

Technical Studies and Sciences as a Visually Impaired Person – Challenges to AT/IT and Study Organisation

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Abstract

Presentation of the SZS with the focus on one of its main tasks helping visually impaired students making technical studies accessible. From the pedagogical and psychological support to the adaptation of study materials.

1 The Studycentre for Visually Impaired Students

Traditionally visually impaired persons getting access to Higher Educational institutions choose book studies like Social Sciences, Literature, Law, History and Philosophy. They ask for personal assistance and read printed Braille or listen to audio files or tapes. A fundamental problem is that they often do not fit with the demands of a correspondent labour market, which asks for IT-qualification, personal independence, orientation and mobility. In addition academic jobs are much more available in Business, Natural Sciences, Computer Science and Engineering. The unemployment rate of visually impaired graduates is far higher than the general unemployment rate.

In 1986 the University of Karlsruhe – the oldest Technical University in Germany - started with a new approach in “Computer Science for the Blind”, computer science as a tool and a study programme. Traditional media ought to be replaced by using IT and e-learning.

The aims were:

- to develop a special language to linearise mathematical formulas
- to enable team work between sighted and visually impaired students
- to establish a tutorial programme to transfer literature and graphics in an adapted version
- to make technical subjects accessible to visually impaired students.

In 1992 the project was installed as the “Study Centre for the Visually Impaired Students” of the Faculty of Computer Science responsible for visually impaired students of all Faculties of the University. The comprehensive mission is a supporting programme for visually impaired applicants, students and graduates combined with AT/IT research activities.

In 2009 the Karlsruhe Institute of Technology (KIT) was founded by a merger of Forschungszentrum Karlsruhe and University of Karlsruhe. By this time the tasks and offers of the SZS increased. Especially since November 2011. From this time the SZS got a new professorship and a new scientific head, Prof. Dr.-Ing. Rainer Stiefelhagen. With his knowledge and previous research in the fields of computer vision for human-computer interaction and assistive technologies the future research fields of the SZS will be broadened. For example in the direction of mobility, navigation, communication, access to graphics, e-learning, etc..

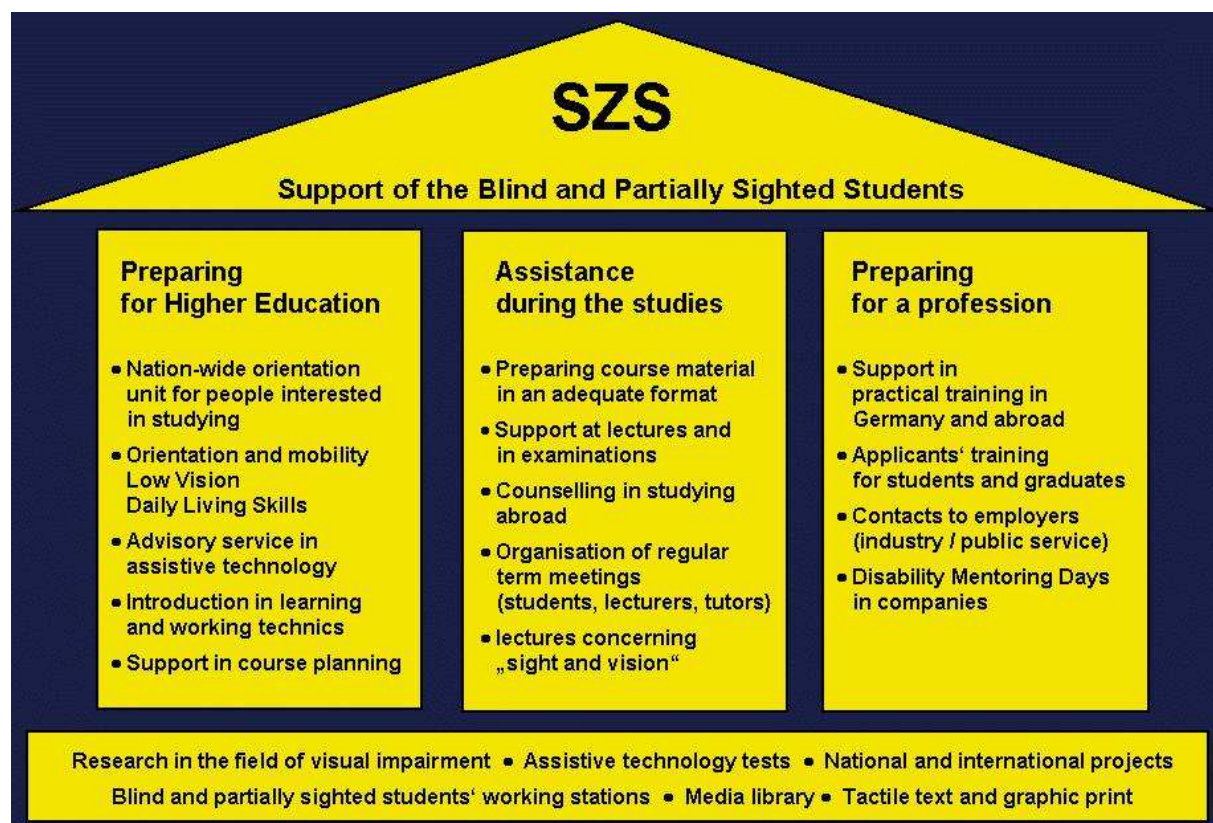


Figure 1: The three columns of the SZS.

2 Base of the literature conversion

The conversion of study literature into a form usable by visually impaired students is one of the major tasks of our centre. This task is based on an intensive co-operation between all academic fields of the KIT and higher education institutions in the area of Karlsruhe: Starting by the individual visually-impaired student who is getting in contact with his/her professors, lecturers, tutors, over the contact between the lecture responsible persons with the SZS, which is coordinating all conversions as well as the exams of the involved academic parties and visually-impaired students. The transfer of the literature and exams is accomplished in cooperation of staff members of the SZS together with trained student tutors, which transfer the books, scripts, foils and other materials in such a manner, that the texts are system-independent and accessible by means of a Braille display or screen reader to the student. The visually-impaired students are thereby also equally responsible for the quality of their converted literature. They are asked to get and stay in contact with their tutors, who are responsible for the transfer of their study literature. The achievement is thus that special literature transfer desires can be dealt with and an optimal cooperation can be developed. This exchange also serves as training for the tutors. They can grow on their tasks and receive from students a direct feedback concerning the quality of their work. For the students on the other hand cooperation with the tutors offers both the possibility of bringing in experiences and ideas and of taking part in the conceptual advancement of the SZS. Working with the forums and platforms of the SZS, students and tutors receive the possibility of developing not only their technical skills but also their key qualifications in social behavior, communication and teamwork aptitudes. The recruitment of the tutors and the support and monitoring of their work is coordinated by a staff member of the SZS, who maintains a strong contact to the academic lecturers, the blind and

partially sighted students as well to blind colleagues, whereby the conversion techniques are constantly optimised, improved and adapted to current technical developments.

3 Transcription of study books, study and exam materials

The student chooses his/her lecture programme for the starting and following terms, which get to be more and more specialized following the study progress. In addition he/she contacts each lecturer or professor to initiate a mutual connection in order to improve adapted university didactics, too. Following the student's information the SZS contacts the teaching staff concerning the used lecture materials and literature recommended. The SZS orders the study books from the publishers, signs a special contract with them concerning copyright and dissemination. More and more publishers are open to our demand, send us an electronic file and we transfer it into an adapted version. All materials are available at the SZS server, included in the general University library system. So the students outside Karlsruhe are able to profit as well.

Two areas of this transcription task are challenging:

3.1 Linearisation of mathematical formulas

Mathematical notations at German schools can't be transferred into a scientific university level (Marburg or Nemeth Code). Therefore already in 1987 we had developed an own mathematical notation called ASCII Mathematic Script (AMS). AMS linearises math notations to be read at the Braille display, easy to learn for blind and sighted persons and thus supporting the inclusion of blind students into the regular learning community. The AMS is short, shorter than e.g. LaTeX. The problem is that it's difficult to convert into other notations. AMS was used for the last 20 years in Karlsruhe and accepted by some other higher education partners. In the meantime LaTeX is widely spread in secondary schools, a free and well supported software, and enables well formatted text. The SZS had to follow this evolution and to leave AMS, although LaTeX offers not a specific math adaptation and presents very long equations.

With LAMBDA – Linear Access to Mathematics for Braille Devices and Audio-syntheses – a research project funded by the European Commission designed a system based on the functional integration of a linear mathematical code and an editor for the visualization, the writing and the manipulation of the text. The code directly derives from MathML and it was designed to be used with Braille peripherals and the vocal synthesis. It is automatically convertible, in real time and without mistakes, into an equivalent MathML version and, through it, into the most popular mathematical formats (LaTeX, MathType, Mathematica ...), both input and output. LAMBDA EU-project finished in 2007, the "Editor LAMBDA 1.1 version" is available for sale, but the problem will be how to make it to a general tool in the community of the visually impaired. On the other hand several functions for a higher educational and job use are still missing. Therefore we have in mind to pick up the idea again and to start to work on a higher math level version of LAMBDA.

3.2 Transcription of graphics in study books and study materials

Science, Engineering and Business studies include graphical information to a great extent. This is to be available to blind users, too. The description of these graphics demands special knowledge in the relevant study field. In addition it should be offered in an electronic version combined with the transferred electronic text.

The SZS elaborated three levels in transcribing graphics:

1. Textual solution

Figures, which are easy to understand or serve as a visualized summary of context developed before in the chapter, can be transferred in a textual way.

2. Textual and tactile solution

The graphic is complex, combined with text and mathematical formulas. First, the SZS process is a reduction of the graphic: removing caption, marking, legend ...; removing unnecessary and confusing lines, broadening the important lines. Secondly, we describe the graphic in simple words, easy to follow and understand. Type and structure of the graphic as well as the arrangement of the elements are explained. Deleted elements are mentioned. The graphic will also be printed by a tactile Braille embosser in tactile and visual way so the sighted and visually impaired students can use it in the same way.

3. Tactile graphics There are pictures and graphic information not to be described verbally and written down, so e. g. geographical maps, plans of public transportation systems. Here we produce one to one tactile versions.

4 Further conclusive areas

The holistic concept of the SZS is not coherent without two further mosaics:

1. A pedagogical and psychological support

Up the first contact with visually impairment future higher education students use the orientation unit of the SZS, which offers individual counselling, group training and networking with the Student Counselling and Guidance Centre of the University. These topics comprehend e. g. study planning including practical training and studying abroad, study and exam conflicts, personal disorders. Group trainings are dedicated to special study skills like PowerPoint presentation, study skills, introduction in new technology and software programmes. Special tutorials can be offered by the Faculty for visually impaired students, where the regular programme is too visual or too crowded. Students with disabilities have enlarged or adapted exam regulations. Those exams take place in the SZS, where the technology needed is available. In cooperation with companies producing assistive technologies, we offer presentations and testing possibilities of their latest products.

2. Special adapted research programmes

Up the first moment the SZS programme was a theme of the German blind community and their associations. Activities in European countries connected the SZS to improve the higher education possibilities for visually impaired persons and to discuss ways of transfer. That's why a variety of universities adapted the SZS model and included it into their organisational and academic structure. EU-funded programmes supported this process. Mobility and orientation programmes combined with the city of Karlsruhe stabilized the inclusion of visually impaired students as normal inhabitants. Scientific approaches were transferred to enhance the situation of elderly people or persons with other disabilities. Joint study programmes with other European partners are dedicated to accessible web design, or barrier-free entrance into the labour market. The high profit of all those research projects is the inclusion of visually impaired students and their personal education.