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## Access Technologies (AT) for students with visual impairments

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### Abstract

The present paper aims to highlight the importance of access technologies (AT) to studying the Information Technology (ICT) for students with visual impairments. The research has shown that students with visual impairments are attracted to new technologies and even though at first they have not proven confidence in the benefits of studying this subject, towards the end of the school year the situation changed, meaning that most students were delighted to study this subject and also in the benefits that their acquisitions have upon their personal and interpersonal development.

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*Keywords:* Access Technologies (AT), Information Technology (ICT), optional curriculum, visual impairments, group cohesion, interpersonal communication.

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### 1. Introduction

The present paper aims to highlight the importance of access technologies to studying the Information Technology (ICT) for students with visual impairments.

Introducing the optional curriculum in Special Secondary School for the Visually Impaired aims at a real social integration of students with visual impairments and at narrowing the gap between a special school, where children with sensory impaired view are schooled, and a public school, where children with disabilities are enrolled.

Implementing a learning plan to attract children with visual impairments to the outside world leads to

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encouraging social interaction, especially with children from other schools, from other places, in other countries. Continued use of ICT-related activities after they leave the classroom are beneficial because any student can make progress when applying lessons learned at school and at home with family or friends.

## 2. Highlights of defining visual impairment

Visual function is a dynamic synthesis of several sub-functions, and violating one of them is sufficient for the whole system to be harmed (CIF, 2001). Injuries or malfunctions of the visual analyzer may cause (Ștefan, 1981):

- *amblyopia* (ambly - weak, blunt and ops - eyesight) - broadly means all cases of reduced visual capacity, regardless of etiology and severity, or the loss of vision that persists after the appropriate correction has been made
- *blindness* - loss of vision – can be either total (= inability to perceive light), or practical (light is perceived, but visual acuity is less than 2%).

In the educational therapeutic process, knowing the factors that caused the visual impairment underlies the design of treatment measures and compensatory interventions for optimal mobilization of the visual traces and mental processes of all positive personality traits, which through their dynamic interaction can support the visual function affected. (Rozorea, 2004).

## 3. Concepts in Access Technologies

The term refers to access technology hardware and software with which visually impaired people can use information technology, or computer, and everything related to it, including the Internet and communication services related thereto. (Emiliani, & Burzagli & Como & Gabbanini & Salminen, 2009). Any equipment in the field of electronics may be included in AT if it meets several conditions:

- facilitates independent access to information for the person with visual impairments;
- allows the formation of new skills such as to facilitate the social and professional integration;
- allows performing tasks with relative independence and at a pace similar to that of a person without disabilities;
- supports educational activities and social interactions.

## 4. Research design

**4.1. Purpose of research.** The purpose of this research is to highlight the importance of implementing Information Technology (ICT) as an optional subject to visually impaired students, using access technologies (AT). This research was carried out in three stages, each of which contains specific objectives.

- *Initial stage:* This stage is the initial assessment of students with visual impairments, who are going to study the ICT optional course using AT.
- *Intermediate Stage:* Introducing ICT Optional Course (1 hour per week) by using TA, aimed at enabling students with visual impairments to use computers as a complementary study tool. Case study on a heterogeneous group of students, which has a low group cohesion index, with the specific goals of increasing the group cohesion, increasing the academic achievement, reducing absenteeism, after using the computer for homework and with the help of virtual interpersonal communication.
- *Final stage:* The final assessment in perspective of highlighting the positive effects of the ICT Optional Course on the students.

**4.2. General Objectives.** In the present research the following objectives were targeted:

*Theoretical objectives* - to consolidate personal research:

- Highlighting the role of ICT in the educational process for personal development, interpersonal communication and group cohesion.

*Applicative objectives:*

- Selecting the case study subjects, those displaying aggressive behaviour and school adjustment difficulties;

- Initial assessment, by using two questionnaires, the subjects of the research group to highlight the importance of studying ICT, of motivation for studying ICT and awareness by students towards studying ICT.
- The final evaluation, using questionnaires from the initial stage, of the subjects included in the research group.
- Making comparisons between the results obtained by using two questionnaires at the beginning and end of the school year.
- Designing a group study program including the usage of computer and ICT skills acquired through studying ICT, as an optional course, in order to increase group cohesion, achieve better performance at school, and reduce absenteeism rate.

**4.3. Research Hypotheses.** The main hypotheses of this research were:

H1: It is assumed that ICT is an optional study that contributes to the development of cognitive activities and interpersonal communication skills of students with visual impairments.

H2: It is assumed that the study of ICT is an optional discipline which favours increasing awareness that digital skills are prerequisite training.

H3: It is assumed that the study of ICT is an optional discipline which help increase group cohesion students with visual impairments.

**4.4. Research group.** For the purpose of this study were selected from the school population, students within classes V-VII Special Secondary School for the Visually Impaired Bucharest. This selection is consistent with the study options for students on ICT optional discipline, which is a new discipline and is part of the Technology curriculum. The research group is composed of 32 students (20 students sighted: 11 girls and 9 boys, 12 blind students: 6 girls and 6 boys). Of the 32 students in September are institutionalized (in foster care) and 23 non-institutionalized. The average age of students is 12.8 years.

**4.5. Research methods.** To validate the research hypotheses, the main methods applied were questionnaire (three questionnaires with closed questions) and case studies (which were used to achieve methods of sociometry - sociometric indices and indicators).

**4.6. Results**

The results obtained by applying the above questionnaires were processed and interpreted by the program MS-Excel, using specific functions for processing statistical tables and graphical representation of data. For reasons of efficiency, we only presented those results which are strictly relevant to the research hypotheses.

Results of the first questionnaire on subject choice options highlight the increasing number of students who are attracted to modern technologies. Also, there is awareness of computer use and outstanding directing attention to discipline students involving ICT. The same survey points out that a large number of students consider that studying the discipline deemed optional ICT will help in future personal and professional development. (H2 is confirmed.). The proportion of pupils who agree that the study of this subject is helpful for a future job increases considerably from the initial assessment to the final assessment.

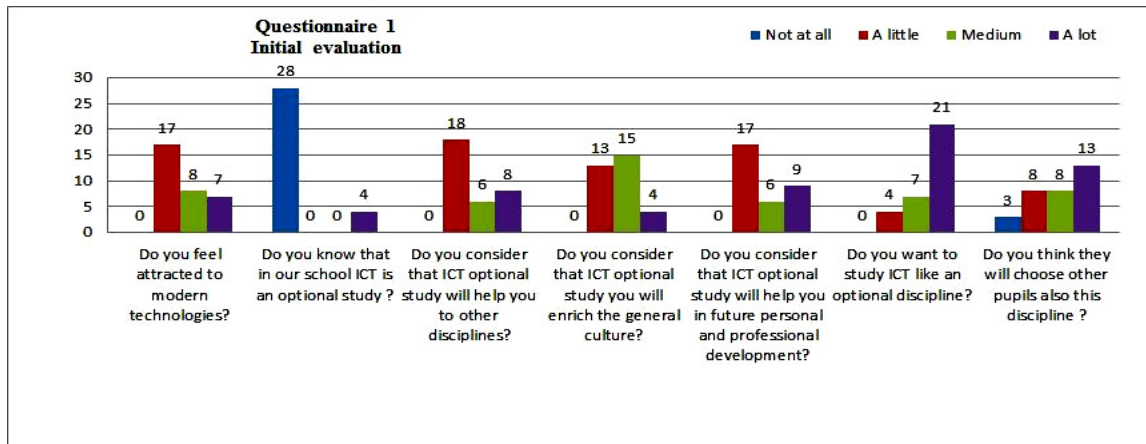


Fig. 1. Investigating satisfaction the third questionnaire – chart

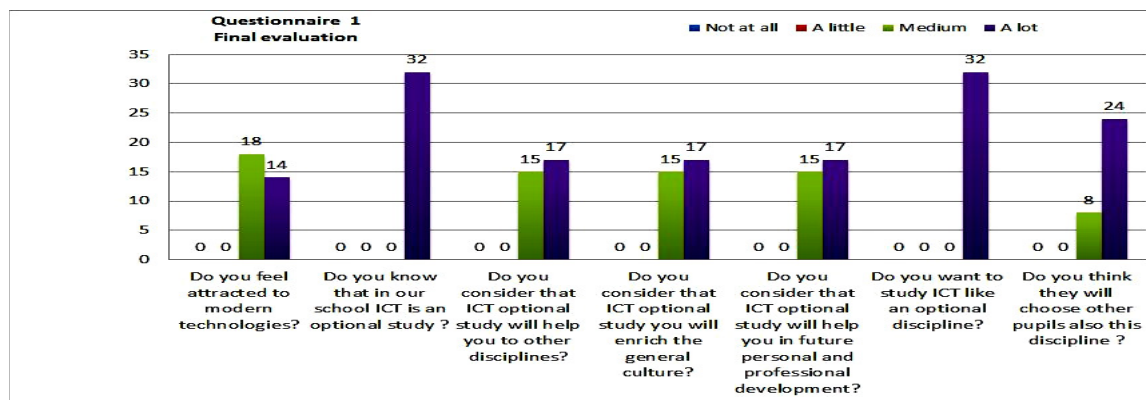


Fig. 2. Final evaluation first questionnaire – chart

The application of the second questionnaire had at assessing the level of knowledge of students in ICT, the extent and manner in which they use the computer. The questionnaire was applied both at the beginning of the school year and after completing matter at the end of the school year. So, after the initial and final applications, the following results were obtained:

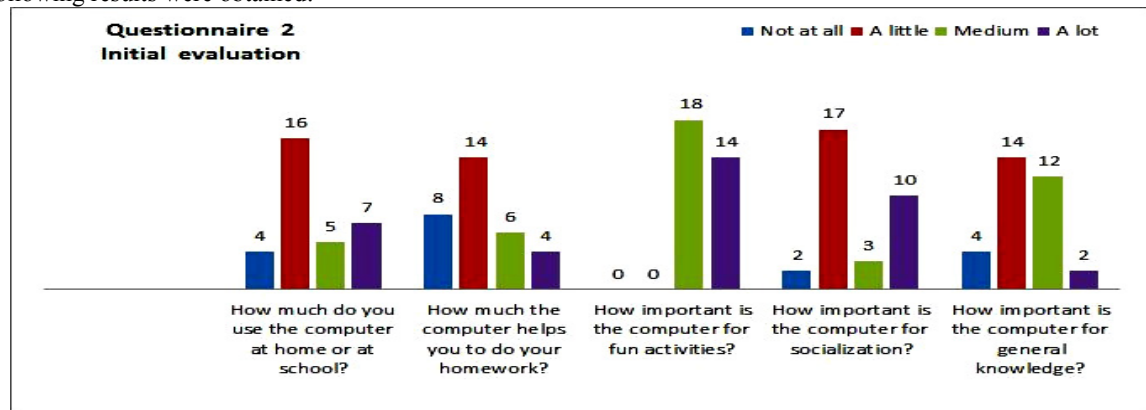


Fig. 3. Initial evaluation second questionnaire – chart

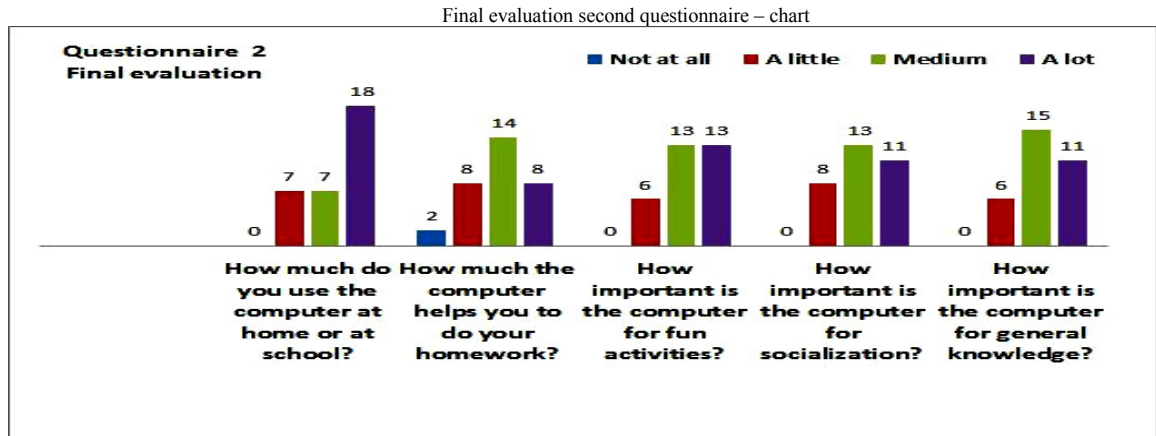


Fig. 4. Final evaluation second questionnaire – chart

The interpretation of the results from survey highlights the increasing number of students which are using the computer at the end of the school year (almost all students use computers), compared with the beginning of the school year. Equally, it is observed that students is considering using the PC as being very useful for the development of communication and increase socialization.

The third questionnaire sought awareness of practical applicability of knowledge in information technology and evaluate the importance of studying this discipline among students. The answers led to the conclusion that this optional course is useful for both students visually impaired cognitive activities as well as the communication / socialization. (This confirms H1.) It has been found that students want to study ICT, considering that the use of PC skills are a prerequisite for professional success. (This confirms H2).

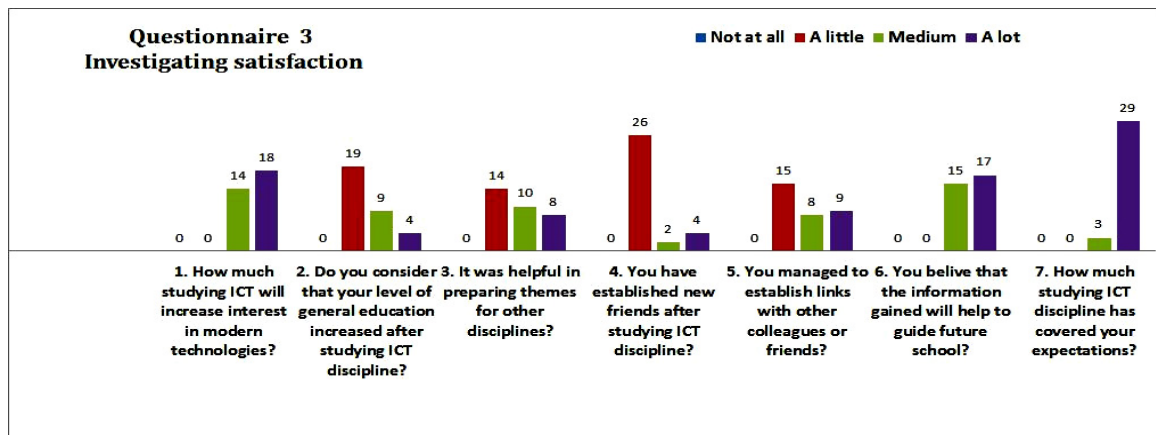


Fig. 5. Investigating satisfaction the third questionnaire – chart

#### 4.7. Case Study

The case study included in the research study revealed that ICT optional discipline can influence the group of students, such as: help increase group cohesion by increasing the capacity for collaboration and communication; can improve educational outcomes by stimulating interest in new and increased intellectual curiosity; develop critical and creative thinking; program of study can be applied at the group level. For the study case, sociometric methods have been applied to highlight the results of the program of study at the group level.

The objectives of the case study were: 1 increase group cohesion; 2 increase academic achievement; 3 reducing absenteeism after using the computer for homework and interpersonal communication skills.

In the second semester, when students have already acquired or developed their digital skills by studying ICT optional discipline, we introduced a trial program for a group of 8 students (6 boys, 2 girls). The group of students was heterogeneous group cohesion index decreased. From the eight students selected 5 have school adjustment difficulties and specific personality traits are predominantly negative, aggression, low empathy, low motivation for learning. The program was applied with a frequency of 4 sessions per month, one hour each session. Students were asked to work in groups to study different subjects, using information and skills developed during the hours of ICT. Were also asked to use the Internet and virtual communication homework or e-mail and face-book.

For research we used a socio-metric questionnaire with two questions, applied at the beginning and end of the program. Through the questionnaire, at baseline, this group found that group cohesion is very low and the number of rejections is higher than the attractions.

Results for application of the initial socio-metric test are shown in the table below.

Students	1.	2.	3.	4.	5.	6.	7.	8.	Ab	Va	Rb	Vr
1.		-1	-1	-3	0	3	1	3	3	10	3	-5
2.	-1		3	-1	-2	1	2	-1	3	9	4	-5
3.	3	-3		0	3	-3	3	0	3	12	2	-6
4.	2	0	1		-3	2	-2	1	4	10	2	-5
5.	-3	-2	0	3		-1	-3	-3	1	4	5	-12
6.	0	2	-3	1	1		-1	-2	3	8	3	-6
7.	1	3	2	2	-1	0		2	4	14	1	-1
8.	-2	1	-2	-2	1	-1	0		2	2	4	-7

Fig. 6. The results of socio-matrix before using AT

where: Ab = Gross elections ; Va = the elections ; Rb = Gross rejection ; Vr = the rejection

Election value is 69, and the rejection is -47. Consistency index (Ic) group also expresses the quality of sociometric relations within the group; The larger the index is, the more cohesive group. Proctor and Loomib has calculated the sociometric index group, the equivalent of cohesivity, considering both mutual choices (C) and unilateral (A) and proposing the formula:

$$Ic = \frac{R \times q}{U \times p} \quad \text{where} \quad p = \frac{k}{N-1}, \quad \text{and} \quad q = 1-p.$$

where: k = number of elections allowed ; N = number of group members ; R = mutual choices ; U = unilateral elections

And that the initial Ic = 0.67. Sociogram elections in the initial stage looks like this:

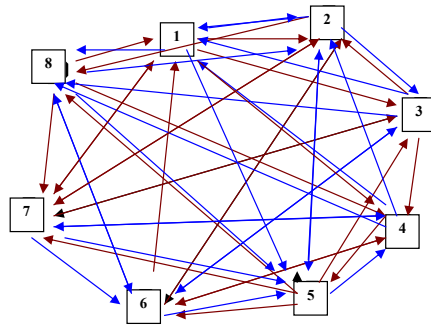


Fig. 7. Sociogram elections in the reasearch group (initial stage)

At the end of the second semester, the results of socio-metric test were as follows:

Students	1.	2.	3.	4.	5.	6.	7.	8.	Ab	Va	Rb	Vr
1.		0	3	3	0	1	1	2	4	9	1	-1
2.	0		1	-3	3	0	-3	-3	3	7	3	-9
3.	2	2		2	2	-1	-1	1	5	9	1	-1
4.	3	-1	2		-1	2	2	0	4	9	2	-2
5.	-2	1	-1	0		3	0	-1	3	3	3	-4
6.	1	3	0	1	1		-2	-2	4	5	2	-4
7.	-3	-3	-2	-1	-3	-3		3	1	3	6	-15
8.	-1	-2	-3	-2	-2	-2	3		1	3	6	-12

Fig. 8. The results of socio-matrix after using AT

Finally  $I_c = 1.7$

In conclusion, group cohesion index increased from 0.67 to 1.7. (H3 is confirmed.) Comparing the overall averages of group between the first study semester and the second semester, in the second semester overall average increased from 6.73 to 7.01. Average absences per second semester decreased from 24% to 21% absences. Sociogram of the final elections stage looks like this:

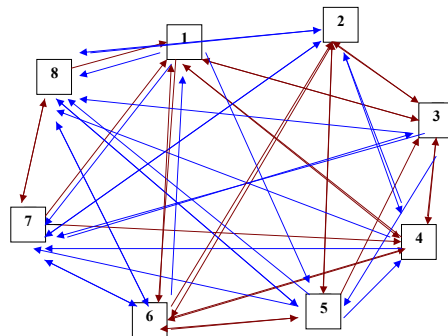


Fig. 9. Sociogram elections in the reasearch group (final stage)

## 5. Conclusions

The present paper aims to highlight the benefit of studying the optional Information Technology (ICT) discipline, using access technologies (AT), for children with visual impairments.

The research has shown that students with visual impairments are attracted to new technologies and even though at first they have not proven confidence in the benefits of studying this subject, towards the end of the school year the situation changed, meaning that most students were delighted to study this subject and also in the benefits that their acquisitions have upon their personal and interpersonal development. Also, the students wish to continue studying ICT, considering that computer skills are a prerequisite for professional success.

The paper work has shown that social integration of students with visual impairments require educational solutions based on open curriculum, student-centered to the principles of integrated education. (Potolea, & Toma, & Cerkez, & Borzea, & Căpița & Tacea, 2013). It was shown that the educational process and compensation, rehabilitation of disabled students mostly apply general principles of didactics, which are adapted to the particulars of students with visual impairments

The paper work has also considered a case study conducted on a heterogeneous group of students, with a low group cohesion index and with learning / adaptation difficulties. Students were asked to work in groups while attending different courses, by using the information and skills acquired at the ICT course.

Upon completion of this program, all three proposed objectives have been achieved, with the following final results: in the 2<sup>nd</sup> semester, the group cohesion index increased to 1.7 compared to 0.67 in the 1<sup>st</sup> semester, whereas the overall average in the 2<sup>nd</sup> semester increased to 7.01 compared to 6.73 in the 1<sup>st</sup> semester, while the absences average in the 2<sup>nd</sup> semester decreased to 21% from 24% in the 1<sup>st</sup> semester.

The benefits of using AT for students with visual impairments can lead to new socio-professional orientations in the future, to the development of new spheres of activity while consolidating the existing ones at the same time.

Currently, Special Secondary School for the Visually Impaired where experimental research was conducted, is partner in project ROBOBRAILLE SMART, a project that is sponsored by Leonardo da Vinci program "Lifelong Learning", which brings together many TA. Robobraille is a media service that enables conversion of documents in documents accessible to people with visual impairments or language. It is a program that works online and convert the information they receive braille documents, which can then be printed or in audio files. Service is always available and free for non-commercial users.

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