



Project for e-Accessible
Education

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

Skopje, March 2015

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The content expressed in this report are the responsibility of Open the Windows and do not necessarily reflect the views of USAID or the United States Government.

1. SUMMARY

The research presented in this report refers to the experiences concerning the introduction and use of assistive technology in the instruction at 31 mainstream primary schools in Macedonia. Assistive technology introduction and use was enabled by the Project for e-Accessible Education, implemented by Open the Windows and funded by USAID in the period 2010-2015.

The research responds to three main questions: the use, relevance (in terms of needs) and the quality of the process of introducing and using assistive technology in the instruction, a model of work implemented for the first time in the country.

Conducted through a survey, the research covered four categories of respondents: schools (as institutions), teachers, students with disabilities and their parents. The survey was conducted in the period February-March 2015, at the very end of the project. Its primary objective was to assess the successfulness of the project for introduction of assistive technology in mainstream primary schools in Macedonia, determined through beneficiaries and stakeholders' satisfaction of it.

Findings confirmed that assistive technology introduction and use positively impacted the inclusiveness of the educational and pedagogical process at the schools, by increasing the opportunities for participation of students with disabilities in the instruction.

The implemented model of assistive technology use is adequate to the needs of students with disabilities and helps schools better work with them on daily basis. The combination of provision of equipment (assistive computer peripherals), capacity strengthening of teachers and schools' professional teams and provision of resource materials (educational software and manuals) leads to increased educational opportunities of children with disabilities. This conclusion is shared by all four categories of respondents, who undoubtedly confirm the relevance and quality of the developed model and its implementation.

Key benefits for students with disabilities from the use of assistive technology in the instruction are: improved participation in the instruction, increased interest for the school curricula, facilitated realization of certain school tasks, and strengthened feeling of self-confidence and equality.

Lack of procedures for systematic registration and monitoring of progress of students with disabilities is a conclusion that has been confirmed yet again. This hampers the implementation, monitoring and evaluation of assistive technology in the instruction, as well as of inclusive educational policies in general.

Key recommendations include: systematic introduction of assistive technology in the education, as a tool that would support and facilitate the individualization of the instruction process for students with disabilities, and their inclusion at all levels of the educational system; and application of person-centered approach (i.e. individualization) with regards to assistive technology use in primary and secondary schools.

The findings, conclusions and recommendations of this research can be used a significant input in the public discussions for development of educational policies aimed at creating a modern and inclusive educational system. In particular, the experiences of the first 31 mainstream primary schools that introduced assistive technology, summarized in this report, represent a solid point of departure for systematic application of assistive technology as a tool of inclusion at all educational levels.

2. INTRODUCTION

The research presented in this report 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 by Open the Windows and funded by USAID in the period February 2010 – June 2015.

The research responds to three main questions: the use, relevance (in terms of needs) and the quality of the process of introducing and using assistive technology in the instruction. Findings and conclusions create a basis for extracting recommendations for further widening of assistive technology use in mainstream primary education.

Open the Windows conducted a similar research among 21 mainstream primary schools in 2012¹, which referred to the initial results of assistive technology introduction. Both research studies are complementary to a large extent, which enabled comparison of some of the obtained results and enrichment of the extracted conclusions and recommendations.

2.1. 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, i.e. their daily work with students with disabilities. The focus was on three main issues:

- the **use** of the donated equipment, resource materials and the knowledge and skills of school staff acquired as a result of the 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 via online. Four categories of respondents were included; special questionnaires was developed and used for each category:

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

The questionnaires were anonymous, with the exception of those for the primary schools. Each questionnaire contained information on the purpose and subject of the research. Most questions were closed, but semi-open and open questions were included, too.

The survey was conducted in collaboration with the primary schools, which disseminated the information and encouraged many of the students with disabilities and their parents to fill out the questionnaires.

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

2.2. 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. 17 of those schools began using assistive technology in the instruction towards the end of 2011 and are marked with blue in the table below; the remaining 14 could started using assistive technology at the beginning of 2014.

Before the survey, the following expectations were set:

- to obtain responses of the questionnaires from all primary schools (as institutions);

¹ Survey Report: Introduction of assistive technology in 21 mainstream primary schools in Macedonia, Open the Windows, 2012

- to obtain at least 60 answered questionnaires by other categories of respondents (i.e. teachers, students and parents).

These expectations were fully met.

No.	Primary school	Number of answered questionnaires			
		School	Teachers	Students	Parents
1.	Dimo Hadzi Dimov, Skopje	1	8	4	4
2.	Bratstvo-edinstvo, Ohrid	1	7	5	2
3.	Gjorgijja Pulevski, Skopje	1	4	5	5
4.	Jas Amos Komenski, Skopje	1	5	4	1
5.	Johan Heinrich Pestalozzi, Skopje	1	5	4	2
6.	Goce Delchev, Prilep	1	4	5	3
7.	Vasil Glavinov, Veles	1	4	5	5
8.	Sv. Kiril i Metodij, Veles	1	1	1	1
9.	Slavcho Stojmenski, Vinica	1	5	5	5
10.	Magdalena Anteva, Kumanovo	1	4	4	5
11.	Slavko Lumbarkovski, Novaci	1	5	6	4
12.	Diturija, Lipkovo	1	5	5	5
13.	Kiri li Metodij, Sveti Nikole	1	3	5	4
14.	Josip Broz Tito, Valandovo	1	3	4	5
15.	Ilinden, Kriva Palanka	1	2	2	1
16.	Sv. Kiril i Metodij, Buchin	1	4	5	5
17.	Simche Nastovski, Vratnica	1	5	5	4
18.	Mustafa Kemal Ataturk, Gostivar	1	4	7	2
19.	Bratstvo-edinstvo, Debar	1	5	5	6
20.	Vancho Prke, Delchevo	1	4	5	5
21.	Sv. Kiril i Metodij, Kochani	1	5	5	5
22.	Dane Krapchev, Skopje	1	5	5	2
23.	Vlado Kantardziev, Gevgelija	1	5	6	6
24.	Andreja Savevski Kjikjish, Tetovo	1	3	3	4
25.	Sv. Kliment Ohridski, Prilep	1	2	2	2
26.	Vidoe Podgorec, Strumica	1	5	5	4
27.	Dimitar Pop-Georgiev Berovski, Skopje	1	3	3	3
28.	Naim Frasheri, Skopje	1	5	2	3
29.	Krste Misirkov, Kumanovo	1	4	1	1
30.	Lazo Angelovski, Skopje	1	4	0	1
31.	Sv. Kliment Ohridski Bitola	1	6	4	4
Total:		31	134	127	112

2.3. Data processing and presentation of results

Data obtained from the responses were quantitatively (statistically) and qualitatively (explicatively and interpretatively) processed and analyzed.

Key findings are presented in absolute and relative size (percentages) and are grouped according to the main questions of the survey. Depending on the needs and possibilities for comparison, the findings are compared to the findings within the above-mentioned similar research of Open the Windows in 2012.

Data analysis was the basis for formulation of conclusions and recommendations, which, on the overall, aim at systematic introduction of assistive technology in the education.

3. FINDINGS

3.1. Sample structure

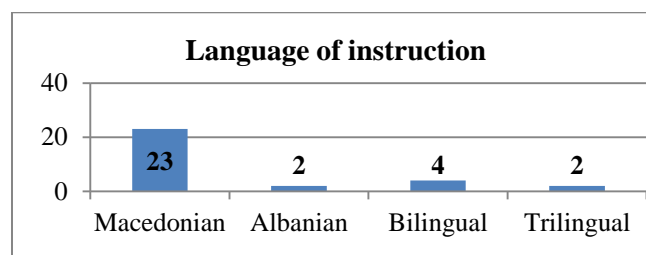
This section of the report contains summary data on the characteristics of each category of respondents, some of which were used in analysis and in formulating the research conclusions. Data are presented for each category separately

Primary schools

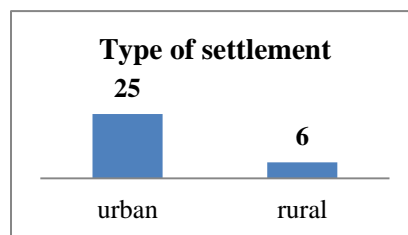
Completed questionnaires were submitted by all 31 primary schools involved in the Project for e-Accessible Education (100%).

These schools are located in all eight planning regions in Macedonia.

Regarding the instruction language, 23 schools (74.1 %) perform instruction in Macedonian and 2 in Albanian (6.5%), i.e. 25 schools (80.6%) perform instruction in one language only. Four schools (12.9%) are bilingual: in three schools, the instruction is in Macedonian and Albanian and in fourth, it is performed in Macedonian and Turkish. Two schools (6.5%) are trilingual and instruct in Macedonian, Albanian and Turkish.



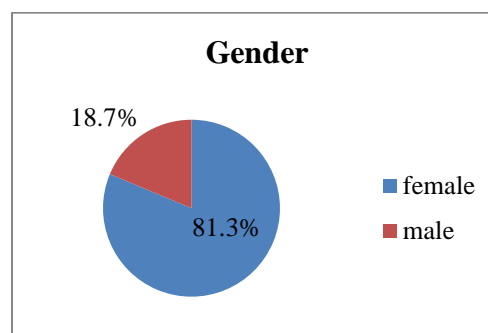
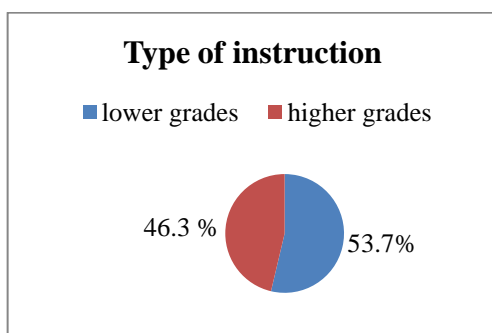
The sample includes 25 schools (80.6%) based in urban and 6 (19.4%) schools in rural environment.



Teachers

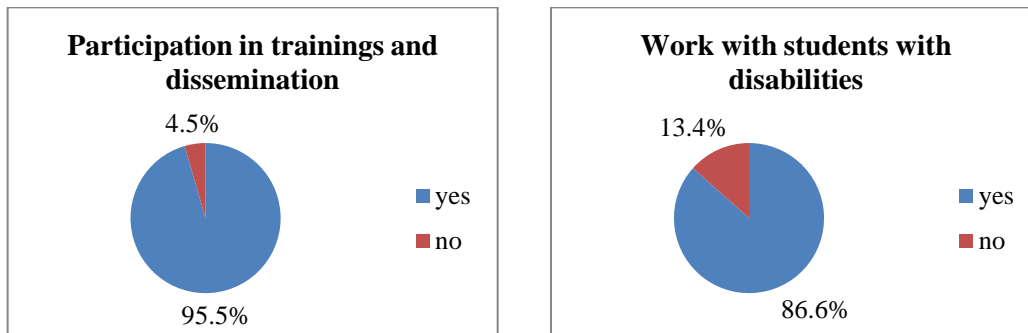
134 teachers answered the questionnaire. They work across the 31 schools involved in the project.

Majority of them – 71 (53.7%) are lower-grade teachers and 62 (46.3%) teach in the higher grades. Majority are women – 109 (81.3%) and 25 are men (18.7%).



Of the 134 teachers who filled-in the questionnaire, 128 (95.5%) participated in the project trainings or subsequent internal (school-level) dissemination activities, related to the use of assistive technologies in the efforts to individualize the schools' approach to students with disabilities².

Most teachers – 116 (86.6%) directly worked with students with disabilities in the 2014/15 school year. Their students faced different types of disabilities.



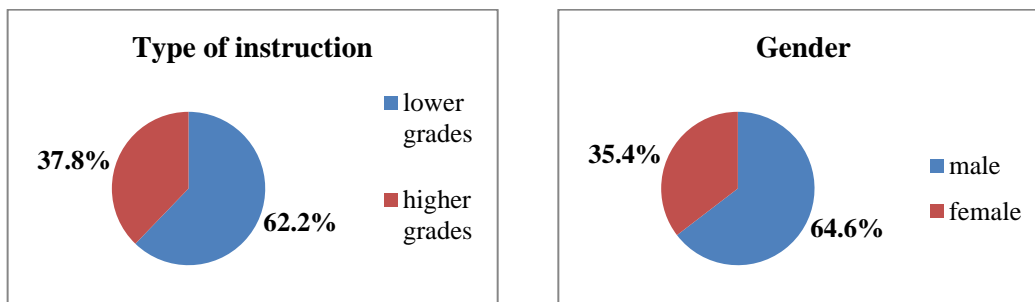
All involved teachers use the computers in the instruction. Majority – 69 (51.5%) responded “regularly, several times a week”. Not a single teacher responded that they did not use the computer in teaching.

Computer use in the instruction:	Број на одговори	%
Every day	21	15.7%
Regularly, several times a week	69	51.5%
Occasionally, several times a month	44	32.8%
I do not use the computer in the instruction	0	0%
Total:	134	100%

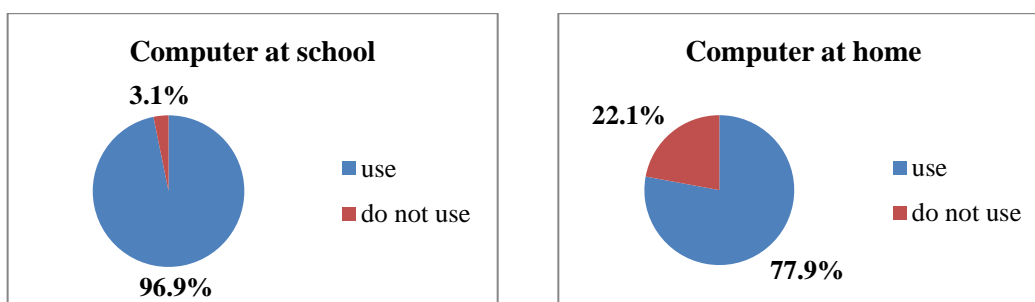
Students

127 students with disabilities from 30 primary schools answered the questionnaire.

79 (62.2%) are from lower grades and 48 (37.8%) attend higher grades; regarding their gender structure, the majority of students are male – 82 (64.6%) and 45 (35.4%) are girls.



Concerning computer use at school and home, vast majority of students use computers at school – 123 (96.9%), and 99 students (77.9%) do so at home, as well.

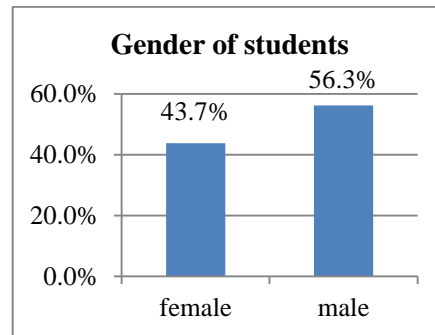
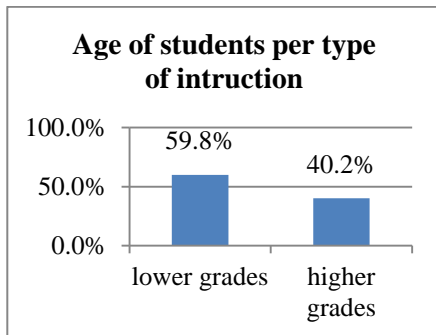


² Representatives of schools taking part in the trainings delivered within the Project for e-Accessible Education were obliged to conduct internal dissemination of the obtained skills and knowledge in their own schools.

Thus, vast majority of students with disabilities who responded to the questionnaire have experience in using computers.

Parents

This questionnaire was answered by 112 parents of students with disabilities from all 31 schools. 67 (59.8%) of them are parents of lower-grades students and 45 of higher-grades students; 63 (56.3%) are parents of boys and 49 (43.7%) of girls.

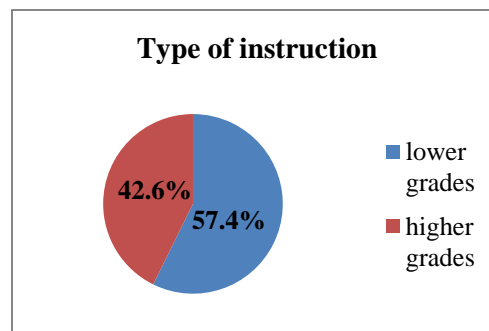
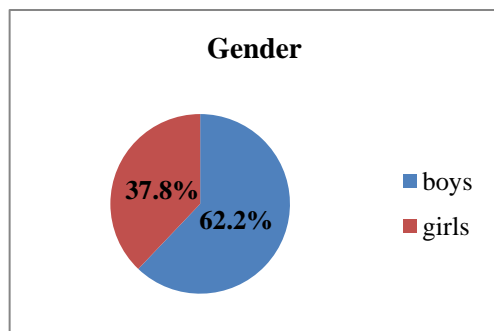


The obtained data also enable a presentation of structure of the parents per the following parameters:

- majority of parents - 74 (66.1%) have never participated in a training related to assistive technology use with children with disabilities, while 38 parents (33.9%) have taken part in at least one training of that type;
- 109 (97.3%) parents are informed that the school uses assistive technology in working with students with disabilities and only 3 parents (2.7%) did not have such information;
- 50 (44.6%) parents stated that their children “face difficulties when using the standard computer”, 45 of whom provided a descriptive answer, most of which referred to the use of standard keyboard and computer mouse and stem from motoric or visual impairments. On the other hand, majority of parents – 62 (55.4%) stated that their child can use the standard computer equipment without major difficulties;
- most parents – 92 (82.1%) stated that their child uses computer “at home”, while 20 parents (17.9%) stated that their child does not have access to the computer at home.

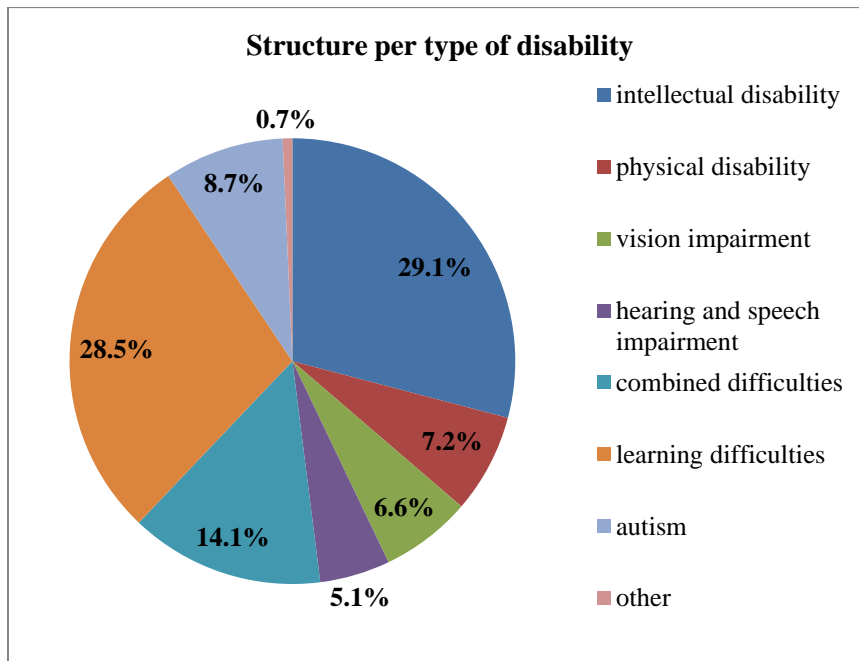
3.2. Use

According to the **schools** that answered the questionnaire, 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%).

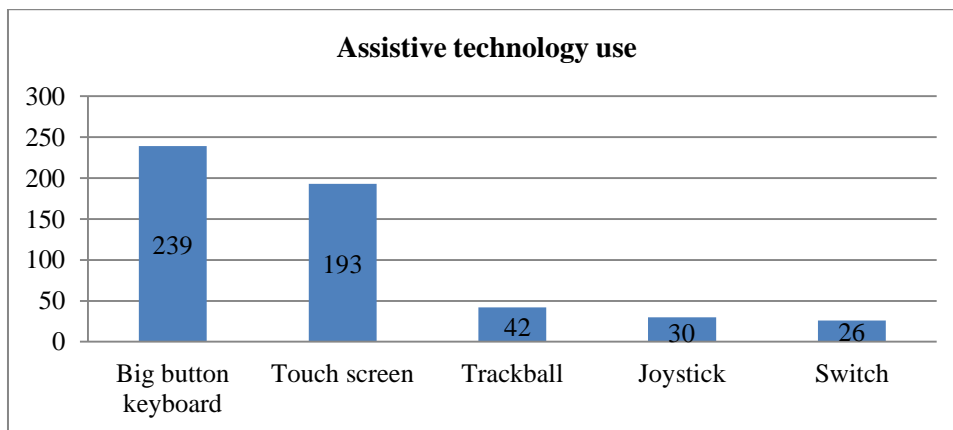


Most of the students were with intellectual disability – 97 (29.1%) and students with learning difficulties – 95 (28.5%), followed by students with combined difficulties – 47 (14.1%), students with autism – 29 (8.7%), students with physical disabilities – 24 (7.2%), students with vision impairment – 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 disabilities³.



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.

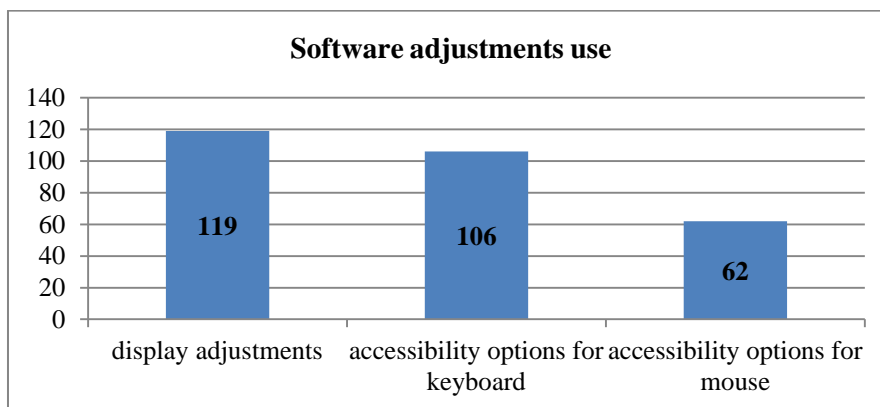


Data are similar with the findings obtained through the research conducted in 2012 when a total of 21 schools were involved: the big-button keyboard remains the most commonly used device.

Compared to the 2012 research, the use of joystick, trackball and switch has decreased. This change was expected, as after 2012 the schools were equipped with touch screens, which often overcome the need for the use of trackballs, joysticks, and switches. At the same time, this finding stresses the importance of individual assessment of the needs of students with disabilities, as a precondition for completely individualized approach in provision of assistive technology entirely in line with the needs and capabilities of each student individually.

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.

³ The used terminology corresponds to the terminology commonly used by educational institutions in Macedonia.



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%);

The 134 **teachers** who responded to the questionnaire stated that a total of 219 of their students used one or more assistive devices of software adjustments.

92 of the users were boys (42.1%), and most of the students faced intellectual disability (49 or 22.4%).

Teachers’ answers confirm that the most commonly used devices were the big-button keyboard and the touch screens; the switches were the least used device.

Their answers also confirmed the ranking of software adjustments in terms of frequency of use by students with disabilities: display adjustment, accessibility options for keyboard, and accessibility options for mouse.

Most teachers – 104 (77.6%) use educational software in their daily work with students with disabilities. The most commonly mentioned applications are: GCompris, Toolkid, About Numbers and ShowMe, provided within the Project for e-Accessible Education, as well as the so-called “green package” recommended by the Ministry of Education and Science.

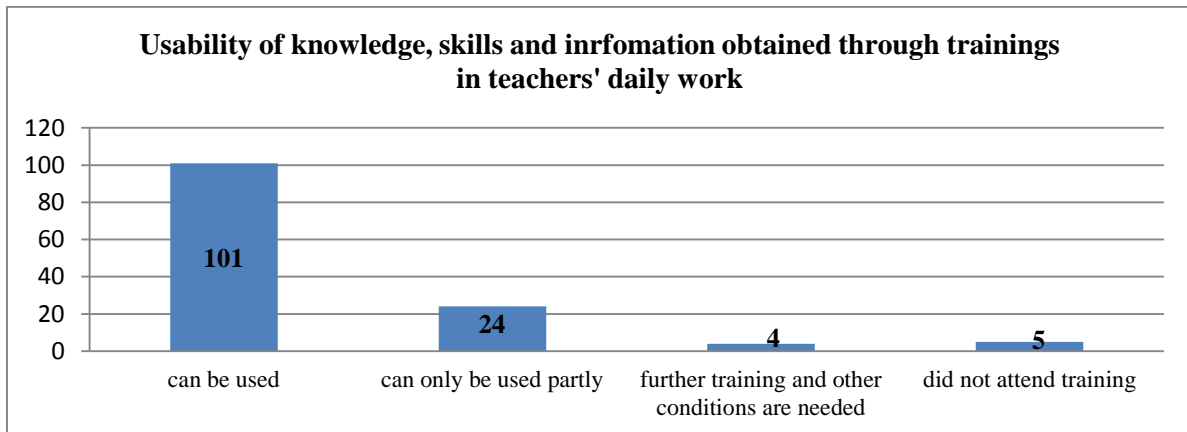
Teachers used these applications, in combinations with various assistive computer peripherals and accessibility options to achieve a wide range of goals (teachers could provide more than one answer):

- literacy skills gaining – 91 teachers (67.9% of all teachers who responded);
- cognitive abilities development (thinking, memory, focus) – 90 teachers (67.2%);
- basic mathematical skills gaining – 82 teachers (61.2%);
- relaxation and leisure – 81 teachers (60.4%).
- enriching vocabulary and improvement of expression – 80 teachers (59.7%);
- development and improvement of the fine motoric of hands – 65 teachers (48.5%); and
- fostering creativity – 57 teachers (42.5%);

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 the questionnaire) did not participate in the trainings.



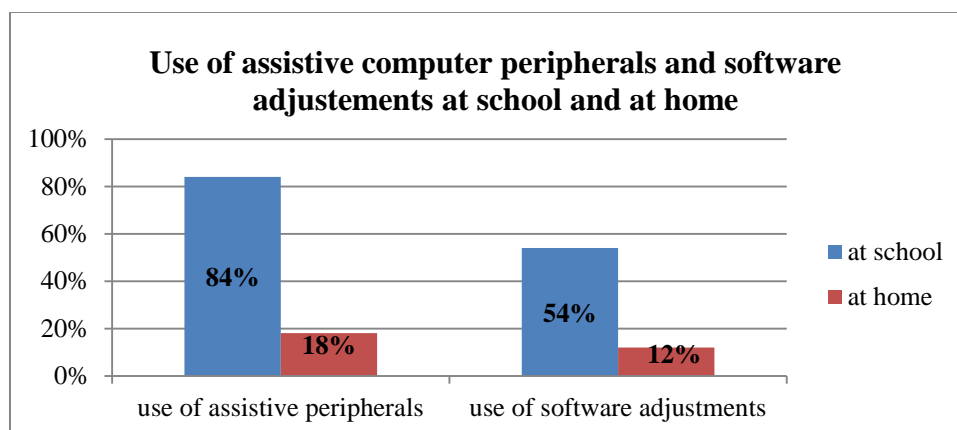
Parents (112) who answered the questionnaire stated that their children use the following assistive peripherals at school: big-button keyboard – 93, trackball – 15, switch – 7, and joystick -14. Six parents (5.4%) did not have information whether their child used an assistive peripheral at school. 12 parents answered that their child did not use any assistive peripheral. Touch screen has not been mentioned by any of the parents among the assistive devices used by their children at the school.

In comparison to working at school, only 17 students (18.5% of the 92 students who use computer at home) use an assistive computer peripheral at home. Vast majority of students borrow these devices from the school; only one parent stated that the family has independently procured an assistive device for their child.

Concerning software adjustments, parents’ answers are as follows: 38 students use keyboard accessibility options, 36 use display adjustments, and 21 use mouse accessibility options. 23 parents (20.5% of all who answered the questionnaire) stated that their child does not use any of thy software adjustment, while 28 parents (25.1% of all parents who answered the questionnaire) did not have information on the accessibility options that their child used at the school).

In comparison, only 13 parents (11.6%) stated that their child uses some software adjustment when using the computer at home. Those parents provided answers on the software adjustment options that their children used at home, with the most commonly used options being accessibility options for keyboard and those for mouse. Some parents felt that adjusted presentations and games were accessibility options, which indicates that these parents lack information on accessibility, highlighting the need for trainings for parents of children with disabilities. Such trainings would ensure continuous support for the children with disabilities in using computers and internet at home, which would significantly improve their results.

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:



Concerning educational software applications, 67 parents (59.8%) stated that their children used such applications at school, 18 parents (16.1%) claimed their children did not use any educational application at school, while 27 parents (24.1%) did not have sufficient information on this issue. When asked to name the educational software, parents limited their answers to applications provided within the Project for e-Accessible Education (and did not name other applications).

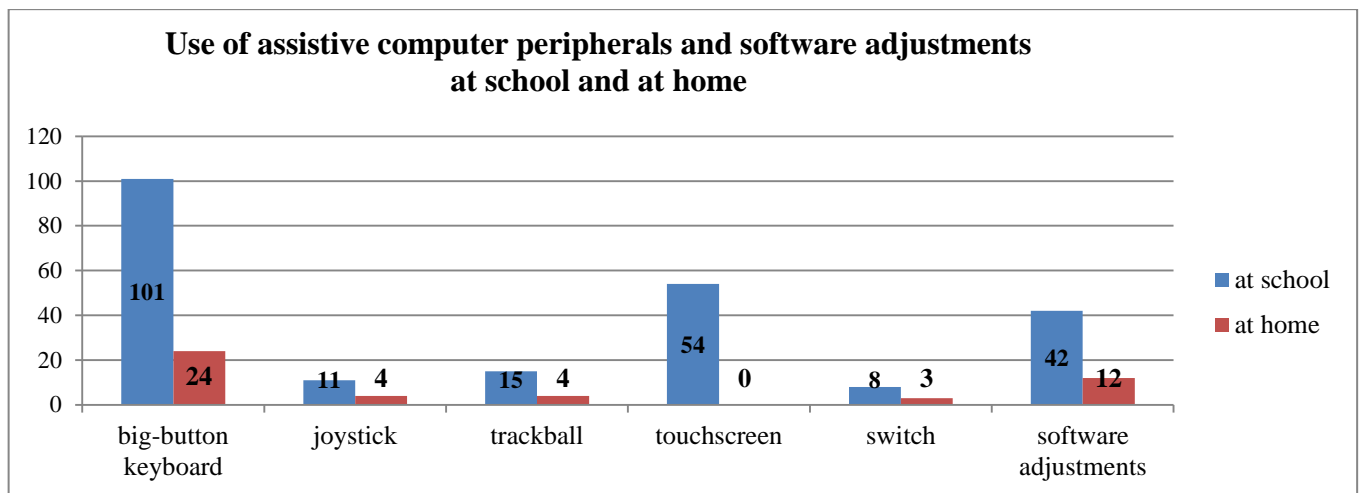
Most **students** – 123 of the total 127 who answered the questionnaire, or 96.9%, used assistive computer peripherals or software adjustments when using the computer. Only four students (3.1%) could use standard computer equipment.

Among the 123 students who used assistive peripherals or software adjustments, most commonly used are: big-button keyboard used by 101 student, joystick by 11, trackball by 15, switch by 8, touchscreen by 54, and software adjustment by 42.

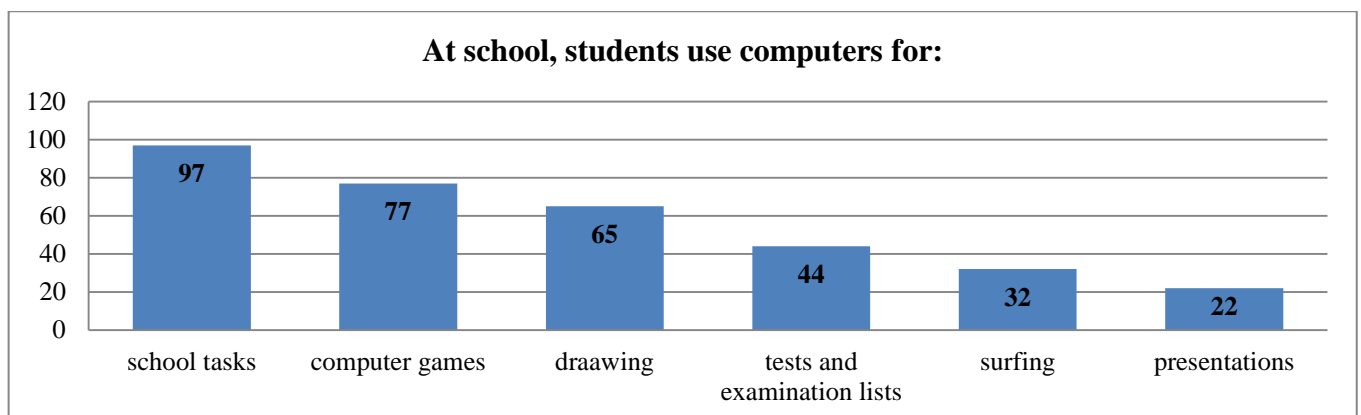
When it comes to computer use at home, 99 students or 77.9% confirmed. Part of the students stated that they did not have a computer at home, which was the reason that they did not use computer at home. Several students stated that they used laptop or tablet at home.

A total of 38 students (29.9%) used assistive computer peripherals at home: Among them 24 students used big-button keyboard, four used joystick, four used trackball, three used switch, and 12 used software adjustments. 22 of the students used the schools’ devices at home, as well; the families of 14 students independently procured assistive devices for their children. Two students received the assistive computer peripherals as donation from Open the Windows.

Due to the fact one student often uses more than one assistive peripheral and software adjustment, these data are presented in absolute size only:



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:



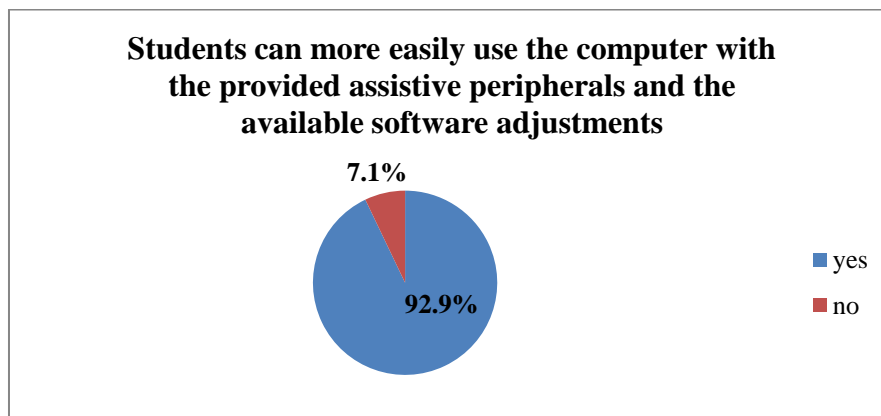
3.3. Relevance

Relevance was assessed through respondents' views on the level of appropriateness of the donated equipment and materials and the knowledge and skills obtained through trainings to the needs of students with disabilities and their inclusion in the instruction.

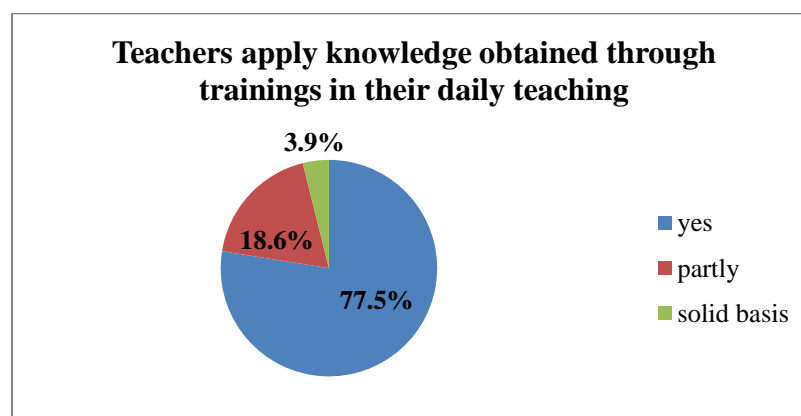
30 schools (96.8%) and 130 teachers (97.1%) felt that the donated equipment was appropriate to the needs of their students with disabilities. Also, 107 parents (95.5%) are satisfied with the equipment that their children use, confirming that it made computer use easier for them. The remaining five parents (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.

3.4. Quality

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.

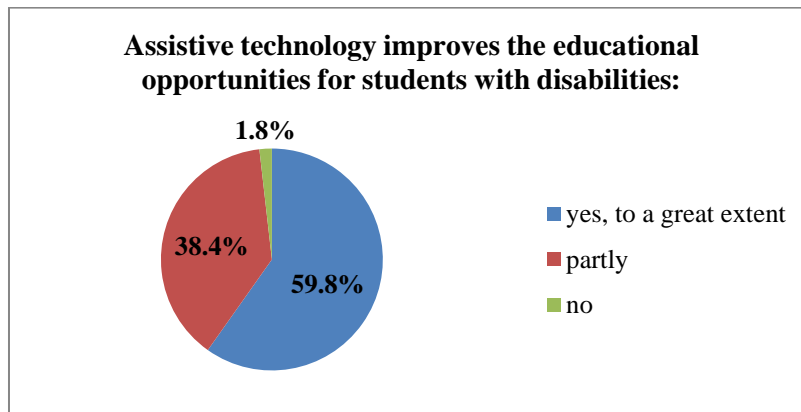
Schools, teachers and parents stated their opinion with regards to the effects of assistive technology use:

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.

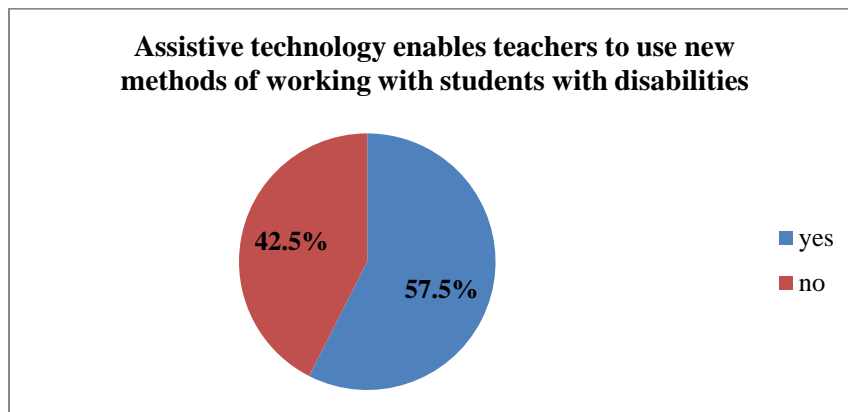
123 teachers (91.8%) were satisfied with the changes that brought about by assistive technology. 11 teachers (8.2%) felt that assistive technology did not result in positive changes for their students with disabilities.

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 the use of assistive technology in the instruction	1	3,2%	11	8,2%
Вкупно училишта:	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 for their children.



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.

3.5. Additional comments and suggestions by respondents

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.

REVIEW OF FINDINGS

of the research on assistive technology use in two pilot secondary schools

The Project for e-Accessible Education made the pioneering steps in introducing assistive technology in the mainstream secondary education in Macedonia. Since the 2014/15 school year, two secondary schools (in Prilep and Skopje) received assistive computer peripherals and training and started using assistive technology in their daily work with students with disabilities.

Despite the school having a rather short time for implementation, and the lack of accessible educational software, the project conducted a survey (similar to the one realized in primary education) to assess their initial experiences. Four categories of respondents were covered: schools (as institutions), teachers, students with disabilities and their parents.

The findings correspond to those determined among the primary schools using assistive technology. The key findings include:

- 14 students use assistive computer peripherals and/or software adjustments in the instruction. Half of them – 7 are students with combined disability, 4 students face mobility (walking) difficulties, 1 is a student with physical disability, 1 is a student with intellectual disability, and 1 is a student with vision impairment.
- Big-button keyboard is the most commonly used device – all 14 students use it. Three students use trackballs, three use switches and 1 uses joystick.
- The provided equipment suits the needs of the students with disabilities. There have been no defects or malfunctioning observed.
- All 14 students use accessibility options for keyboard and mouse; 13 students use display adjustments.
- In the opinion of schools and teachers, assistive technology is helpful in: improvement of literacy skills, mathematical skills, cognitive abilities, fine motoric, and can be used a tool for relaxation and leisure of students with disabilities.
- Teachers find the received manuals supportive for their inclusive efforts and makes assistive technology use easier. The presented tools and formats are used in planning, monitoring and documenting the progress of students with disabilities.
- Parents feel that assistive technology use improved the educational opportunities for their children.
- Both schools enable their students with disabilities to use the assistive peripherals at home.
- Neither school has undertaken any additional initiative for assistive technology promotion.

One of the teachers involved in the survey summarized the usefulness of assistive technology: *“Assistive technology overcomes learning difficulties, students obtain the foreseen basic knowledge and skills and complete the mainstream secondary education. Disability is overcome.”*

One of the parents stressed the progress of their child: *“My child likes using the big-button keyboard, as it enables him to type faster.”*

4. 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.

5. 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.