units need to be moreover separated by using various colours and textures. Although contrast requirements are not specifically outlined, good contrast between the fields, characters and pictograms is crucial for a good orientation, especially for persons with visual impairments. The recommendation for the colour

contrast for neighbouring fields is minimum **70 % contrast**, calculated by comparing Light Reflectance Values (LRV) of the colours. This value has been set in accordance to the research of SEGD (2012) that indicates that signs are more legible for persons with low vision when the contrast of the characters with their background is at least 70%.

To fulfil the requirements for legibility for persons with visual impairment, the orientation plans and floor plans have to be **tactile**. The typographical and pictogram requirements for raised and visual characters are explained in the following part of this chapter focusing on the signage. However, it is important to note, that the term “tactile characters” refers to characters that are read by touch, which includes both **Raised Characters and Braille**.



Figure 5.28 a, b Details of the tactile floor plan of the Faculty of Architecture, Slovak University of Technology in Bratislava (Photo by A. Kubica)

Raised Characters

“**Raised Characters**” are defined as relief version of the easily recognised Latin or Roman alphabet. While the Braille is mainly assigned for persons born as sightless, Raised Characters are for those who have lost their vision during their lives. General recommendation for using Raised Characters in orientation maps and floor plans are focused on **good legibility of the sign**. Only sans serif styles with normal to thin strokes and upper-case characters can be used. And it is necessary to avoid italic, oblique, script, or highly decorative typefaces of the letterform.

Raised Characters size is limited to the range between 16 mm (5/8") and 50 mm (2") in height and raised a minimum of 0.8 mm (1/32") above the background (SEGD, 2012). According to the **general principles of Braille**, the perimeter of one Braille point is 1.4 to 1.6 mm and raised 0.4 to 0.8 mm. The recommended shape of the point is a rotating paraboloid and the horizontal and the vertical distance of middles of two neighbouring points of the same Braille letter is 2.5 mm. The horizontal distance of the middles of two neighbouring points in two different Braille letters is 6 mm. The recommended size of one **line of Braille letters is 10 mm**. In case of application various colour fields to orientation plan, raised patterns or marks need to be applied, whereas one pattern represents one colour, to make the plan legible for people with all disabilities.

Example: Tactile plan of the Faculty of Architecture, Slovak University of Technology in Bratislava

*To simplify legibility of the orientation plan we applied the same size, colour and rise of either Braille or other Raised Characters for the signs of the same importance. The general size of one Braille and Raised Character we have set to 1 cm and all Braille, Raised Characters and Vertical Characters are in **white colour on dark grey** background. Due to the fact, the orientation plan, we have dealt with has been a plan of higher education institution, application of various colours for different functional areas was indispensability. For various functional areas identified on the orientation plan as different colour fields we applied **specific patterns** for each function to make the plan legible for people with low vision as well as with total visual impairment. The basic orientation structure of the plan was identified by thick lines representing walls and the inner structure of the building. Colour fields of different functional areas, Braille, Raised Characters and Vertical Characters have been designed not as markedly as the basic structure to give the highest hierarchy stage to the most important element of the plan.*



Figure 5.29 Braille and Raised Characters on the tactile floor plan of the Faculty of Architecture, Slovak University of Technology in Bratislava (Photo by A. Kubica)

Appropriate Size, Position and Material

To maximise legibility and usability of the orientation plan, the **appropriate size and position** has to be chosen and a suitable material needs to be applied. The size of the orientation plan is mostly influenced by ergonomic requirements. According to Cervenka (2003), all points of the plan have to be sufficiently **accessible by both hands** from one standing/sitting position. The recommended maximum width of the tactile orientation plan is approximately 120 cm and the depth up to 60 cm according to **reach range**, including also person in a wheelchair. Therefore, the tactile maps and plans should be placed in the height of 80 cm to 110 cm. This height is still acceptable also for standing person. Additionally, the tilted position (15–30°) of the plan is recommended (Ceresnova, 2008). The stand of the orientation plan needs to be designed without any barriers and must allow people in a wheelchair to shift under the stand to maximise the reach range.

Orientation plan is a permanent object used with a high frequency; therefore, application of an appropriate and well resistant material is crucial. The requirements for an **appropriate material** for tactile maps and plans are to be well resistant against touch to preserve the legibility of tactile char-

acters, without any undesirable structure and effects. This material has to meet the requirements for contrast, glare and detailing of tactile characters. Moreover, the material used for tactile plan needs to be safe and pleasant for users to maximise their comfort and attractiveness of the plan. Cold and unpleasant materials with sharp edges are not appropriate solution for tactile orientation object.

Example: Floor Plan of the Faculty of Architecture, Slovak University of Technology in Bratislava

The size of the orientation plan we have designed has been adapted to the proportion of the longitudinal shape of floor plan of the university building. Material used for the orientation plan has been regulated by technical possibilities of producer (freiraum-europa, Austria) and method of production. To avoid any connections on the plan, which may lead to undesirable tactile lines and confusion when reading the plan by touch, we have decided to produce the plan in indurated plastic. This material allows demanded colour range, layering and provides accurate details and resistance for tactile characters. Moreover, the weight of the material is still acceptable.



Figure 5.30 Tactile floor plan of the Faculty of Architecture, Slovak University of Technology in Bratislava (Photo by A. Kubica)

A specific attention needs to be focused on the **symbols and signage** on the orientation plan, and also on the room identification and direction signs. The exact figures and signage used on the orientation plan has to be provided on permanent room signs and direction identification. In the orientation plan, the main direction sign is an arrow and a wall that provide the best description of the environment. The wall is the best natural direction element for people with visual impairment; however, the barriers and the exact number of openings needs to be shown as well.

Doors, apses and openings help people better orientate in the given environment and locate themselves. Barriers like stairs and pillars advise possible danger to people with visual impairment, who are offered the opportunity to avoid these barriers and to choose more consensual route. Also, spaces with specific status for persons with disabilities must be clearly marked by identification signs as well as on the orientation plan and the route to these spaces has to be accessible and legible.

Figurative characters on the orientation plan designating for example main entrances; meeting spaces in case of **emergency** and ascendant of stairs and ramps are also very important and must be as legible as possible and cannot be interchangeable with any other character (e.g. sightless person do not feel any difference in the shape of hexagon and circle, or triangle and empty arrow), whereas the signs helps to orientate in the environment and are very important also in case of emergency to identify the escape direction and the meeting point.

Signage Requirements

To fulfil the requirements for the best possible legibility of a building and wayfinding for people with disabilities, it is crucial to link all the orientation elements together. The main aspect of legibility of space and internal structure of a building is clear architectural design. However, in the case of a more comprehensive layout due to the requirements of the specific functional needs, spatial structure and size of the building, further orientation elements (e.g. orientation plans) are required.

Orientation plans necessarily need to cooperate with "**identifica-**

tion signs” and **“directional and informational signs”**. In these cases, the common language used for all the orientation elements is even more important to enhance the cooperation between orientation plan and signage. The main requirement for either Identification Signs, or Directional and Informational Signs is to support the Orientation Plan as a fundamental orientation element of the building. Two ways of signage design are possible as follows (SEGD, 2012): (1) Visual Characters and Raised Characters on a single plate; and (2) Visual Characters and Raised Characters with Braille on separate plates. It is difficult to choose better option looking at these two methods of communication. It is necessary to look at the specific needs and requirements of the users and function of the building.



Figure 5.31 a, b Identification signs with Visual and Raised Characters with Braille, Boston Convention Center (Photo by Z. Čerešňová)

Identification Signs

Signs identifying a permanent room or space are required to **use both, Raised Characters and Braille** and must be situated on the consistent location according to the regulations due to ergonomics. In special circumstances, signs identifying a permanent room or space may be compensated by Visual Characters as long as the specific Visual Character is well known and identifiable for all.

Standard location for identification signs is on the wall, next to the door, on the latch side for better prediction of door opening for person with visual impairment. Signs should be mounted within a reach range of person in a wheelchair. The standardized baseline for the Signs is however

set between **1200 mm to 1500 mm** above the finished floor. In particular circumstances, when a mounting space is not available on the strike side of the door, it can be placed on the nearest adjacent wall. At double doors Signs must be mounted on the inactive door, if only one door is operable. If both doors are operable, the sign must be mounted on the right-hand door. However, the safety of the tactile reader is a priority, in cases of doors opening outwards into the path of travel, to protect the reader against an outward swinging door, the sign must be mounted outside the arc of the door swing.



Figure 5.32 Identification Sign with Braille, Masaryk University in Brno (Photo by Z. Čerešňová)

Visual Characters

Directional and informational signs do not require placement on the consistent location and require only **Visual Characters**. The requirements for Visual Characters are equal to the requirements for finish and contrast, Character size etc. of identification signs. All the requirements are mostly covered in the previous chapter and their usage in orientation plans. However, the specific need is focused on the size of Visual Characters according to their placement above the finished floor. Visual Characters must be located at minimum 1000 mm above the floor or ground.

Pictograms Requirements

To accept various cognitive limitations of users, it is recommended to prefer visual symbols instead of written information. Pictograms are common method how to communicate easily with everybody and according to the International Symbol of Accessibility (ISA or “wheelchair” symbol) in some cases it is a must. ISA is required when not all toilets or bathing facilities, entrances, or lifts in a building are accessible, as might be the case in an existing or historical building. In this case, it is crucial to place the symbol on all the accessible toilets, entrances and lifts. Direction sign to the nearest accessible facility should be placed at each inaccessible one. The international Symbol of Hearing Loss is another specific international symbol and must be displayed where assistive listening systems are required. The sign is informing persons with hearing impairment of the availability of assistive listening devices. This sign must also meet Visual Character guidelines.

To protect the legibility for all it is necessary to fulfil the requirements that all symbols and their backgrounds must have a non-glare finish, and the symbols and their backgrounds must contrast with each other. The recommendation for the colour contrast for neighbouring fields is minimum 70 % contrast, calculated by comparing Light Reflectance Values (LRV) of the colours.

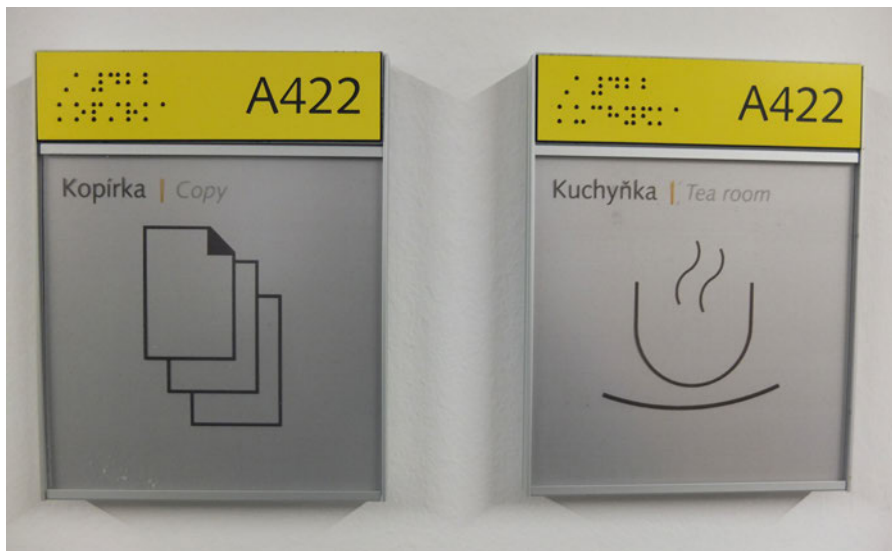


Figure 5.33 Pictograms with Braille, Masaryk University in Brno (Photo by Z. Čerešňová)

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6. Recommendations

Zuzana Čerešňová

Inclusive higher education can be achieved when all students have equal access, appropriate conditions, and support for active involvement in educational process. In order to meet the provisions of UN Convention on the Rights of Persons with Disabilities (CRPD), and in particular Article 9 **Accessibility**, as well as the other related articles of the CRPD, the following **systematic solutions** should be progressively implemented:

- **Harmonization of European legislative** and regulatory requirements in the area of accessibility of environment, services and information and communication technologies to create equal conditions for all students with special/specific needs within the European Higher Education Area;
- Adoption of the **European Accessibility Act** and the development of the European Standards for Accessible Environment in accordance with human-centred approach (e.g. Universal Design, Design for All, Inclusive design);

- Implementation of **human-centred design principles** into national programs, but also into development plans, legislative regulations, and technical standards, as well as the action plans and institutional documents of higher education institutions;
- Adoption of the **control and sanction mechanisms** to ensure compliance with the accessibility requirements – they must be part of all measures and legislation adopted;
- Promotion of the human-centred design and its overall **contribution to society** in order to overcome barriers in people's attitudes;
- Promotion of an **education and research** related to accessibility and human-centred design, with the development of accessible products, programs and services;

To improve the accessibility of higher education, particularly in connection with the implementation of the provisions of the CRPD, Article 24 **Education**, the following systematic steps must be taken:

- Adoption of the legislative provisions on higher education so that minimum **standards for access to the academic environment** are defined with the aim to create a universally accessible environment and adequate support services for all students;
- Specification of the legislative provisions on appropriate adjustments (reasonable accommodations) and support services; for example, in form of the **catalogs of support measures** which the HE institutions should provide to students in general;
- Supporting the creation and funding of the **counselling and support centres for students**, and improve the professionalism and establishing standardised services in order to share them more easily among higher education institutions and verify the quality of these services;
- Provision of **multisensory (in multiple modes) and accessible study materials and ICT** (including websites, online courses, etc.) that support different cognitive and sensory limitations of users in order to achieve effective learning and communication;

- Supporting the implementation of **student-centred pedagogical approaches** such as Universal Design for Learning (UDL), Universal Design for Instruction (UDI), which flexibly respond to diverse abilities and individual/specific needs of students.

The **human-centred approach** is one of the cornerstones for the creation of inclusive environment. This approach provides solutions for comprehensive **universal accessibility of higher education** for a wide range of people with different abilities /disabilities; covering all aspects of accessibility and usability:

- **Inclusive teaching and learning methods** using student/learner-centred approach (e.g. UDL, UDI);

- Accessible services, study materials, ICT provided in **multisensory form** (combination of tactile, visual and audible forms) or compatible with assistive technologies and devices;

- **Inclusive indoor and outdoor environment** that is friendly, accessible, safe, healthy and satisfying the requirements of students, teachers and other staff and visitors of the higher education institutions.

UNIVERSAL ACCESSIBILITY OF HIGHER EDUCATION	
STUDENT/LEARNER-CENTRED PEDAGOGY	Universal Design for Learning (UDL)
	Universal Design for Instruction (UDI)
HUMAN-CENTRED DESIGN OF SERVICES AND INFORMATION	Accessible information (webpages, academic information systems, etc.)
	Accessible study materials (in multisensory form)
	Available assistive technologies
	Available support services
HUMAN-CENTRED DESIGN OF THE BUILT ENVIRONMENT	Inclusive (accessible) indoor and outdoor environment
	Flexible and adaptable spaces and elements
	Multisensory form of orientation and information systems

Table 6.1 Universal accessibility of higher education

Inclusive indoor and outdoor environment of higher education institutions can be achieved by the implementation of the following **human-centred design recommendations**:

- Provide **overall accessibility** of HE campuses and buildings (including accommodation, sport, leisure and cultural facilities) in line with human-centred methods (e.g., Universal Design, Inclusive Design, Design for All);
- Provide **flexible and adaptable** environment (e.g., various seating arrangements, movable and height-adaptable furniture) that reflects individual/specific needs of users, as well as the various learning and teaching styles, such as individual work, team work or discussions;

- Provide **clear layouts and visual overview**/preview of spaces to allow people to have visual contact and control over the activities within the spaces;
- Provide **multisensory elements** (combination of visual, tactile, and sound elements) in the orientation and information systems, but also in the teaching and learning processes, as well as in form of the relaxation and therapeutic tools;
- Create **predictable and safe environment** (without obstacles, protruding objects, sharp edges, etc.) to minimize dangerous situations mainly for people with visual impairment;
- Offer **comfortable spaces, furnishings and equipment** that take into account different physical limitations and space requirements of users; and create good microclimate conditions (acoustics, lighting, visibility, thermal comfort, etc.) of learning spaces;
- Provide **spatial solutions** of the campuses and school buildings that include a wide range of users, taking into account maneuvering space and reach distances of different users.

Moreover, **inclusion and active participation** of people with disabilities in the monitoring, designing and decision-making processes at international and national level (development of national strategies, action plans, legislation and standards, etc.), as well as at institutional level (identification of barriers, and proposals of accessibility adaptations, etc.) is very important in the creation of inclusive society.

7. Conclusions

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The right to education can be successfully implemented only if the educational environment will be **equally accessible and usable** to all people. The ambition of human-centred design is to create a **non-discriminatory** environment that ensures equal opportunities for all citizens through universal accessibility of the environment, products, services and information and communication systems.

In order to create an inclusive learning environment, it is necessary to apply comprehensive human-centred methods covering **various aspects of accessibility**: (1) accessible physical/architectural environment, (2) accessible information and communication technologies, services and study materials, (3) accessible teaching and learning methods using student/learner-centred instruction. Furthermore, it is necessary to use **participatory planning** methods which include users/experts with different limitations in the planning and decision-making processes in accordance with human rights conventions.

To create an accessible educational environment, it is necessary to have knowledge on the spatial requirements of different users but also to understand their perception, communication and educational needs and limitations. By accepting the **diversity of users** and by creating the appropriate conditions and support services, it is possible to achieve an inclusive educational environment.

Based on the UNIALL project research, this publication defines a comprehensive framework of the **systematic solutions** that can help to create inclusive higher education in line with the international and national policy and legislative documents, which are presented in the first chapter. The **human-centred approach**, described in the second chapter, takes into account the human diversity and accommodates this heterogeneity as much as possible in all areas of the educational environment, including the teaching and learning process. Inclusive methods, for example Human-centred Design, Design for All, Universal Design, Inclusive Design and others, are implemented not only in urban planning, architecture and product design, but also in information and communication technologies (ICT), services and educational strategies. The third chapter presents diversity of students with special/individual needs in higher education. This chapter focuses on the key principles of accessibility of ICT, study materials and support services according to the specific disability types of the students. The tables in this chapter summarise the standardized service measures to be provided by the higher education institution to meet the special needs of students according to their individual types of disabilities.

Consistent use of the human-centred principles such as equality, flexibility, simplicity/intuitiveness, perceptibility, safety, low physical effort and appropriate spatial parameters can lead to the creation of an inclusive environment. The fourth and the fifth chapters provides the proposals and recommendations on how these principles should be implemented in urban and landscape planning of university campuses, as well as in designing of educational facilities, student dormitories, cultural and sport facilities that are inseparable parts of the campuses. Furthermore, the importance of sensorial accessibility in the built environment is highlighted in this chapter by providing multisensorial orientation and information systems.

The contribution of the publication is the formulation of solutions and recommendations for the implementation of human-centred approach to achieve inclusive higher education. A comprehensive enforcement of inclusive methods in higher education will provide equal opportunities for all people to participate not only in educational activities but also in sport, leisure time and cultural activities. Enabling active participation of people with disabilities in social life leads to the fulfilment of social inclusion – the full inclusion of all people in a society.