BEST PRACTICES REVIEW:
Assistive Technology Use in Mainstream Education in Macedonia and Austria

USAID FROM THE AMERICAN PEOPLE
Project for e-Accessible Education

Open the windows

Skopje, May 2015

Project for e-Accessible Education

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Publication:
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Publisher:
Open the Windows

Editor:
Vladimir Lazovski

Authors:
Vladimir Lazovski
Magdalena Dimkova-Velevska
Radmila Stojkovska-Aleksova
David Hofer
Irmgard Steninger

Design and printing:
BoroGrafika - Skopje

The preparation and printing of this publication was made possible by the generous support of the American people through the United States Agency for International Development (USAID), which is a part of the mission of the USA in the Republic of Macedonia. This activity was realized within the Project for e-Accessible Education, implemented by Open the Windows.

CONTENT

GRATITUDE

Behind every good practice, project, model, policy… are people. It is their energy and efforts, their will and skills, their hearts and minds that make things happen.

It is people that make the world change.

At Open the Windows, we are proud to have initiated the pioneering steps in introducing assistive technology in mainstream education in Macedonia.

We are happy and content with the first steps: sometimes small, sometimes shaky, a few falls here and there, a bruise or two… We walked the distance!

And we feel thankful. We feel sincere and humble gratitude for everyone who cheered for and smiled together with us, lent their hand, helped us when things were rough, kept us awake when things seemed smooth, shared their passion and dreams, and kept away our fears.

We thank all of you who showed us that changes are possible!

Open the Windows hereby thanks:

Natasha Buleska
Lela Jakovleska
LiAnna Marr
Joanna Kinberger
Elena Ivanovska
Naziktere Sulemani
David Hofer
Ivo Ivanovski
Martin Todevski
Daniela Graoroska
Darko Chekerovski
Tamara Blagojevic
Aleksandar Stevanovski
Goran Shukulovski
Vera Apostolovska
Viktorija Penova

and many teachers, school staff, parents and students with and without disabilities across Macedonia, as well as the following institutions and organizations:

USAID Macedonia
Diakonie Austria
LifeTool, Austria
Ministry of Education and Science
Ministry of Information Society and Administration
Bureau for Development of the Education
State Educational Inspectorate
the municipalities of Karposh, Vinica, Aerodrom, and other
over 30 primary and two secondary schools

and all other persons, institutions, and organizations that we had the pleasure to work with.

FOREWORD

Technology makes life easier for *all*.

Assistive technology is an ever-more important tool for inclusion of persons with disabilities into the modern digital world, based on knowledge and information.

In education, assistive solutions are an important resource used to improve the educational opportunities of children and youths with disabilities.

Many countries have gained vast experience in using technology's potential for positive achievements in the inclusive education. In Macedonia, people often associate such experiences with developed, rich countries that can afford expensive state-of-the-art technology.

Rather, used to do so.

Since a few years ago, the country has been witnessing a model of introduction and use of assistive technology in the mainstream education, which 'produced' our own, local positive experiences and practices. Many children with disabilities in mainstream schools throughout the country, as well as their parents, teachers and school staff, contributed to, participated in and succeeded through these positive real-life stories.

This Best Practices Review presents a part of the achievements and successes of assistive technology use by students with disabilities in mainstream education in Macedonia. This publication entails statistical data and general findings that speak of improved educational opportunities for children with disabilities. Several individual cases depict a clear picture of the progress and personal development of students using assistive technology.

All these achievements are merely the beginning. In the future, efforts need to be strengthened to include more schools and more children, to improve practices and develop new ones, to explore other manners of supporting children and youths with disabilities.

The directions for the future work can be extracted from the presented examples of an experienced Austrian organization in using assistive technology in the education. Exchange is an effective manner of learning: Austrian lessons learnt could be "translated" into improvements in Macedonia.

Finally, the Review sheds a light on the provisions of the UN Convention on the Rights of Persons with Disabilities related to assistive technology. With its ratification, the Macedonian institutions are under legal obligation to ensure the Convention's implementation. As can be seen through the presentation of the European Union's Digital Agenda, turning the Convention into reality would positively impact the country's progress towards EU accession, as well.

The presented model of introducing and using assistive technology in the education has received several prestigious domestic and international awards. In neighboring Serbia, an initiative was launched to replicate the experiences.

We are convinced that the Best Practices Review support future steps to ensure wide use of assistive solutions for greater inclusiveness of the education in Macedonia and in the region.

Skopje, May 2015

Vladimir Lazovski
Executive Director

PROJECT FOR E-ACCESSIBLE EDUCATION: Introduction of assistive technology in mainstream education in Macedonia

In February 2010, Open the Windows launched an initiative to introduce assistive technology in mainstream primary education in Macedonia, financially supported by USAID.

The Project for e-Accessible Education, as was the official title of the initiative, aimed at supporting the inclusion and facilitating the active inclusion of students with disabilities in mainstream education through assistive technology use in the instruction.

At the start of the project, assistive technology and its potential role in the education were fairly new issues to the Macedonian public, including educational institutions, school staff, and even children with disabilities and their families. Still, until June 2015, over 30 mainstream primary schools, roughly 10% of all primary schools in the country, used assistive technology in their daily work with students with disabilities, ensuring improved educational opportunities for them.

Cooperation with all relevant educational and other institutions was one of the key factors for success: The Ministry of Education supported the needs assessment and played pivotal role in informing schools of the effects of the initiative. The Ministry of Information Society and Administration used budget funds to procure part of the equipment – assistive computer peripherals for the involved schools. The Bureau for Development of the Education and the State Educational Inspectorate participated in trainings to help ensure sustainability.

The undertaken model of introducing and using assistive technology in mainstream schools has received several national and international awards and recognitions. In 2015, an initiative was launched to replicate the experience in neighboring Serbia. Thus, the model used in the project to enable schools use assistive technology is *per se* a good practice.

Step 1: Needs assessment

Macedonia aims at building an inclusive and modern educational system, one that includes wide use of computers and information and communication technologies (ICT) in the instruction. Assistive technology naturally connects these long-term commitments of the educational institutions.

In order to take into account the context properly, the project conducted two nation-wide research studies:

In 2010, the needs of mainstream primary schools were examined through a combination of survey and field visits. Over 70% of all primary schools in the country took part, providing information on the prevalence of students with disabilities, level of inclusiveness, and practices of computer use in the instruction. Based on the findings and the observed needs of schools with regards to assistive technology, 21 primary schools across the country were selected to receive support in introducing assistive technology in their daily work. The full research report is available on OtW's website.

At the start of 2015, Open the Windows conducted a similar research among mainstream secondary schools in the country. 75% of all high schools took part. Based on the findings and observed needs, two secondary schools were selected to pilot the use of assistive technology. The full research report is available on OtW's website.

Both research reports helped cover the existing gap of statistical data and information on students with disabilities in mainstream education.

Step 2: Provision of equipment

Over 30 primary and two secondary schools received the following computer peripherals: big-button keyboard, trackball, joystick, a pair of switches, and touchscreen monitor. These devices met the needs of most students with disabilities in mainstream schools who faced difficulties or could not use the schools' standard computer equipment. The number of devices per school was determined on the basis of the previously conducted needs assessment.

Big-button keyboard can be used by children with motor difficulties or vision impairments. It is also helpful for students with learning disabilities who avoid standard keyboards because of the large number of buttons. The device offers greater accuracy, speed, and clarity.

The joystick replaces the computer mouse and is intended for students who have motor difficulties. Apart from the hands, it can be used with the chin, elbow or foot.

The trackball replaces the computer mouse. It is used by students who have well-developed fine motor skills (i.e. motoric skills of the fingers), but have difficulties in performing movements with the larger muscles. It can also be used with the chin.

The switch is a replacement for the left and right clicks of a standard computer mouse. It is used by students with fine motor skills difficulties, who are not able to accurately use the mouse. Switches can be can be used by hand, chin or elbow.

Touchscreen monitor is not an assistive device *per se,* but it makes computer use easier for children with visual impairment and intellectual disability, for whom it may be challenging to comprehend the hand-eye coordination when using a standard computer mouse or other control device.

All provided equipment was complementary to and could easily be used with the schools' computers.

Step 3: Training delivery

Open the Windows delivered numerous trainings mainly targeting teachers and schools' professional team members, but also parents, representatives of educational institutions, municipalities, relevant civic organizations, etc. Over 1,200 persons took part in trainings and subsequent follow-up dissemination activities and learnt how to make the best use of the provided equipment.

Trainings, in general, referred to assistive technology use in the instruction process with students with disabilities, covering the following topics: inclusion, e-inclusion and e-accessibility of education, introduction to assistive technology, role of technology in individualized teaching, individual needs assessment with regards to assistive technology, inclusive computer-based computer practices, use of accessible educational software, role of the school's assistive technology coordination team, etc.

Step 4: Provision of resource materials

Three accessible educational applications were localized in Macedonian and Albanian language and made available to all schools in the country. The project produced guidelines to reference the applications to the school curricula, part of which specifically addressed the needs of students with disabilities.

Two new educational applications were developed and made available to schools: one for literacy skills (reading and writing) and the other for basic mathematical skills.

The project produced the country's first e-accessible textbooks: 20 primary school textbook (in all four languages of instruction) were made available in a user-friendly electronic format for students with disabilities.

Several manuals for teachers were produced and distributed, including two developed in cooperation with and reflecting the schools' experiences in using assistive technology: on the role of assistive technology in individualized teaching, and on computer-based inclusive practices and school activities.

Various information and simple computer educational games and presentations were also made available to involved schools and teachers, but also to the general interested public.

Step 5: Support to assistive technology use

Schools received consultancy and advisory support to use the assistive technology. Experienced special educators shared their experiences and helped schools respond to individual students' needs. Teachers and school staff visited Open the Windows service provision arm to get directly acquainted to assistive technology use with children with disabilities.

Various events were organized to motivate schools, students and teachers use assistive technology: computer-made arts (drawings, videos and literature) competitions were organized, with hundreds of submissions from students with and without disabilities. Teachers submitted inclusive practices based on computer, ICT and assistive technology use in the instruction. The best participants, as selected by special juries, were publically presented with awards in high profile public events.

Step 6: Information and exchange

Exchange mechanisms were setup and supported to enable and facilitate mutual learning among schools. Several regional events – roundtables were held to present achievements and exchange best practices and lessons learnt. Several national events – conferences and public debates with a variety of stakeholders ensured that the achievements of the initiative were shared with experts, professionals, and the general public. In total, several hundred persons attended these events, which reached a much wider public through media.

In the spirit of the project, a Facebook group was established on e-accessible education, which attracted over 2,300 supporters, mainly teachers, school staff, and parents, who follow the latest resource materials and actively exchange.

In 2013, a group of representatives of relevant educational institutions and civic organizations attended a study visit to the USA focusing on inclusive education. Participants could also see various models of assistive technology use in the instruction. This helped obtain new ideas and explore opportunities for replication of some of the observed approaches in Macedonia.

Step 7: Evaluation

Bearing in mind the pioneering nature of this initiative, all steps and undertaken activities were well-documented and followed. However, special attention was paid to evaluation the

achievements, mainly expressed through the satisfaction of the key involved actors: students with disabilities, their parents, teachers and schools (as institutions).

In 2012, the first evaluation was carried out among the then 21 primary schools that had started using assistive technology in their daily work with students with disabilities. The report can be found on Open the Windows' website.

In 2015, the second evaluation covered a total of 31 primary schools and two secondary schools. The key findings, conclusions and recommendation are presented in the next section of this publication; the entire report can be found on Open the Windows' website.

Both studies concluded that assistive technology improved educational opportunities for students with disabilities and strengthened their self-confidence and active inclusion in the instruction and school activities. Teachers and schools were satisfied with the quality and relevance of the provided supported, which, generally, enabled them use new methods of work and approaches towards students with disabilities.

Also, the studies enabled extraction of recommendations that would facilitate the systematic use of assistive technology across the educational system.

RESEARCH REPORT SUMMARY: Assistive technology use in 31 mainstream primary schools in Macedonia

Introduction

This research refers to the experiences of 31 mainstream primary schools in Macedonia, which use assistive technology in the instruction. Assistive technology introduction and use was enabled by the Project for e-Accessible Education, implemented in the period February 2010 – June 2015.

Methodology

The scope of the survey was to assess the experiences of 31 mainstream primary schools which introduced and used assistive technology in the instruction. It focused on three main issues:

- the **use** of the donated equipment, resource materials and the knowledge and skills of school staff acquired within trainings and subsequent dissemination activities;
- the **relevance** of the donated equipment, resource materials and the trainings regarding the needs of schools and their students with disabilities; and
- the **quality** of the support, expressed through the satisfaction of stakeholders, as well as through eventual positive effects (impact).

The survey was conducted online. Four categories of respondents were included:

- primary schools;
- teachers;
- students with disabilities;
- parents of students with disabilities.

The research was conducted in the period February – March 2015.

Sample

31 mainstream primary schools from Macedonia were covered, which introduced and used assistive technology in the instruction within the Project for e-Accessible Education. All schools responded to the survey questionnaire.

The number of teachers, students with disabilities and parents who participated in the survey was 134, 127 amd 112, respectively. They came from all 31 schools included in the project, with the exception of one school where not a single student with disability filled out the questionnaire.

Data processing and presentation of results

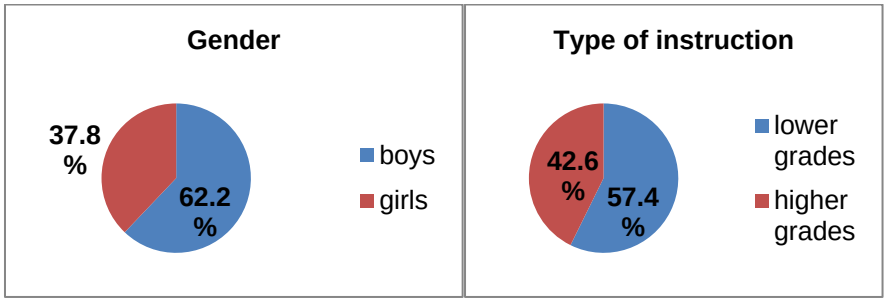
Obtained data were quantitatively (statistically) and qualitatively (explicatively and interpretatively) processed and analyzed. Key findings are presented in absolute and relative size (percentages).

The analysis resulted in conclusions and recommendations, which aim at systematic introduction of assistive technology in the education.

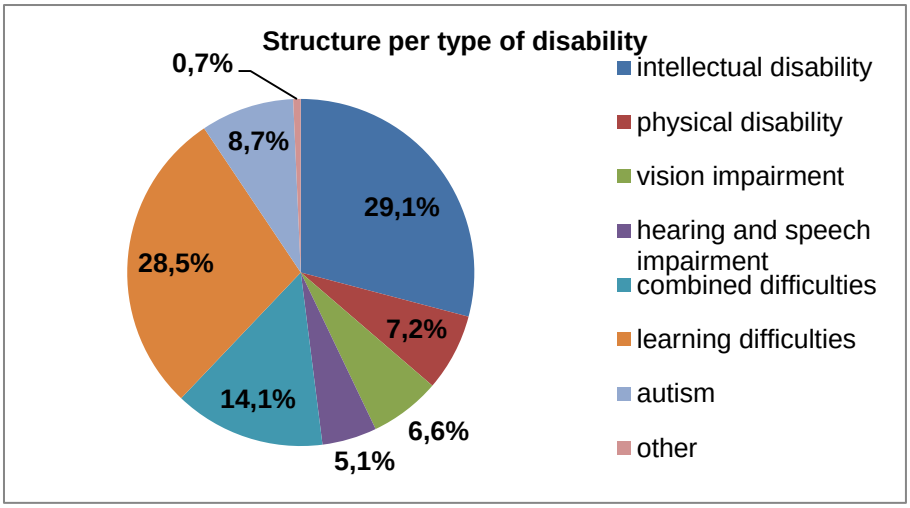
The entire report is available on the website of Open the Windows.

Findings

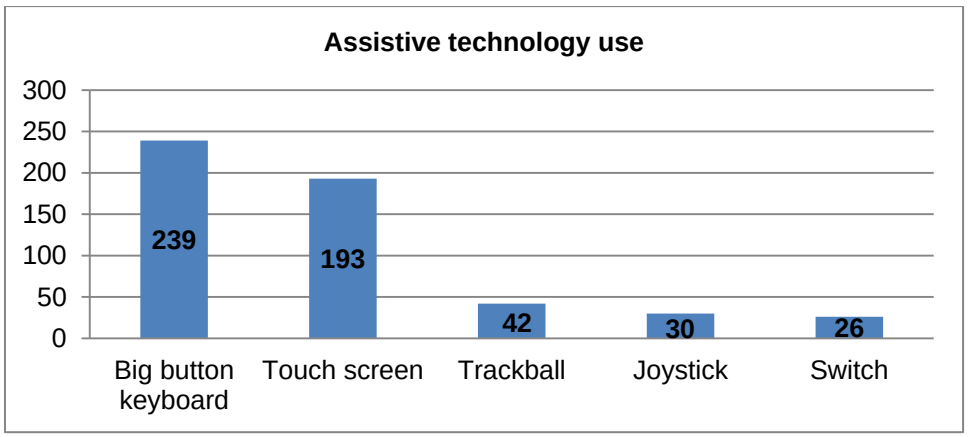
A total of 333 students use one or more of the donated assistive peripherals or software adjustments (accessibility options). 207 of them were boys (62.2%) and 126 were female (37.8%). There were more students in the lower grades using assistive technology – 191 (57.4%) compared to 142 students in the higher grades (42.6%).



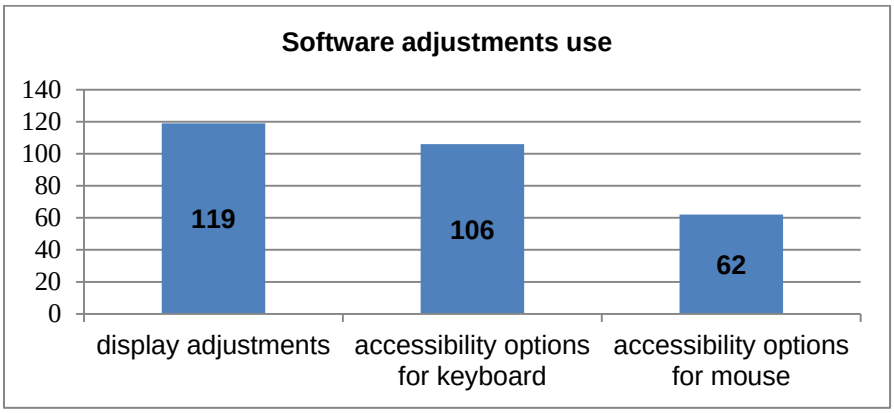
Most students were with intellectual disability – 97 (29.1%) and students with learning difficulties – 95 (28.5%), followed by students with combined difficulties – 47 (14.1%), students with autism – 29 (8.7%), students with physical disabilities – 24 (7.2%), students with vision impairment – 22 (6.6%) and students with hearing and speech impairment – 17 (5.1%). Only 2 students (0.7%) using assistive peripherals and software adjustments face other types of disabilities.



The most commonly used assistive computer peripherals are: big-button keyboard (239 students) and touch screens (193 students), followed by trackball (42 students), joystick (30 students) and switches (26 students). Due to the fact one student often uses more than one assistive peripheral, these data are presented in absolute size only.



The most commonly used software adjustments are: display adjustments – 119 students, accessibility options for keyboard (106 students) and accessibility options for mouse (62 students). Due to the fact one student often uses more than one software adjustment, these data are presented in absolute size only.

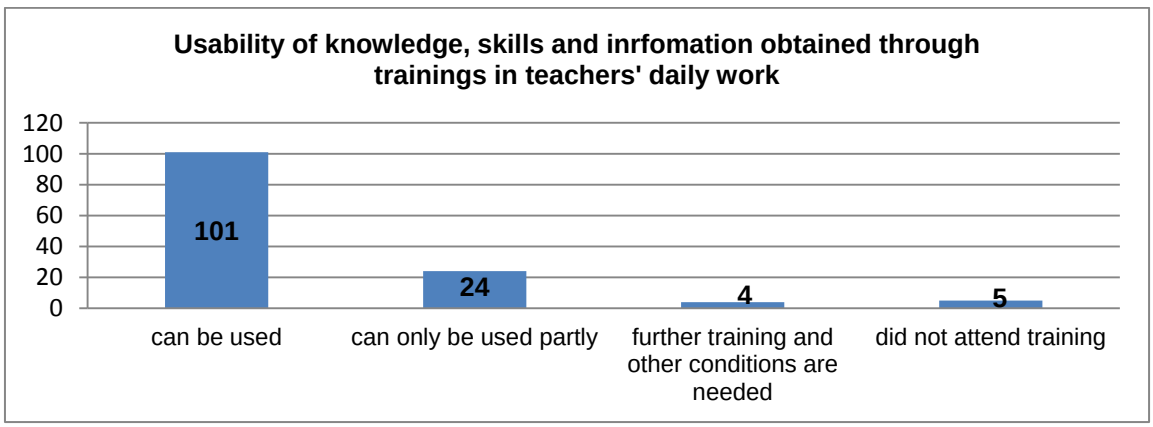


29 schools (93.5%) confirm using educational software in their work with students with disabilities. Most often, they use the software provided within the project, such as GCompris, About Numbers and ShowMe, as well as the so-called "green package" recommended by the Ministry of Education and Science. These applications, combined with the assistive computer peripherals and accessibility options, are used to achieve a wide range of goals (schools could provide more than one answer):

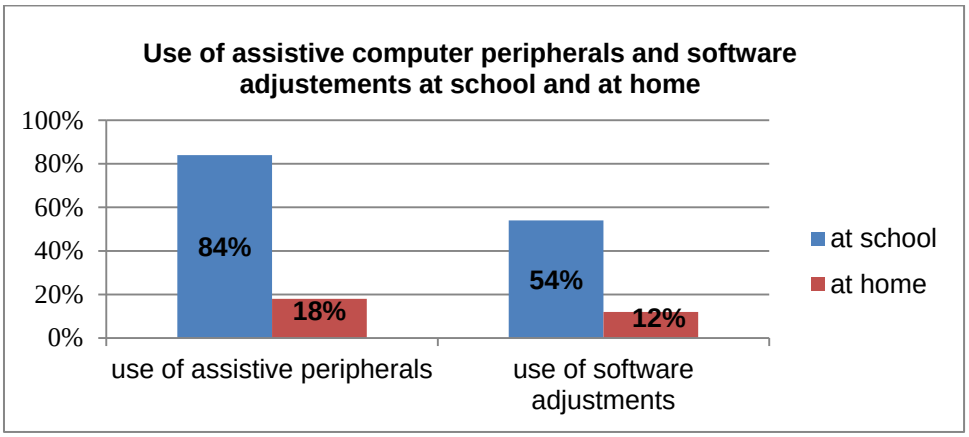
- cognitive abilities development (thinking, memory, focus) –30 schools (96.8%);
- literacy skills gaining –29 schools (93.5%);
- basic mathematical skills gaining –26 schools (83.9%);
- enriching vocabulary and improvement of expression –23 schools (74.2%);
- development and improvement of the fine motoric of hands – 23 училишта (74.2%);
- relaxation and leisure –23 schools (74.2%);
- fostering creativity –16 schools (51.6%).

Vast majority of teachers expressed their satisfaction with the usability of the obtained knowledge and skills within the trainings on assistive technology use in the instruction: 129 teachers (96.3%) participated in trainings delivered within the project. Among them, 101 teachers (i.e. 78.3 of those who participated in training activities) felt that they could "use the acquired knowledge, skills, and information" in their daily work; 24 teachers (18.6% of those who participated in training activities) could do so "partly". Four teachers (3.2% of those who participated in training activities) responded that the training created a solid basis "but further training and additional conditions are needed before I can use them in my daily work".

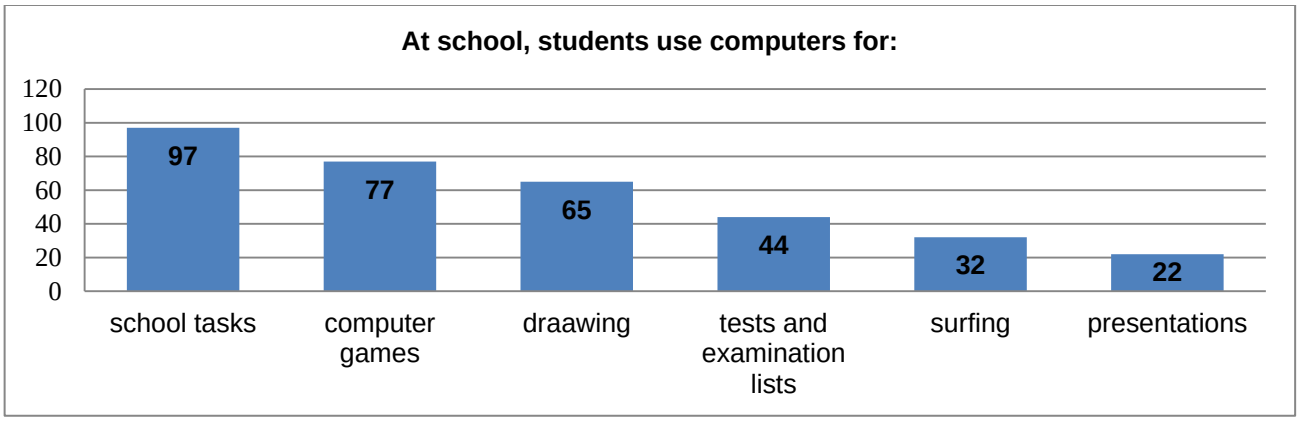
Five teachers (3.7% of the total number who answered) did not participate in the trainings.



According to the parents' answers, some children do not have access to computers and in particular assistive technology at home. The following graph presents the comparison between the use of assistive peripherals and software adjustments at school and at home. The presented results only take into account parents' answers specifying concrete peripherals and software adjustments used:



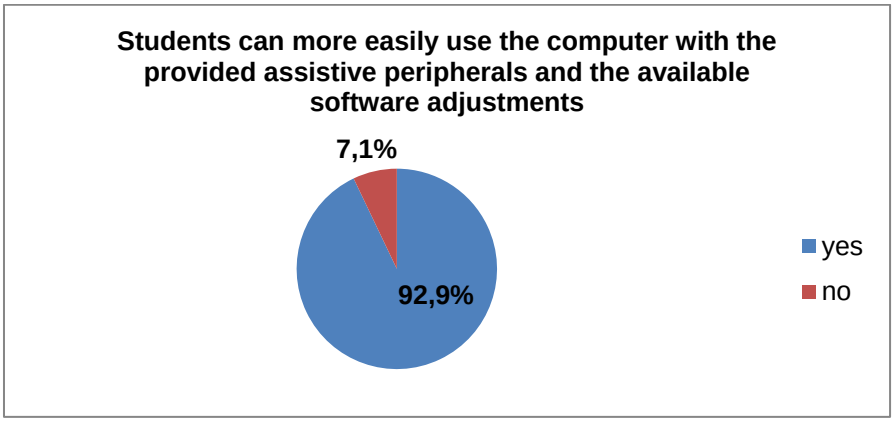
At school, students mainly use the computer to: complete schools tasks – 97 students (76.4%), computer games – 77 (60.6%), drawing – 65 (51.2%), working on tests and examination lists – 44 (34.6%), surfing online – 32 (25.2%), and preparation of presentations – 22 (17.3%). Students could provide more than one answer, thus the following graph only presents their answers in absolute size:



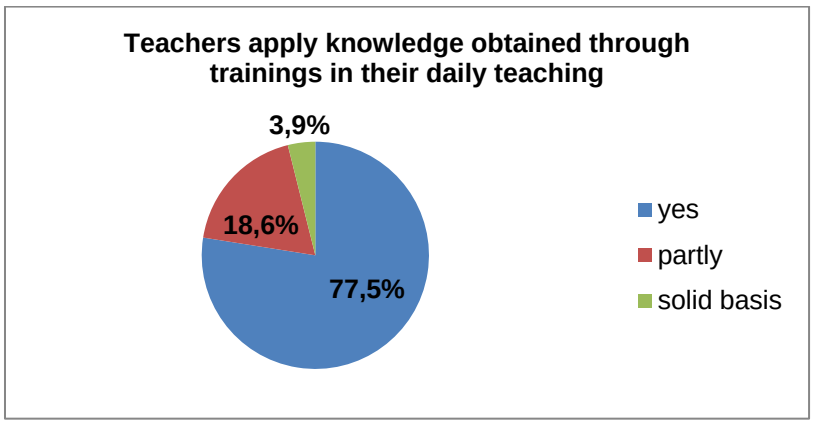
30 schools (96.8%) and 130 teachers (97.1%) felt that the donated equipment was appropriate to the needs of their students with disabilities. Also, 107 parents (95.5%) are satisfied with the equipment that their children use, confirming that it made computer use easier for them. The remaining five parents (4.5%) that responded negatively to this question added that their child did not need an assistive device when using the computer.

Also, 25 schools (80.6%) were satisfied with the number of assistive peripherals provided for their students with disabilities. 104 teachers (77.6%) were completely satisfied with the internal distribution of the assistive peripherals at the level of their school; 27 teachers (20.1%) were partly satisfied; three teachers (2.3%) were not satisfied with the internal distribution of the devices.

118 students with disabilities (92.9%) expressed their satisfaction with using the provided assistive computer peripherals, as it made computer use easier for them. Nine students (7.1%) stated that the computer use was not made easier for them through assistive peripherals use. Thus, students also confirm the relevance of the provided equipment to their needs.



Large majority of the teachers who took part in the trainings (total of 100, or 77.5%) answered that they could apply the obtained knowledge, skills, and information in their daily work with students with disabilities. 24 teachers (18.6%) felt that they could only "partly" apply the newly obtained knowledge, skills, and information. For five teachers (3.9%), the trainings only provided them with a solid ground that needs to be further improved.



Only five teachers (3.7% of all teachers who answered the questionnaire) did not participate in trainings on assistive technology delivered within the project.

Concerning the quality of donated assistive computer peripherals, 26 schools (83.9%) answered that "there were no defects or malfunctioning noticed on any of the donated assistive peripherals". Five schools (16.1%) stated that defects or malfunctioning were "particularly rare".

Teachers' experiences are similar: 124 teachers (92.5%) stated "there were no defects or malfunctioning noticed on any of the donated assistive peripherals", while only ten teachers (7.5%) faced such difficulties.

Schools and teachers were also asked to assess their satisfaction with the provided printed materials (manuals, guidebooks, formats) with regards to their daily work with students with disabilities. Vast majority of teachers – 125 (93.3%) agreed that the use of printed materials supported their efforts to use assistive technology in the instruction. They explained that the manuals were particularly useful in:

- approaching students with disabilities;
- using assistive technology in the instruction; and
- conduct of individual work and use of individualized approach in teaching.

All 31 schools (100%) were unanimous in assessing that the provided printed materials facilitated and supported the use of assistive technology in the instruction.

Concerning the application of the offered formats for monitoring and documenting the progress of assistive technology use by students with disabilities, teachers' answers were as follows:

- 87 teachers (64.9%)– the formats are very useful in the teaching process;
- 37 teachers (27.7%) – could only apply a part of the provided formats;
- six teachers (4.5%) – the provided tools create solid ground, but need to be further adjusted and improved; and
- four teachers (2.9%) – used other formats and tools in the instruction.

Trainings and consultative support delivered to schools by Open the Windows led to the creation of school-level assistive technology coordination team at 19 schools (61.2%). The teams are tasked with individual assessment of the needs of students with disabilities with regards to assistive technology, development of working plans, application of the plans, monitoring, documenting and evaluating progress. In four schools, the professional team undertook the responsibility for these assignments, while in five schools (16.2%) the existing inclusive team was in charge with coordinating assistive technology use. In the remaining three schools (9.7%), these activities were left to the individual will, interest and engagement of teachers working with students with disabilities.

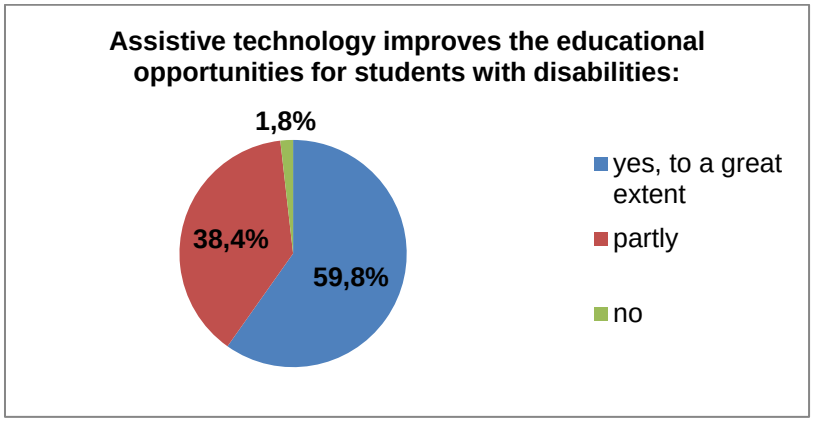
Schools, teachers and parents stated their opinion with regards to the effects of assistive technology use:

30 schools (96.8%) felt that assistive technology use in the instruction brought about positive changes and effects among students with disabilities. Only one school (3.2%) felt that assistive technology did not positively impact students with disabilities.

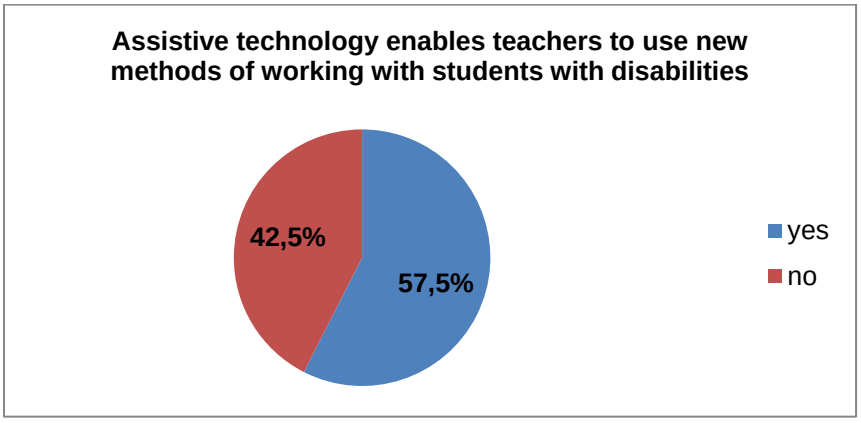
123 teachers (91.8%) were satisfied with the changes that brought about by assistive technology. 11 teachers (8.2%) felt that assistive technology did not result in positive changes for their students with disabilities.

Observed changes:	**Schools**		**Teachers**	
	No	**%**	**No**	**%**
Increases the interest of students with disabilities for the instruction, their curiosity and desire to acquire new knowledge	27	87.1%	91	67.9%
Enables easier preparation of homework and mastering of curriculum by students with disabilities	27	87.1%	83	61.9%
Improves the involvement of students with disabilities in the instruction and school activities	24	77. 4%	109	81.3%
Fosters a sense of equality and strengthen the self-confidence of students with disabilities	23	74.2%	85	63.4%
Generally, no changes were observed among students with disabilities as a result of assistive technology use in the instruction	1	3.2%	11	8.2%
Total schools:	**31**	**/**	**134**	**/**

Vast majority of parents though that the assistive technology improved the educational opportunities for their children: 67 parents (59.8%) felt that the educational opportunities were improved “to a great extent”, while 43 parents (38.4%) observed “partial” improvement. Only two parents (1.8%) thought that the assistive technology did not improve the educational opportunities.



Assistive technology use enabled the majority of teachers – 77 (57.5%) to "apply new methods of working with students with disabilities". The novelties described by teachers included new methods for individual work with the students with disabilities, improved individual approach towards the students' needs, and use of games in teaching.



Large majority of schools – 22 (70.9%) undertook activities to promote and widen the use of assistive technology beyond the school itself. While activities vary from one school to the other, the most commonly used activities are the following:

- Dissemination of information and technology through the mobile special educator engaged on municipal level;
- Meetings, events, trainings, dissemination with representatives of different institutions: local self-government, day-care centers, primary and secondary schools, parental associations, etc.;
- Initiatives for regional exchange among schools with regards to inclusive practices;
- Donation of assistive peripherals to other municipal schools that enroll students with disabilities;
- Participation in seminars, conferences and sharing information with printed and electronic media.

Most initiatives and activities undertaken by the schools so far were at local level.

Schools, teachers and parents could provide additional comments and suggestions when answering the questionnaire.

Generally, the comments expressed gratitude for the support and described positive effects of assistive technology use, such as improved ability to focus by the students, improved inclusion in the instruction, improved self-confidence, improved ability to master school curricula.

Several respondents described their limitations in terms of premises and equipment when using assistive technology.

The respondents provided excellent suggestion for improvement and widening of assistive technology use as a tool that support the inclusion of students with disabilities in primary schools:

- to enact a strategy for inclusion of students with special educational needs;
- to establish regional centers for assistive technology;
- to provide more assistive computer peripherals for a greater number of schools;

to organize trainings for teachers and parents on assistive technology use, in particular for those who had previously not had a chance to attend similar events; etc.

Conclusions

Experiences gained thus far by primary schools confirm that assistive technology introduction **improves the inclusiveness** of the educational process and **widens the opportunities for active inclusion** of students with disabilities.

This general conclusion emerges from the following specific conclusion grouped per the three main issues in the survey's scope:

Conclusions on use

Assistive technology is used in all schools involved in the Project for e-Accessible education.

In each school, ten students on average use one or more assistive computer peripherals or software accessibility options. The students face various types of disabilities.

All types of donated assistive computer peripherals are in use: big-button keyboard, trackball, joystick, switch, and touch screens. The level of usage is different: the big-button keyboard and the touch screens are most commonly used; less than half of the donated joysticks and switches are currently used.

In all schools, students use software accessibility options, among which the most commonly used are display adjustments, accessibility options for mouse and keyboard.

Students with disabilities from the schools involved in the project could also use assistive technology at the school and at home. Most schools offer their students an opportunity to take the assistive computer peripherals at home.

The educational software provided within the Project for e-Accessible Education supports the teaching and learning process and contributes to achieving a wide range of goals related to the students' personal development and creating increased educational opportunities for the students.

Conclusions on relevance

Generally, the applied model of introducing assistive technology suits the needs of students with disabilities:

The types of donated assistive computer peripherals meet the needs of students with disabilities to a large extent and make computer use easier for them.

Obtained knowledge and skills help teachers use assistive technology in the instruction.

Assistive computer peripherals and software accessibility options are applied in a manner that supports computer use in educational purposes by students with disabilities.

Conclusions on quality

The donated assistive computer peripherals are of excellent quality: there have almost been no defects or malfunctioning observed.

Assistive technology positively impacts the improvement of educational opportunities of students with disabilities. Positive effects of its use have been observed, including: improved inclusion in the instruction, strengthened interest for the curricula, easier completion of school tasks, and strengthened feelings of equality and self-confidence.

Materials, resources and formats made available to schools contribute to easier use, monitoring, documenting and evaluation of the effects of assistive technology use.

Assistive technology school teams are the basis for systematic approach toward assistive technology use in the instruction and toward provision of individualized support to students with disabilities.

Assistive technology enables teachers to use new working methods with students with disabilities. It creates opportunities for individual work and application of individualized approach to every individual student.

Schools involved in the project have become promoters of assistive technology in their local communities, as well as of individualized (person-centered) approach towards students and persons with disabilities.

Recommendations

The conclusions presented above confirm the need for **systematic introduction of assistive technology in the education.**

Assistive technology is a tool that supports and facilitates the **process of individualization of teaching of students with disabilities** and one that ensures their **successful inclusion** at all educational levels.

In order to realize this general recommendation, the following activities and steps need to be undertaken:

1. To develop and establish a systematic solution for individual assessment of the needs with regards to assistive technology, and its application at all educational levels.

Two articles of the UN Convention on the Rights of Persons with Disabilities support this recommendation:

Article 9 stipulates that *"…States Parties shall take appropriate measures to ensure to persons with disabilities access, on an equal basis with others, to the physical environment, to transportation, to information and communications, including information and communications technologies and systems…".*

Article 24 foresees that *"…States Parties recognize the right of persons with disabilities to education. With a view to realizing this right without discrimination and on the basis of equal opportunity, States Parties shall ensure an inclusive education system at all levels and lifelong learning…"*.

Macedonia has ratified the Convention. Therefore, the introduction of assistive technology as a tool of inclusion in the education is not a matter of choice, but it rather is an internationally undertaken obligation by the state.

2. Positive effects of the applied model of introduction and use of assistive technology in the education need to be presented to relevant institutions and policy-makers.

Presentation of the effects of introduction and use of assistive technology in 33 mainstream school (31 primary and 2 secondary), as per the model developed in the USAID-funded Project for e-Accessible Education implemented by Open the Windows, will raise the awareness on the importance of assistive technology as a powerful tool for quality education for all. The experiences gained enable analytical review of all possibilities for systematic approach towards this issue.

3. Individual approach needs to be applied in procuring and distributing computer equipment to primary and secondary schools.

When providing assistive technology, one needs to take the individual needs and abilities of each student as a point of departure. Appropriate computer and assistive equipment needs to be recommended and provided on the basis of individual needs assessment.

4. Promotion of the effects of the use of accessible educational software in the educational process to relevant actors.

Combining assistive technology and accessible educational software enables more individualized and more comprehensible educational solution for each student.

Presenting the effects of accessible educational software, used in the most commonly used languages of instruction in the country, needs to cover all relevant actors: educational authorities and institutions, universities and faculties, software development companies, etc. This will raise the awareness of potential role of accessible educational applications for all students.

This will motivate the creation of new educational software applications, which will decrease the existing lack of accessible educational software in the languages of instruction in Macedonia.

5. Schools' capacities need to be strengthened for use, monitoring, documenting and evaluating the effects of assistive technology use.

Human resources are of key importance for the inclusive educational process: Schools' capacities need to be significantly strengthened, primarily of teachers and professional team members, for assistive technology use based on individual approach. Monitoring and documenting the effects needs to be encouraged, as well as the inclusion of assistive technology in the individual educational plans.

Schools need to establish teams for assistive technology that will provide adequate internal support in the introduction and use of assistive technology in the daily work with students with disabilities.

6. Cooperation between schools and parents needs to be strengthened, among other, for assistive technology use.

Parents need to be active partners of schools in using assistive technology at the school. Parents need to be informed about and enabled to help their child use assistive technology at home, in order to ensure continuous efforts.

7. Schools' capacities need to be strengthened for successful implementation of inclusive educational policies in general.

Ensuring inclusion of students with disabilities in the mainstream education means overcoming architectural barriers and provision of accessible premises for all, but even more importantly strengthening the capacity of teachers, professional teams and schools' management in implementing inclusive practices.

In this regard, it is extremely important to enact the foreseen bylaws on enrolment of students with disabilities in mainstream education and to build a system of early identification of the special educational needs of students. Identification and monitoring of students with disabilities will facilitate the planning and implementation of inclusive public policies in the future.

This obligation, namely, stems from the UN Convention on the Rights of Persons with Disabilities, which in its article 31 stipulates that *"States Parties undertake to collect appropriate information, including statistical and research data, to enable them to formulate and implement policies to give effect to the present Convention".*

8. Cooperation needs to be strengthened between primary and secondary schools in the field of inclusion and assistive technology use.

When a student transits from primary to secondary education, schools need to cooperate better through information and experiences sharing with regards to inclusion and assistive technology. This is even more important when it comes to students with disabilities (or all students who have followed an individual educational plan), and for whom it is of vital importance to receive continuous support through their entire education.

SELECTION OF GOOD PRACTICES IN MACEDONIA

Assistive technology and good cooperation – factors of success

"Having received the assistive devices, our school got an opportunity to provide better and more complete response to the needs of all our students. Teachers received an additional tool to bring curricula closer to the students with special needs, to teach them in a clearer and more understandable manner for them."

Emilija Mijalova, special educator at the St. Cyril and Methodius primary school in Kochani.

The St Cyril and Methodius primary school from Kochani fulfills all accessibility standards. In addition to the access ramps, elevator, adjusted toilets and classrooms, the available assistive devices, the school runs a complete professional team and an assistive technology team that take care of the students with special educational needs.

Seven-year old M.S., student in the first-grade, is among them. He likes writing, drawing, watching animated films and educational presentations, especially when he can use his fingers to manage the slide show on the touch screen. His attention is attracted to certain sounds, and when sounds are used in a synchronized manner, the student remembers better the material related to the instruction. He is a calm and somewhat reserved boy who can hardly hold a pencil due to the tremor affecting his hands. He sometimes behaves inappropriately, and short-spanned attention and difficulties in thinking and memory have turned obtaining literacy and mathematical skills into a troublesome challenge.

The school's assistive technology team has however assessed that the student might improve his school performances using the computer. He can overcome the hands tremor by using a trackball and a touch-technology monitor, and he gets much more interested in the letters when using the colorful big-button keyboard. M.S. uses "slow keys" and other software adaptations to ensure that the pointer moves slower on the screen. He likes using the educational applications About Numbers and ShowMe, and learns together with Dino the Dinosaur, a character of the online educational game Dino's Adventures.

His teachers and family have all been trained to adjust the computer for M.S. Therefore, he can use IT at school and at home. The close cooperation between his school and his family enabled M.S. to use the school's assistive devices even when at home.

Results achieved so far include: improved concentration (focus) and longer attention span; literacy skills at the level of recognition – M.S, can, for example, name, write or connect a Cyrillic letter to a visually presented objected that starts with that letter; obtained basic mathematical notions such as quantity, numbers, relations in space between different elements; improved time orientation with regards to days in the week, seasons of the year and use of watch; and improved ability to independently conduct manual activities, such as writing or drawing. His teachers successfully adjust school tasks to the needs and capabilities of the student.

The student, the school teams and his family continue working together in using assistive technology. Achieved results and documented benefits prove the successful and fruitful cooperation of everyone involved.

Prepared by: Emilija Mijalova, special educator

Technology – an additional opportunity

"The big-button keyboard and the touchscreen offer greater precision and overview when writing new words. The joy and satisfaction of having a task well-completed are a motivation and driving force for yet greater engagement of the student with regards to learning French."

Irena Naumoska, French-language teacher at the Goce Delchev primary school in Prilep.

B.S. is a twelve-years old girl student in the sixth grade at the Goce Delchev primary school in Prilep. Friendly, easily-adjustable, curious, and open for new knowledge – these are the characteristics that her teachers use to describe her.

When moving around the school premises, she is accompanied by her friends and fellow class mates. Details, strong colors and distant objects create difficulties for her vision impairment. Among the school subjects, mathematics was particularly challenging for B.S. prior to the introduction of assistive technology at our school.

The inclusive school team once again proved its creativity and dedication when they further adapted the big-button keyboard to the student's needs: using silicone, the team has modelled all letters on the keyboard, making it even simpler for the student to use the device with large, colorful and clearly visible keys. So, when B.S. faces difficulties in visually perceiving the keyboard's letters, she can rely on the hand-made silicon models. In addition, she uses a touchscreen with simple, one-colored background, without unnecessary details and with large icons.

Further supporting the student's active learning and participation in the instruction, the school's team cooperated with the Union of the Blind to provide a screen reader and an optical magnifier. These devices enable B.S. to easily use the computer and the Internet.

In this manner, technology helps our student in following the instruction in mathematics, Macedonian, French, English, and computer science. However, it is the support from the teachers and her fellow classmates that turns assistive devices and educational software into a useful tool for B.S.'s education and daily life.

Her family also got acquainted to the assistive technology and supports her in using it not only at the school, but also at home. The parents are active partners in the entire process and gladly follow the instructions received by the teachers and the school's professional team. The student herself is very pleased too: she can now write her homework using the school's big-button keyboard at home, for which she received permission from her school.

Teachers and school's professional team jointly plan, document and evaluate the assistive technology use in the instruction. The procedure and formats presented by Open the Windows are of great help in this regard.

Whenever B.S. faces additional obstacles in acquiring the foreseen knowledge and skills, her teachers seek creative manners to produce useful teaching aids, such as pot- or straws-made letters and numbers.

All these efforts based on assistive technology and other creative solutions enabled B.S to read and write more easily, and to comprehend the basic mathematical operations. Her happy and satisfied smile further motivates her school to put additional efforts in supporting her education.

Prepared by:

Elizabeta Sekuloska, special educator

Liljana Dunimagloska, psychologist

Biljana Dukoska, pedagogue

Irena Naumoska, class teacher

I can now write as all my friends do

"I find it very interesting to write using the big-button colorful keyboard. I can better see the letters and numbers. Previously, I could not catch up my friends when we wrote during classes; I can now write as all my friends do."

C.A. 14 years, students at the Simche Nastovski primary school in the village of Vratnica

C.A., a student at the Simche Nastovski primary school in the village of Vratnica, does not have a computer at home. The school is the only place where he can enjoy the benefits of modern information technology.

He is a friendly person and feels well among his classmates who offer their support whenever he needs it. The student receives the same response from his teachers and the special educators engaged in the school's special classes.

Before he started using assistive technology, C.A. could only recognize a part of the printed letters. Reading and writing seemed very difficult tasks for the cheerful boy.

Seeking to improve his self-confidence when working on reading and writing-related tasks, the school team decided to offer the student to use a big-button keyboard during the Macedonian language classes. His computer's settings were adjusted to increase the font and icons on the screen, as well as to decrease the speed of the pointer's movement. Educational software helps teachers to focus and maintain his attention to the instruction activities. C.A. works individually with the school's psychologist using the touchscreen once or twice a week.

The school team is completely aware of the importance of the assistive technology as a tool for inclusion and carefully plans its use in their daily work with the students. Assistive technology has become a resource that teachers include in their daily planning of instruction activities and in developing individual educational plans for students with special needs.

As an illustration, C.A.'s individual educational plan in Macedonian language instruction includes assistive technology as a tool to realize a variety of educational goals. Part of the planning is presented below (excerpt of the student's original individual educational plan in Macedonian language):

Индивидуално тематско планирање

***за ученикот** Ц. А **од VIII одделение со посебна образовна потреба:** лесни пречки во психичкиот развој*

училиште: ОУ „Симче Настовски" - Вратница **предмет:** Македонски јазик **наставник:** Даниела Коцеска

Тема: Почетно читање и пишување, изразување и творење, литература, медиумска култура

Реден број	Цели	Содржини	Форми и методи	Активности (на наставникот и на ученикот)	Интеграција / корелација	Оценување	Услови за работа	Време на реализација
1. 2.	- да ги препознава и именува видовите медиуми - да ги препознава согласките и самогласки	- Видови медиуми	- лепење слики на лист за електронски и печатени медиуми	- наставникот подготвува слики за видовите медиуми, а ученикот ги лепи на лист		- набљудување	- слики	- септември
3.	- да ги препознава симболите на гласовите и да ги поврзува со зборови	- Поделба на гласовите - Поврзување на букви со предмети	- вежби во работен лист - вежби во работен лист	- ученикот лепи букви во работен лист - ученикот ги поврзува буквите со слика		- усна повратна информација	- работен лист - тастатура со големи копчиња	- октомври
4.	- да се оспособува да раскажува	- Раскажување по слики	- усно изразување	- наставникот покажува слики, а ученикот раскажува	- историја	- набљудување	- екран на допир	- октомври
5.	- да се оспособува за пишување зборови	- Читање и пишување кратки зборови	- пишување, читање	- ученикот пишува кратки зборови според		- усна повратна информација	- работен лист	- октомври
						- усна повратна	- екран на	- ноември

Such a plan helps the student in achieving the set tasks that enabled him to independently recognize and write all letters. Writing words and short sentences makes C.A. happy and facilitates his inclusion in the instruction.

C.A.'s success did not go unnoticed by his classmates. One of the fellow students from the class says: *"We are very careful about how we behave towards our friend, we try as much as we can to help him. We are aware that he is so much happier when using the big-button keyboard. We constantly try to include him in all class activities and we never let him feel left behind."*

Assistive technology use has also made the work easier for his Macedonian-language teacher Daniela Koceska, who now has more opportunities to creatively develop new activities: "Using the big-button keyboard, the student can more easily complete his school tasks, he is more interested in the instruction, he smiles more often, completing the tasks makes him happy and satisfied. He never refuses working, and opts to use the big-button keyboard whenever he has a chance to do so."

Prepared by:

Daniela Koceska, Macedonian language teacher

Snezhana Markovska, special educator in the school's special classes

Assistive technology – means of communication

"Assistive technology brings every child, regardless of their capabilities, disabilities, emotional condition or any other difficulty, two new opportunities: to learn, and to show what they learnt!"

representative of the assistive technology team of the Dimitar Pop Georgiev Berovski primary school in Skopje

A. is a second-grade student at the Dimitar Pop Georgiev Berovski primary school in Skopje. She can write simple words, count to ten, she tries hard to communicate despite not having a completely developed speech. She can more easily learn from the computer than from a book: she finds it more easy to focus her short-span attention to activities presented on the computer.

A. obtained her first experiences with assistive technology at the Center for assistive technology of Open the Windows. Thus, using big-button keyboard and a touchscreen at her school was merely a continuation of her work at the center. In addition, the student is accompanied by an assistant in the instruction.

The school team ensures that the school is a comfortable place for A. In the classroom, she always sits next to the window, which enables her to easily follow all actions in the class, while at the same time having her own space out of the center of affairs. As all other students, she shares her desk with a fellow co-student. Whenever needed, A. has at her disposal premises for individual work with her teachers.

Whenever A. faces content that she faces difficulties grasping, the teacher and her assistant use educational software to help her comprehend in a simpler and more understandable manner. Through time, the computer became a tool for the teacher to more easily establish communication and follow the student's progress in obtaining knowledge and skills.

Assistive technology is a great support in the Macedonian language instruction, as it enables A. to learn reading and writing. Using the big-button keyboard, A. mastered hyphenation and can write separate words, properly leaving space between each individual word.

The team closely follows and documents each success of A.S. and uses assistive technology as a valuable resource whenever the student needs such support.

Prepared by:
Borka Boshkovska Jurukova, psychologist
Vera Trajkovska, teacher
Aneta Crvenkovska, special educator-assistant

SELECTION OF GOOD PRACTICES IN AUSTRIA

Accessible educational software

Inclusion as a human right

By ratifying the UN Convention on the Rights of Persons with Disabilities, Austria has committed to introducing inclusion as one of the guiding principles of educational policy. This requires the expansion and adaptation of teaching methods to work successfully with heterogeneous groups. In 2005, the so-called “Schulunfähigkeit” (non-ability to attend school or literally: “unschoolability”) was abolished, making it impossible for educational authorities to exclude a child from compulsory education.

Inclusion requests the best possible education for all children and the guarantee that each child’s need for individual support is met as much as possible.

In Austria, about half of the students with special needs attend a mainstream school: primary or lower secondary. It is very challenging for their teachers to teach groups of children with a very wide range of abilities and competencies – after all it is not only necessary to teach them subject matter but also to foster social learning and to motivate the individual to participate actively in class.

Problems in the schools

Disabilities make students’ participation in the class more difficult:

- Physical disability makes it impossible to hand in written assignments or to take notes within a reasonable period of time. Exercises with physical activity such as setting tiles, experiencing letters kinesthetically, stacking, sorting… may also be problematic.
- Learning disability requires the creation of small portions of the taught content. On the one hand, this strategy gives the students the feeling of success; on the other hand, they will only be given more difficult tasks once they have mastered the easier ones successfully.
- Impairments of perception require delivery of content in various media formats such as audio, video (in appropriate size, clarity and coloring, in a non-written format) and similar.
- Speech impairment makes it impossible for students to contribute to class directly in a verbal way.

Information and Communication Technology (ICT) in Austrian schools

IT-competency is one of the key competencies which are of course taught by schools. The ICT educational offensives eFit and eFit2 of the Austrian Ministry of Education, Arts and Culture laid the foundations for the use of ICT in the Austrian educational system in terms of technology, infrastructure and methodology. Thus, all schools should have the chance to use the possibilities of ICT in education.

Students with a physical impairment might need special input devices to work with a computer. Operating a computer mouse can be made possible by a variety of special mice, joysticks, trackballs, multi-button mice, head mice or even simple switches which only require a single muscle to be operated. In addition, there’s also a large variety of special keyboards

available – there are mini keyboards and large key keyboards with simple or more complex layouts.

In Austria, the implementation of the UN Convention on the Rights of Persons with Disabilities has not advanced to the level that children having problems accessing education without assistive technology would get governmental financial support to obtain it. There are different practices in the nine Austrian federal states however: In Upper Austria, for example, there is the so-called “Hilfsmittelpool”, i.e. pool of assistive technologies. It supports the inclusion of children with special needs in Upper Austrian mainstream schools, kindergartens and after-school care by providing children with assistive technology for the duration of their attendance to these institutions.

Advantages of computer use in schools

Nowadays it is impossible to imagine a school without computers. Computers became simply a part of our daily life, thus the school is the right location to learn how to handle them. It is beyond dispute - but what about children with disabilities? What are the advantages of the use of computers in schools for them? And which special requirements do computers and software have to meet? Let us have a closer look:

- **Computers are an additional learning tool:** Some students might need the learning content in different modes, such as multimedia with pictures and sound. Using the computer it is possible to create trial surroundings where students can try different new ways without any risk or danger.
- **Computers are a prosthetic tool:** For students with physical disabilities a computer can be a crucial tool to attend school and to acquire knowledge. It also might be an essential tool for them to show their skills and knowledge.
- **Computers are tools for special support measures:** In particular, students with cognitive delays may need the content to be presented in a special way and at a level of difficulty which is appropriate to their level of perception. Special educational software should meet this requirement.
- **Experiences of independence and effectiveness:** Students with impairments face a lot of situations of strong dependence where they need of help. If they use a computer with the appropriate software it is possible for them to work independently for some time, to face success and effects. They can experience themselves like persons who create, work, and produce results.
- **Errors are permitted!** The feedback of a computer is always the same, the computer never gets board or irritated by the acts of the user. So the student is motivated to try out new ways without endangering the relationship to the teacher or relative person. Making errors often leads to new solutions or inventions and always enriches the knowledge. This is the perfect starting situation to be creative and go new learning ways.
- **Motivation and Fun:** It is obvious that computers have a great attraction for children. So a lot of students would prefer to learn on the computer and they have a higher motivation to learn. Also if there is fun connected to educational contents research showed that this content floats into mind much easier and stays longer because it is connected with a positive emotion.
- **Computer literacy as one of the essential cultural techniques:** Because computer is all around us in daily life it is essential to learn the (right) use of computer in schools.
- **Good educational programs:** The existence of good educational programs facilitates the life of the teachers - if they are open to technology and motivated to explore programs and find out how to benefit from them. Good educational programs usually are easy to understand and easy to adapt to peoples need; nevertheless, the teacher has to explore and use the Editor and the options menu and to find out the whole power of the program.

Educational Software Development

Right from its foundation in 1998, LIFEtool has been dealing with the development of educational software. In the last 15 years, 22 software titles were published. This number does not include upgrades which required a complete redevelopment of the program. This means that, on average, 1-2 programs were released a year.

Depending on complexity, programming software usually takes between 500 and 1,000 working hours to develop. However, prior to the actual programming, a pedagogical concept has to be developed which takes several months and a big amount of meetings of professionals. The pedagogical concept is the heart of the program and constitutes much of the quality of an educational program. The basic ideas often evolve out of consulting situations with persons with disabilities, teachers, therapists or parents. They know what is needed, they know the problems of their students and children and often have very good ideas how to present the content. They know how the students can be motivated, what catches their attention, what is their way to learn. The task of the team of LIFEtool is to form this ideas and inputs into a whole concept, to match it with existing software and to do research in pedagogical concepts and learning strategies regarding the subject matter. The pedagogical team has to define very clearly and in detail what is the structure and the script of the program and in the end the programming team has to transform this concept to a working and stabile program.

But what are the guidelines for a concept for educational software for the pedagogical team, as well as for the technical team - what are common criteria of good educational software? The quality criteria are as follows:

- the duration and number of exercises are adjustable,
- a good amount of support is ensured: hints and help,
- level of difficulty should be adjustable to the user's needs,
- level of difficulty adjusts according to the progress,
- feedback is factual and still motivating,
- usability (big letters, big objects, visibility, etc.),
- easy exit and rescue,
- stability also in the case of wrong usage,
- documentation of learning progress,
- possibility of saving and/or printing of the results,
- parents/teachers are enabled to create their own training sequences or to extend the program, and
- the relation of animation and training sequence should be balanced.

LIFETool also ensure the following features of its educational games:

- automatic adaption to screen resolution so that programs always are presented in full screen,
- touchscreen capability,
- newer programs include Eyegaze capability,
- user-manager for multiple users,
- exact adjustability with minimal complexity at the same time,
- evaluated with potential users.

By obeying these principles, the software should be accessible by many students with a variety of physical and mental levels. A study in Germany in 2005 of the use of five LIFEtool programs in integrative schools clearly showed that the clear design and stringent concept not only enhanced the learning progress of students with disabilities, but also contributed to a learning progress of students without disability.

Educational and psychological concept of AboutNumbers

To get a clear picture of how educational and pedagogical considerations look like, let us have a look at one of LIFETool's programs: AboutNumbers.

AboutNumbers is an early math game dealing with counting, sets, numbers and calculating in the number domain up to 10. An important feature throughout the entire program is the structured representation of sets (2 lines and 5 columns) to facilitate non-counting strategies of recognizing sets, the understanding of the relation among numbers and the notion of numbers in general.

The program is designed for pre-school and elementary school children with or without impairments, for persons with math deficiencies, as well as young people and adults with learning disabilities.

The AboutNumbers program is based on established educational and psychological views.

- **Visual concept:** The leading principle in the graphical implementation was to achieve a clear screen layout and at the same time an attractive design. Unnecessary, distracting elements were eliminated, special effects reduced to a minimum and background pictures may be removed, if necessary. This is especially helpful to persons with impaired perceptions and attention deficits. Furthermore, we have made efforts to make the program equally suited for children, young people and adults. Thus it will also be especially attractive for adults with special needs who would not be too keen on working with a childish design.
- **Acoustic concept:** Here we were also led by the principle that less is more. The program presents itself very calm, acoustic effects are used to support and not to distract or frighten. Instructions, feedback and help are given verbally and thus facilitate the use of the program for persons without reading skills.
- **Numerous setting options:** Learning is fun but only if you are successful. By means of the numerous setting options, the program may be adjusted to the individual skills of the users. Thus you can make sure that the program neither asks too much nor too little. Persons with learning difficulties will benefit from this step by step approach.
- **Motivation:** Motivating feedbacks will increase the selfconfidence and the fun with learning. If the input is wrong, the program offers a possibility to put it right. After a second incorrect input, the correct answer will be given automatically to avoid random tries and frustration. A diploma illustrates the progress in learning and may be printed as a reward.
- **Motor skills:** A big mouse pointer and rather large objects facilitate the handling of the program. All inputs may be reduced to a single click: it is never necessary to hold down the mouse button and move the mouse at the same time (the Drag&Drop command). This will facilitate the handling for users with impaired motor skills and users of alternative mouse devices. If necessary, the programme may even be operated with one, two or three switches via scanning mode.

AboutNumbers is a useful tool in class: The setup of the user administration with login screen facilitates the program use in class. Due to numerous setting options and special control options, which may be stored separately for each child, the program is very well suited for use in inclusive teaching. Detailed protocols for each child will show learning progresses. The game mode training sequence offers the possibility to specifically train certain topics one after the other in class. Thus, training objectives may easily be monitored and modified.

AboutNumbers is a learning and training program: The setup of the user administration with the login screen facilitates the use of the program by day-care institutions and therapists who work with different clients. Detailed protocols will give an overview of the progresses made.

The following didactic considerations will help each trainer to successfully operate the program within a short period of time:

- Make yourself familiar with the most important functions of the program before you start working with your child / client.
- Press F2 in the Main Menu to get to the Options Menu and try out different settings. Do not worry, you cannot ruin anything.
- At the beginning you should work together with your child / client, so that you can explain the different functions and interfere when help is needed. Working together may generally be more beneficial than working alone. You are the trainer who knows where support is needed and additional social praise will strengthen your child's / client's selfconfidence.
- Explain the functions of the diploma to your child/ client so that this will become an additional incentive to use the program.

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Best Practice: Max Buchegger

LIFEtool was founded in 1998 and has 17 years of practice in counselling, training and development of assistive technology. It gathered technicians with experiences in programming and pedagogues and psychologists to develop accessible educational software for all kinds of disabilities and different intellectual levels. The overall goal was to enhance the inclusion of people with special needs in the educational process via special software which allows students with motor disabilities to use computers as students without disability do.

In the past years, LIFETool accompanied several people on their way to and through school. One of these persons is Max, who will serve as a best practice example. His life story will present you observations and information about his starting position, the environmental conditions (school system in Austria, support, assistance and help) and how he profited from the use of assistive technology, including special educational software.

Starting situation

Max was born with Cerebral palsy on May 13, 1994. He was not able to control his hands and arms and to use them for exploring his surrounding, making experiences with objects and move to where he wanted to. Later, it became clear that he could not use his voice in a manner that other people than his parents could understand him.

The parents were convinced that that Max understood a lot of what they were saying, because, for example, he was laughing at the right moments. That gave them hope that Max had no intellectual restrictions.

But for the parents it was also clear that Max would need to use a wheelchair for all his life. When he was a child, he was fixated to his child-wheelchair to reduce his uncontrolled big movements. They could only hope that he would be able to control an electric wheelchair.

Max was persistent and determined with his speech. His efforts and the patience of his parents bore fruits: Max is now easy to understand for everybody!

However, participation in education was a big problem. There was no way Max would be able to learn to write, to ask and answer and to bring evidence of his knowledge, even to prove that he is able to read. So the big question for the parents was: what are the best educational options for our son to develop his talents and gain qualifications?

Conditions for students with motor disabilities in Austria

Before a child with disability can visit a school in Austria, it first has to be diagnosed from a doctor. In Max’s case, the doctor stated a severe disability, so a school career in a common Austrian primary school would not be possible without certain measures.

These measures are foreseen within an individual educational plan, for which the parents or the school need to apply. The assessment takes place in an institution that is called the "Sonderpädagogisches Förderzentrum" in Austria. Special educators exam the child to identify the right school type and determine the proper "individual educational plan", which contains supportive measures and foresees assessments, observations und counselling during its implementation. Upon need, the special educational plan (SEN) y also define where and how it should be realized.

Since 1993, Austria has a new education law that stipulates that special schools should not be the only option for children with disabilities. Families can make the decision whether their child will attend one of the still existing special schools for certain disabilities ("Sonderschule"), or a mainstream school willing to provide the needed conditions.

Special schools have over 100 years of history in Austria and need to be closed by 2020. There are several types:

- **Common special school for students with a learning disability with the special curriculum** (called ASO), which take nine to complete, which is the whole duration of the compulsory education in the country. The last year is called "vocational preparation". Curricula are generally special, although certain parts may follow curricula of mainstream primary or secondary schools if that is appropriate to student's skills.
- **Special school for students with severe disabilities**, which take between 9 and 12 years to complete, depending on the wishes of students and their parents. Curricula is entirely special, without references to mainstream education.
- **Special school for students with physical or visual handicaps or hearing impairment:** These schools follow a special education plan that is largely similar to the mainstream curricula, but includes special skills to overcome the disability.

All this schools with special curriculums can also be run as special classes in common schools.

However, as noted above, students with disabilities can be part of **mainstream primary or secondary schools.** In general, if pupils with learning difficulties or other disabilities are integrated in a class than the number of pupils in common has to be reduced. The maximum number of pupils in the class may not exceed 21 (up to 25 in mainstream classes), while the number of pupils with special needs may not exceed 4. There needs to be one more teacher in the class who had been trained in special education according to the type of disabilities.

The target is to diminish special schools and create a fully inclusive educational system in Austria by 2020. By then, all 321 special schools will have to change their status, while at the same time over 3,200 primary schools need to prepare for a much more open und inclusive way of teaching; or else, the inclusion cannot happen.

Max´s way

Max visited kindergarten and got speech therapy to enhance his communication. At that time his father travelled to the US and encountered **assistive technology** and the possibilities of computer use for children with disabilities like his son.

At the same time, the first consulting centre for computer aided communication was opened. At his first visit to the centre, Max, his parents and the assistant of the Special Pedagogic Centre jointly set his personal development targets and discussed and tried out the use of assistive technology.

The professions of Max's parents proved very favourable for him: Max's mother was a primary school teacher and his father a constructing engineer. His family has built a strong network with families of other children with disabilities and were very well-integrated in the social life of their home town. Thus, they were able to provide better support for their son than what was common practice at that time concerning children with severe disabilities.

Still, Max was not able to use a normal computer mouse or keyboard – this was clear for the parents and confirmed by the LIFEtool consulting centre, which they visited in search of adequate assistive devices. Big-button keyboards were not the solution either: the large number of keys caused way too many errors.

Extra-large mouse emulations seemed like the only accessible devices. Max could try several available mouse emulations and one seemed to suit his needs: each of its four direction

keys had a width of more than 10 cm! The mouse was hand-made by a Bavarian producer. It weighs several kilos and is designed to endure rough movements because of its very robust construction.

Max had to go through hard trainings to get full control over the device. At the beginning, the training units were not longer than 10 minutes, after which Max would be completely exhausted and not able to focus any longer.

What helped him concentrate was the CatchMe software from LIFEtool. This application helps users make success with little steps and provide rewards for it: the starting task was to just move the cursor (in the form of a bee, or car, or seal) left or right to hit a particular target. In the more advanced stages, Max had to use all four directions use the “fire” button, with both the cursor and the target constantly getting smaller.

This little ‘gaming’ progress also confirmed one more fact: he was able to fully understand the task and did not have any cognitive problem with it. While it took him a few more months before he could master the mouse emulation, the CatchMe helped Max make his first steps in opening the world of computing. By the time he had to enrol at schoo, he used the computer as a tool for communication and expression of his clever young mind.

Max started his **school carrer** as his parents decided to send him to a special school for physical disabilities, where he followed a special educational plan.

In the first grade, the most important target for Max was to learn letters and numbers. In achieving this, his tool was an onscreen keyboard. He used his mouse emulation to navigate the cursor to the wanted letter and then *"fired".*

His next software which helped him to learn letters, words, writing and reading was Hanna & CO. This is a software with integrated onscreen keyboard, making it quite easy for Max to handle the exercises.

The software Archimedes was a useful tool for him to learn numbers and counting: For students with physical disabilities who are not able to use their fingers for understanding numbers and basic calculations, maths is a real challenge. All materials which help students without disabilities to visualize quantities and numbers require some motor skills. If students with physical disabilities try to learn using these materials, very often they use all their concentration to manage their physical skills, leaving them with no energy for the intellectual task. Thus, a software that takes over the task of visualizing, building amounts, figures, of showing the arithmetic procedure, helps these students to concentrate on the subject matter.

Max used another software called "Multitext" that supports students who write with one finger or only work with a mouse. It includes an onscreen keyboard and enables the student to make rather complex mathematical functions on the screen and which has some special features such as writing from right to the left (for calculation purposes), writing underneath, calculate square roots, or make drawings and calculations with a compass. The software also includes a synthetic speech output, enabling Max to write and let his fellows listen to his comments. This is quite powerful software that required some training for the teachers in the school to be able to use it.

In addition to the tools used at school, it was important to ensure that Max was also able to do his homework, just like any child. That he did that with a notebook computer. The mouse emulation he used was rather difficult to transport, so it was purchased twice – for use at school and at home.

In addition to the learning software he used, Max was especially interested in using the Internet and in e-mailing. As he was able to express himself by using his computer keyboard (the software Multitext allows text-to-speech output), he was able to communicate with other people even if they were located far away. Even though this was Max’s actual objective of using

computers, he started loving them in general and spent most of the day in front of them. Thus, his knowledge of computers grew and soon he was far ahead of his classmates and some of his teachers.

This was very important for his self-confidence. Even though he was inferior to other children in many things, he was ahead of them in this – very important – context.

After compulsory school Max was able to gain **further education** in a qualification measure called Virtual office funded by the province of Upper Austria. Max completed the training without problems: he was able to deepen and consolidate many of the skills he already had acquired. In addition, he gained a lot of confidence in dealing with people in the new working environment.

Throughout his school career and his further education continuous assessments took place to ensure that the assistive technology Max used was state of the art. While he is still not as fast as a regular user, Max successfully overcomes his strong movement restrictions when using the computer. He now has a computer working place and works with his colleagues, using his tools, happy with his jobs and tasks and appreciated from his colleagues.

Funding of Assistive Technology in Carinthia

Austria is a federalist state with 9 federal provinces. Due to history and political organisation, many aspects of the legislation differ from state to state.

One of the pillars of health care is the compulsory insurance. In Austria, there are 22 social insurances: each of the nine provinces has its own insurance funds, and some special professions have their own insurance funds, as well. An umbrella organization negotiates the legal framework with the other social partners and takes care of the general implementation.

Generally, assistive technology for people with special needs is not financed by these social insurances. Negotiations are currently underway, but Austria still does not have a nationwide solution concerning the funding of procurement of assistive technologies - which would be the aspired goal. Some provinces established special solutions for people in need of assistive technology, as their own response to this unsatisfactory situation at national level.

Students with special needs heavily rely on assistive technology to take part in education; assistive technology is sometimes an essential tool for them.

Thus, the federal state of Carinthia responded by establishing the so-called **resource pool.**

History

The resource pool was first planned in 1993 and was supposed to target students with visual impairments. In 1994, the first offers for special devices were reviewed; already in 1995, the first tools were bought by the social department of the Carinthian government. At that time, the name of the pool was *Resource pool for visual impaired.*

From that year on, the pool was highly regarded. It was enlarged to include students with motor and mental disability and also for students with speech impairment. Corresponding with the enlargement of the target group, the content of the resource pool was expanded, as well. Software titles are also included and upgraded regularly. Devices are maintained and necessary repair work is conducted by a specialized resource pool team.

Since 2009, the resource pool publishes a newsletter to inform educational institutions of the available resources.

Organisation

Assistive technology is provided to students as long as they need it - maximum until the end of compulsory education. The devices are used in early intervention in inclusive kindergartens, primary and secondary education and vocational schools.

Devices are only to be used in the educational institutions, but if the device has bearing on the user's life beyond their education, than this may be the ground for an exception: For example, if the assistive device in question is a communication device that the student also needs and uses at home or at any other place of need.

Once the student gets a device, he can take it with him or her to the next educational institution. Devices which are not needed any more have to be given back to the pool and will be provided for other students in need. There are no fees for the families for renting the devices. The costs are financed by the public sector.

Following kinds of devices are listed in the pool:

- prosthetic devices for sensory impairment,
- prosthetic devices for speech impairment,
- prosthetic devices for mental or physical impairment,

- assistive devices such as screen readers, Braille display, special input and output devices for computers, etc.,
- special educational software,
- therapeutic/pedagogical tools like moto-pedagogical materials, special game sets etc.

To obtain a device, families have to fill out an application which can be downloaded from the pool's homepage. The relevant educational institution has to fill out parts of it, as well. Medical certificate is mandatory. Also, an assessment concerning assistive technology is required.

If the device is available, it will be delivered to the user immediately; if not, public funds will be used to procure it.

Targets of the resource pool

The resource pool aims to ensure:

- comprehensive supply of support,
- quick application of assistive technology,
- professional use of assistive technology,
- economical use of assistive technology,
- responsible management of financial resources,
- certified assistive technology through continuous maintenance, and
- objective assessment for choosing the right assistive technology,

so that students with disabilities get:

- the best possible support in early intervention,
- the best results in their education,
- a better integration in their family life, and
- more autonomy and independence to enrich their self-determined life.

ASSISTIVE TECHNOLOGY AND INTERNATIONAL DOCUMENTS

UN Convention on the Rights of Persons with Disabilities

The modern world becomes ever-more digital. Contemporary society, based on information and knowledge, offers improved conditions for education, employment and overall living, overcoming or decreasing currently present limitations in people's daily lives.

Information technology today offers almost limitless source of information, knowledge, opportunities for work and leisure, communication… But its most important feature is that it enables these opportunities for all.

Assistive technology in particular enables all persons, regardless of their disabilities, to overcome difficulties and more easily benefit from technology development. Assistive computer peripherals and software contribute to effective participation of all persons in contemporary digital societies. For persons with disabilities, assistive technology is a tool for accommodation of their needs and for active inclusion in the societal living in general.

The **UN Convention on the Rights of Persons with Disabilities** is an internationally binding document developed in 2006 and signed by 158 states. The Macedonian Assembly ratified the Convention in December 2011, making it an integral part of the national legislation and creating an obligation for the state to ensure its implementation.

Among other issues that promote equal opportunities for persons with disabilities, the **Convention clearly stresses the need for accessible and assistive technologies** that aim at supporting the participation of persons with disabilities in the society:

Article 4 that refers to the general obligations, states-parties to the Convention are obliged to ensure and promote the full realization of all human rights and basic freedoms for all persons with disabilities, without any discrimination on the ground of disability. Among other, states-parties commit to:

> "g) To undertake or promote research and development of, and to promote the availability and use of new technologies, including information and communications technologies, mobility aids, devices and assistive technologies, suitable for persons with disabilities, giving priority to technologies at an affordable cost;"
>
> "h) To provide accessible information to persons with disabilities about mobility aids, devices and assistive technologies, including new technologies, as well as other forms of assistance, support services and facilities".

Article 9 promotes measures for enabling **accessibility** and obliges the states-parties to "promote access for persons with disabilities to new information and communications technologies and systems, including the Internet".

Article 20 refers to personal mobility and states that the states-parties to this Convention need to undertake effective measures to ensure the personal mobility of persons with disabilities with the greatest possible independence for persons with disabilities, including *inter alia:*

> "b) Facilitating access by persons with disabilities to quality mobility aids, devices, assistive technologies and forms of live assistance and intermediaries, including by making them available at affordable cost"; and

"d) Encouraging entities that produce mobility aids, devices and assistive technologies to take into account all aspects of mobility for persons with disabilities."

Article 21, which refers to the freedom of thought and expression and access to information, obliges the states-parties to undertake all measures to ensure that persons with disabilities can enjoy the freedom of thought and expression, including the freedom to demand, receive and disseminate information and ideas on an equal footing with other citizens and by using all forms of communication, as per their own choice. The foreseen measures include, *inter alia:*

"a) Providing information intended for the general public to persons with disabilities in accessible formats and technologies appropriate to different kinds of disabilities in a timely manner and without additional cost;" as well as

"d) Encouraging the mass media, including providers of information through the Internet, to make their services accessible to persons with disabilities."

Assistive technology is also mentioned, among other, in **article 26** that refers to habilitation and rehabilitation. This article states that states-parties will undertake "effective and appropriate measures, including through peer support, to enable persons with disabilities to attain and maintain maximum independence, full physical, mental, social and vocational ability, and full inclusion and participation in all aspects of life. To that end, States Parties shall organize, strengthen and extend comprehensive habilitation and rehabilitation services and programs, particularly in the areas of health, employment, education and social services" and shall, *inter alia* "…promote the availability, knowledge and use of assistive devices and technologies, designed for persons with disabilities, as they relate to habilitation and rehabilitation."

The stated examples doubtlessly present that the Convention on the Rights of Persons with Disabilities perceives assistive technology as an essential tool for provision of equal opportunities, equality and active inclusion of persons with disabilities in the overall societal living.

The Digital Agenda of the EU's Europe 2020 Strategy

Modern Europe confirms the importance of digital knowledge and aims at improving the access into the digital world and to the benefits of the development of information and communication technologies for all persons, on an equal footing.

According to the latest data of the European Commission on the digital inclusion and skills that refer to 2013, 72% of Europe's population use the internet at least once a week. However, this percentage decreases to 57% when vulnerable groups are looked into separately, such as: persons aged 55-74, persons with low education or unemployed, and pensioners or inactive persons. Despite the constant increase of the number of persons using information and communication technologies and internet, 20% of the population of the European Union are yet to use the internet.

On the other hand, digital skills are crucial for daily life and in the labor market in particular. The same report of the European Commission shows that 47% of the European population have insufficient digital skills, while 23% have no digital skills at all. These numbers are even more worrying when it comes to vulnerable groups: 64% of them have insufficient digital skills, including 38% who have no digital skills at all.

These numbers point out to the existence of significant differences in the access to the benefits offered by the information and communication technologies (i.e. the so-called digital gap), even in the most developed and modern member-states of the European Union.

In response to the determined digital gap, the European Union has undertaken several initiatives. One of the most important is the **Digital Agenda,** one of the seven pillars of the Europe 2020 Strategy that entails the developmental goals of the European Union by 2020.

The main objective of the Digital Agenda is to enable development of single digital market at the level of the European Union, as a manner of fostering smart, sustainable and **inclusive development** in Europe. The foreseen measures represent an attempt to use the potential of information and communication technologies in improving innovations, economic growth and progress, in a manner that will enable decrease of the digital and overall social gap and will strengthen the cohesiveness and inclusiveness of European societies.

The Digital Agenda, as well as the Europe 2020 Strategy, consists of seven pillars. One of them, Pillar 6 – Enhancing digital literacy, skills and inclusion aims at creating digital skills that would provide full participation of all citizens in the society. The internet is recognized as the main channel of access to information and knowledge, but also services. The barriers that some citizens might be facing due to the inaccessibility of the internet space (or the digital space, or e-space) directly lead to social exclusion and have negative economic impact.

Therefore, Pillar 6 of the Digital Agenda foresees series of measures to ensure access to modern technologies for *all* and to the ever more-important digital space. The most illustrative measures include:

- action 63 that draws upon the Convention on the Rights of Persons with Disabilities and calls for assessment of the accessibility of legislation,
- action 64 that specifically foresees accessibility (as per the international web-accessibility standards) of webpages of the public sector across the European Union, in particular those that offer services to citizens, and
- action 67 that elaborates the determination to improve the accessibility of information and communication technologies.

These and similar measures could guide the planning of similar activities in Macedonia, as a candidate country for accession to the European Union.