Babeş-Bolyai University Cluj-Napoca
Faculty of Psychology and Sciences of Education

PhD Thesis

Characteristics of learning styles in people with visual impairments in using assistive technologies

- S U M M A R Y -

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This research aimed to investigate the characteristics of learning styles in case of the visually impaired persons. The approach of learning style was based on how information is used, on the strategies and learning models, motivation and progress in learning. We focused on the influence of the assistive technologies and on the shaping of an optimal learning style. The study was applied on a sample of 282 persons, a group of 141 participants with visual impairment (N=103 pupils, N=38 students) and a group of persons without any disability. The average age of the participants was around 19, 4 (17-32). The results offer not only a global and a particular image of the learning style of the persons with visual impairments but also some explanation regarding the relationship between them and assistive technologies.

Key words: learning styles, learning strategies, visual impairments, assistive technologies, psychosocial impact of assistive technology.

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Introduction

The ways to explain the conditions that are leading to learning and the possibilities to optimize the act of learning represent the exclusive contribution of the learning theories, which have generated in time several models of learning. The outline of a learning theory, depending on the psychological and / or the pedagogical approach, led to the rising of a controversy and highly evoked study field, that of learning and cognitive styles. The various psychological approaches left their mark upon the learning theories, each theory relying on the concepts of the given approach. Thus, there have been outlined theories such as: classic association, classic conditioning, behavioral conditioning, operant conditioning, pragmatic functionalist theories, cognitive theories, integral-hierarchy and holistic theories; constructivism theory.

The learning styles research field is a vast one which also determines a lot of conceptual confusions. Each individual is defined by his own learning style. If we use a simple combinatory analysis, we could get as a result a number with several billion digits of thinking and learning styles. The chance to find two people who think (cognitive style) and learn (learning style) in the exact same way is relatively non-existent. From this point on, a controversy problem for researchers derive: the identification, among subjects (people), of some categories, types of learning styles (cognitive), depending on various attributes, constant features which preserve themselves during the process of learning and which characterize one learning style or another. The issue of learning styles maintained a stimulating controversy in the field of social sciences, against the multitude of models and trials (more or less successful) of elucidating and offering effective methodological alternatives.

In our scientific attempt to approach the learning styles, we focused on the evaluation of their features in a more special context, that of the visual disability. In order to achieve our research goal, the theoretical approach included radiography of the learning styles and the cognitive styles, in order to limit them, both from the perspective of their approach and also from the perspective of their presentation. The achievement of this differentiation was based on both the bibliographical references analysis and the observation that sometimes, in the scientific literature, the two terms are confused or used with the same meaning.

The selection of instruments was based also on a subjective analysis. The lack of specific instruments for people with visual disability, led us to use various instruments, from various research fields. The Vermunt Inventory Learning Styles allowed us to explore the

learning styles' features of visually impaired people from the perspective of information processing strategies, their motivation for learning and their learning used mental models.

Also, this model offered us the possibility not to resume ourselves only to the personal or the processing style characteristics, but also to outline the characteristic of the learning environment. The Felder and Solomon Index of Learning Styles offered us the possibility to gather information regarding the way in which people with visual impairments select information, regarding the sensorial channel which facilitates information and the means of processing information. The Fleming and Mills Learning Styles Inventory offered us data regarding the aspects of perception and processing of learning material.

In order to emphasize the global and the particular features, people with visual disability and people without visual disability were included in the present study.

The first approach of this thesis focused on the particularities at the level of learning styles of visually impaired people. The second part conducted in our research was the relationship between learning styles and the use of assistive technologies, at all the learning processes' levels. In order to achieve our goals, we elaborated a questionnaire to investigate the opinions of the visually impaired participants regarding the strategies they use in the process of learning in the context of using assistive technologies. We also used an instrument focused on the identification of the psychosocial impact of the assistive technologies.

The obtained results offered us the possibility to find out the information treatment means in specific learning contexts, depending on the features imposed by the visual disability and in the framework of using assistive technologies.

We consider that, through our approach, from its theoretical, practical and investigative dimension, this paper originally and importantly contributes to the learning styles' scientific approach, with an express reference to the learning styles of people with visual disabilities, in the context of using assistive technologies. What is more, we mention that our efforts wish to represent an open gate to the new further research and the conclusions of our study can be considered by those who are interested in the issue of learning styles as new hypothesis (goals and objectives) for future theoretical and applicative research.

Theoretical Framework

The first chapter („Theories regarding the definition and the assessment of cognitive styles") brings into discussion the concept-notions of „learning style" and „cognitive style". Thus, learning style and cognitive style are separate concepts even though they are often confused. But, certainly, the cognitive styles influence the learning style, the last one contributing as well in a smaller or bigger degree to the enhancement of cognitive styles efficiency. Learning styles can be improved by practice, depending on the experience. Being aware of a particular learning style presence represents a premise of his development and optimization for a better control of the conditions from the immediate or remote reality and the adjustment to environment.

An issue that has to be treated thoughtfully in the research refers to the degree the cognitive styles reflect themselves into learning styles and the degree in which the teaching styles take into consideration the characteristics of the cognitive styles mediated by associated personality type and value-attitude traits in relation to miscellaneous types of information the person get in contact with. In order to the information the person gets in contact with to become operational and be used in a customized manner during various educational, professional contexts, it is necessary to define and to assess cognitive and learning styles. The identification of cognitive styles, together with the mediator and moderator variables specific to each person by means of a valid psychological instrument to delimitate pragmatically the factors that compound cognitive and learning styles is imperative. In the context we are discussing, the prominence of cognitive styles characteristics (if any) at people with disabilities would significantly influence the compensative-corrective and educational-instructive process.

This is the reason we focus on the definition and establishment of cognitive styles dimensions from different operational approaches (the approach focused on cognition, neuropsychological approach, the approach focused on personality, the approach focused on activity). We chose for this perspective for at least two reasons:

- it allows operational definition and assessment of cognitive styles and of learning vs. teaching styles;
- identification of cognitive styles and their dimensions supports the elaboration of certain customized methods and strategies that allow the transmission, assimilation, appliance and transfer of information they get in contact with.

The approach of cognitive and learning and teaching styles was a pragmatic one, taking into consideration a long time known principle, but still not so much applied in some fields, namely the most practical aspect is a good theory, but we assume that a theory is good only when it applies clearly marked practical valences. All the more so, some theories on cognitive styles do not have to miss this aspect.

A pupil with a cognitive style that is consonant with the teacher's one who teaches in class or prepare him for a certain discipline has bigger chances to have more positive learning experiences. This issue is valid for the working team members as well: if the cognitive styles of the team members become consonant and oriented toward the same aspiration level, they will probably feel all the same positive experiences. If in the framework we operate there is a consonance of cognitive styles, it will make us feel more comfortable when we work together, but however this cannot guarantee the success.

Apparently similar to the significance regard, at common sense level, the two collocations – cognitive style and learning style – are practically are almost the same. Cognitive style refers only to a procedural "how" from the cognition-meta-cognition point of view. But, during learning, besides the cognitive dimension there are other dimensions involved as well: the affective one, the volatile one, the psycho-motor one and various elements that act as impeding or stimulant factors for instruction-learning process: external and internal conditions of learning, prescriptions, norms, teacher's personality and his relation with the pupils, learning style, ergonomic aspects of learning etc.

The most recent researches on brain functionalities state that when learning modalities are better adapted to learning context, to demands of learning process, pupils achieve better results with less effort and in a reduced period of time. Consequently, we believe an important role in learning, besides knowing the dominant learning style of pupil is represented by cognitive and learning styles assessment as well. This can be attain by: noting and analyzing our own learning experiences, characterizing learning style on the base of explanations, descriptions, exercises presented in the guide, applying specific questionnaires (Internet, handbook with psychological tests), discussions with specialists from special education support offices from national counseling network, information regarding learning styles resulting from self-knowledge will (strong and weak aspects of personal learning style), active involvement in practical activities with this theme at different hours, especially in those of counseling and orientation, various optional, involvement in educational programs treating this theme (e.g. optimization of learning style, efficient learning techniques).

At the same time, we mention that an important role in the development of cognitive and learning styles is represented by access technologies especially for the visual impaired pupils / students case. A detailed radiography of the relation between access technologies and learning styles is presented in the next chapters (second and third), from different theoretic and methodological perspectives.

In the second chapter („Theoretical and practical approaches of learning styles") the focus is put on the definition, presentation and thorough description of learning styles. Learning style is unique and the chance to find two persons with the same learning style is null.

The diversity of people implies a cognitive diversity (of cognitive styles) and by default of learning styles. However, it does not mean that there are no people that are similar by the manner of processing data (cognition) and metadata (meta-cognition). Thus, the researches concerning learning styles are roughly focused on compulsory identification of a certain learning style or a different learning style and design of psychological profiles in which people can be grouped, categorized despite their diversity. Thus, various taxonomies, classifications of learning styles (Kolb model, Fleming and Mills model, Felder and Silverman model, 4MAT model, Dunn and Dunn model, Vermunt model etc.) appeared that take into consideration diverse factors and variables of the learning process, as criteria for classification.

The same way in didactic, educational field, we can talk about a learning style of pupils that influence the learning results, the generation and the development of skills, their assimilation and fixation in the long term memory, we can discuss about a certain manner of teaching, of a procedural „how" of teaching act that depends on a variety of factors that interfere in the teaching act, including internal factors that depend on the teacher's personality. Teacher's teaching style influences the generation and development of a particular learning style of pupil. This means that teacher's personality can determine a certain manner of processing information, a routine tendency of learning that tends to become a constant and transform itself in a personal learning style.

Another conclusion that can be drawn from our theoretical approaches is that in relation to the listed and described classifications of learning styles, we do not have to assess them as „good" or „bad". Each learning style is coordinated with a set of characteristics that makes up the identity and uniqueness of that style and that differentiates it from the other. On

the other side, we cannot discuss about learning (or teaching) styles in a „pure" condition, as we cannot talk about pure human temper. Due to instructional reasons we classify, differentiate, describe them identifying their features. Practically, a person (pupil, student) during learning process has a preference for a certain way, manner of acting, but he can borrow traits, effects, operations belonging to other learning styles too.

We even offer an advice for teachers in order to help pupils know themselves during learning process, discover their favorite style, be aware of it, managing therefore to supervise learning activity, avoid learning obstacles and difficulties. A learning style is not an unchangeable „given"; it is compounded and remodeled continuously depending on methods, techniques, strategies that pupils use during the learning act. It is important that the pupil helped by meta-cognition becomes aware of what and how much he is able to do in learning act, what and to what extend he can modify, adjust his style to learning context and difficulty of the learning tasks.

Thus, the identification and recognition of the learning style is on one hand an intrinsic prerequisite for obtaining learning performances and on the other hand, it offers a wide range of benefits for **pupils** (self-knowledge development, revealing learning strengths and weaknesses, eliminating learning obstacles, self-esteem improvement, prevention of children-teacher and parents dissensions, highlighting learning skills, learning optimization by adopting a personal manner, obtaining better marks at school, developing a positive relation with others, decreasing acting problems etc.), **parents** (comprehension of children learning needs, identification of the reasons that generated scholar failure, reassessment of learning barriers and a positive approach of children's full potential) and **teachers** (less stress is perceived daily in and out the class, better results and professional satisfaction are achieved, time management is ameliorated, an accurate impression on class diversity is formed, team spirit is raised, teacher-pupil interpersonal relation and communication between pupils, teachers and parents are developed, pupils individual learning needs are clarified, learning by cooperation and group working succeeds, needs of pupils classified as „low" and of „talented" pupils are accurately identified, the causes of learning failures are identified, strategies for learning optimization are established).

Finally, along with the awareness of learning style, we stress the necessity of continuous development, optimization and enrichment of it because all the time pupil (the one involved in learning act) has to appeal on strategies, techniques that do not belong to his own learning style to surpass learning obstacles.

The final conclusion that we achieved is that all the pupils can learn, in their own tempo if teachers, parents, those that offer them support are ready to know how to teach them, to suggest programs for developing their learning style and practicing transferable skills: of communication, working in team, learning, time management, problem solving, negotiation, listening, creativity, computer literacy etc.

The third chapter („Access of visual impaired people to education and information by the means of access technologies") consists in our intentions to focus on the necessity of support technologies utilization for the visual impaired people to access education and information by outlining a proper learning style influenced exactly by the access and utilization of support technologies.

We consider thus that the formative valences of AT for visual impaired people can be noted in the new educational and professional orientations, in communication management, information and study activities, at school, university, home or at work. The impact of introducing assistive technologies is high and positive for customized and adequate optimization and value of learning styles of visual impaired pupils and students.

AT form the premise of access to information of a group of persons with a potential to develop and support modern values, but for this society is required to adapt to the requests of visual impaired people. Multimedia systems based mainly on graphical complex elements have to be designed to be accessible to blind people as well.

Future researches will be able to prove more accurately which are the changes inducted by AT in human personality, in respect to learning performances, personality elements, cognitive and learning style for visual impaired people.

Visual impaired people encounter learning difficulties due to the nature of the deficiency, severity of the affection. Overcoming and decreasing of learning difficulties can be obtained by diversified and proper utilization of AT. These can participate to the optimization, enrichment of dominant cognitive and learning style as well, facilitating overcoming of learning obstacles with positive effects on self-image and self-esteem of the learner.

We assume that AT allow the development of learning mechanism as far as the person that use the computer benefits of knowledge and a vast previous practice acquired via specific training courses and individual practice. Even in the case of people that use for the first time AT, these can ease the overcoming of learning obstacles through „the modification" of

learning style that pupil/ student has had and through the conversion of this style in one that is based on AT as adjuvant elements in learning act. Therefore, he can cope with educational-instructive and professional process demands at a relative identical level of the person without disabilities. It is relative because difficulties derived from the visual impairment intercede here like: perception of stimuli in motion, of three-dimensional nuances or of complex design.

We can state that AT represent indispensable elements that have to be used for visual impaired pupils / students facilitating a better educational, socio-professional insertion. Their frequent utilization in the learning process, in various situations, contexts, for sets of problems, exercises, improve learning to a considerable degree (according to our demonstration from the practical approach) and at the same time „influence" in a positive way the construction of a learning (and cognitive) style much more adapted to the individual requirements of pupil in relation to the requirements of adapting to the educational and/or socio-professional environment.

We conclude that currently the utilization of AT in the learning process, for visual impaired pupils, is a dimension of modern instruction, contributing to attaining positive results and even learning performances, optimizing individual – cognitive and learning – styles of pupils. They support fundamental changes in AT presence referring to a better, more accurate and more efficient adaptation to learning context with positive repercussions in learning outputs layout.

At present, an instruction that is not based on AT utilization, in the more or less severe visual impaired pupils is going to fail induced by low learning results set of pupils. We consider that AT, besides the modern dimension offered by educational (and not only, but also extra school) instruction and education brings additional motivation and simplification of learning act, as learning successes represent the energy-motivational premises for the release of next (sequent) cognitive act. This happens if it participates more efficiently to the adaptation of predominant cognitive and learning style of pupil with learning difficulties related to context, situation, moment of learning, to their demands, helping the learner to surpass them successfully.

Research Methodology

General and specific objectives

The general objectives and the specific ones derived from the general objectives are:

1. The assessment of learning strategies and styles of pupils and students with and without visual impairments, by investigating the differences between them.

1.1. The Assessment of the learning styles of pupils from the schools for visually impaired persons and of the visual impaired students on the following dimensions: cognitive processing strategies, metacognitive regulation strategies, learning motivation, mental models of learning, active / reflective, sensory / intuitive, visual / verbal, sequential / global, visual learning strategies, auditory learning strategies, learning strategies by reading / writing, kinesthetic learning strategies.

1.2. Design of a platform for learning style assessment by self-administration, with the necessary adaptations for the pupils and students with visual impairments.

1.3. Development of a guidance standard for each of the evidences available on the platform of learning styles assessment.

2. Identification of the level of assistive technologies utilization in educational and vocational guidance activities.

1.1. Development of an assessing tool for the preferences and strategies used in the learning process in the case of assistive technologies utilization.

3. Identification of relationships between the constructs underlying models of learning styles and use of assistive technologies in the educational-instructive process.

3.1. Identification of the relationships between the assistive technology and the educational process dimensions:

- *Educational and vocational guidance;*
- *Relationship with schools / teachers;*
- *Preferences for the teaching style;*
- *Orientation and mobility;*
- *Preferences / needs in the use of the assistive technology;*
- *Ways of accessing information;*
- *Learning in the context of using assistive technologies;*

- *Preference for learning materials;*
- *Structure of materials, the preference for reading;*
- *Time allocated for learning;*
- *Self-training;*
- *Assessment of knowledge with / without using assistive technologies;*
- *The structuring way of learning materials on the computer;*
- *Executive attention;*
- *Computer learning strategies.*

4. Identification of the psychosocial impact of the assistive technology from the pupils and students with visual impairments perspective.
    - *4.1. Adaptation and validation of the assessment scale of Assistive Technologies Psychosocial Impact.*
    - *4.2. The impact of the assistive technology on the self-esteem, competence and adaptability level of the pupils and students with visual impairments in relation with assistive technology.*

General and specific hypotheses

Based on the above objectives we have formulated the following **general and specific hypotheses**, through which we intend to identify the presence or absence of the factors that reveal the studied constructs structure. We approached the knowledge level because it is obtained on learning style base:

1. There will be significant global differences between the learning styles and strategies of the pupils / students with visual impairments comparing with pupils / students without disabilities.
    - 1.1. *There are differences between the learning style of the pupils / students with visual impairments on the active / reflective, sensory / intuitive, visual / verbal, sequential / global dimensions comparing with the pupils / students without disabilities.*

2. There will be significant differences between the dimensions of learning styles and strategies (reproduction oriented, understanding oriented, knowledge-oriented and non-oriented) at pupils / students according to the presence versus absence of the visual

impairment.

2.1. Pupils / students with visual impairments will show higher scores than learners without disabilities, at the following variables in the studied models:

- concrete processing, vocational guidance, the use of knowledge;

- deep processing, self-regulation of the processes and outcomes, personal interests, skills testing, knowledge accumulation;

- deep processing – relating-structuring and critical thinking, external control, certificate directed, intake of knowledge.

2.2. The pupils and the students with/without visual impairments will obtain similar scores at the following factors in the studied model:

- no setting, stimulating education, collaborative learning, ambivalence.

3. There are significant differences regarding the analysis (visual, auditory, reading / writing, kinesthetic) of information between pupils / students with visual impairments, compared with pupils / students without disabilities.

3.1. Pupils / students with visual impairments will score high regarding the analysis method level of the auditory information and reading / writing.

3.2. Pupils / students without visual impairments will score high regarding the analysis method level of the visual and kinesthetic information.

4. Assistive technologies influence the structuring and shaping of the learning styles and strategies of the pupils and students with visual impairments.

4.1. Assistive technologies are a constant predictor in the generation of specific strategies and learning styles of students with visual impairments.

4.2. Using assistive technologies correlates with the strategies used in learning, preference for study materials, ways of treating the information, adaptability, competence and self-esteem.

The participants in the study

In the study, a number of 282 participants aged between 17 and 32 years was included, out of which 206 pupils and 76 students, grouped into groups of pupils / students with or without visual impairments.

The group of participants with visual impairments consisted of: (a) pupils from special

schools and (b) students registered in public or private universities from Romania. The group of participants without visual impairments was composed by: (a) pupils from the Pedagogical High School "Stefan Odobleja" from Drobeta Turnu Severin and (b) visually impaired students registered in public or private universities in Romania.

In the participants selection for the study, especially for the group of pupils, we took into consideration the minimum age of 17 years and 6 months. According to the studies mentioned in the theoretical section, the selection criterion by participants age was based on the assumption that states that at this age there is a relatively stable level of learning preferences and so the premise of a defined learning style is present.

Table 1. The distribution by gender - global

Gender	Frequency	%
Male	119	42,2
Female	163	57,8
Total	282	100,0

Table 2. Distribution in terms of degree of deficiency Table 3. Groups distribution according to the level of education

		Frequency	%
Pupils	Severe	41	39,8
	Accentuate	31	30,1
	Medium	14	13,6
	Low	17	16,5
	Total	103	100,0
Students	severe	30	78,9
	increased	8	21,1
	Total	38	100,0

Table 3. Groups distribution according to the level of education

		Frequency	%
Visually impaired pupils	11-th class	47	45,6
	12-th class	56	54,4
	Total	103	100,0
Pupils without disability	11-th class	54	52,4
	12-th class	49	47,6
	Total	103	100,0
Visually impaired students	first year	7	18,4
	Second year	17	44,7
	Third year	5	13,2
	master	9	23,7
	Total	38	100,0
Students without disability	first year	4	10,5
	Second year	20	52,6
	Third year	7	18,4
	master	7	18,4
	Total	38	100,0

The research design

This study is a multifactorial one, and the comparisons can be done in accordance with the assumptions set out, based on the following dependent classifying variables:

- **gender** (male / female);
- **school level** (pupil / student);
- **visual impairment** (presence / absence);
- **the profile** (real / human).

Dependent variables:

- ILS 1 - Vermunt Inventory of Learning Styles;
  - relating-structuring
  - critical processing
  - memorizing and rehearsing
  - analyzing
  - concrete processing
  - self-regulation of learning processes and results
  - self-regulation of learning content

    - external regulation of learning processes
    - external regulation of learning results
    - lack of regulation
    - personally interested
    - certificate directed
    - self-test directed
    - vocation directed
    - ambivalent
    - construction of knowledge
    - intake of knowledge
    - use of knowledge
    - stimulating education
    - collaborative learning
- ILS 2 - Felder and Solomon Index of Learning Styles;
    - active and reflective learning style
    - sensing and intuitive learning style
    - visual and verbal learning style
    - sequential and global learning style
- VARK - Fleming and Mills Learning Styles Inventory;
    - visual strategies
    - auditory strategies
    - read/write strategies
    - kinesthetic strategies
- PIADS - Rating Scale of Access Technologies Psychosocial Impact;
    - Competence
    - Adaptability
    - self-esteem
- CAT-BP - Assessment of the preferences and strategies used in the learning process in the assistive technologies use context.
    - educational and vocational guidance
    - teaching style preferences
    - orientation and mobility

- preferences / needs in the use of assistive
- technologies methods of accessing the information
- learning in the context of the assistive technologies use
- preference for learning materials
- materials structure
- time for learning
- self-instruction
- the structuring way of the learning materials on the computer
- executive attention
- computer learning strategies

Independent variable		Dependent variable				
		Learning style			PIADS	CAT-BP
		ILS 1	ILS 2	VARK		
gender	**male**	x	x	x	x	x
	female	x	x	x	x	x
school level	**pupil**	x	x	x	x	x
	student	x	x	x	x	x
visual impairment	**presence**	x	x	x	x	x
	absence	x	x	x		
the profile	**real**	x	x	x	x	x
	human	x	x	x	x	x

Legend:

- ILS 1 - Vermunt Inventory of Learning Styles;
- ILS 2 - Felder and Solomon Index of Learning Styles;
- VARK - Fleming and Mills Learning Styles Inventory;
- PIADS - Rating Scale of Access Technologies Psychosocial Impact;
- CAT-BP - Assessment of the preferences and strategies used in the learning process in the assistive technologies use context.

The instruments used

In order to achieve the objectives and verify the proposed hypotheses, we used the following tests:

- Vermunt Inventory of Learning Styles[1] [2]
- The Felder and Solomon Index of Learning Styles[3]
- The Fleming and Mills Learning Styles Inventory[4]
- The Rating Scale of the Assistive Technology Psychosocial Impact[5]
- The questionnaire for assessing the preferences and the strategies used to learn, in the assistive technologies use case.

Because no studies were identified to aim at primary identification or design of a learning style of visual impaired pupils and / or students, we chose a widely used scale in the academic environment, and for the assistive technology field, we used the PIADS scale. At the same time a questionnaire was developed to assess the needs, preferences and strategies used in educational and vocational guidance for the pupils and students with visual impairments.

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[2] Translation and adaptation Trif Gheorghe Florin, (UT Cluj-Napoca) (Trif 2007, 2008). Technical University, Department of Teacher Training, Str. Constantin Daicoviciu, no. 15, second floor, Cluj-Napoca, 400020 CLUJ. E-mail: trif.gelu@dppd.utcluj.ro

[3] Index of Learning Styles Questionnaire - Copyright 1991, State University of North Carolina. Authors: Richard M. Felder and Barbara A. Solomon. Reprint with the consent of the State University of North Carolina. http://www4.ncsu.edu/unity/lockers/users/f/felder/public/ILSdir/ILS-faq.htm.

[4] The consent for the use of the VARK questionnaire for youth and adults was obtained from Prof. dr. Neil D. Fleming, flemingn@ihug.co.nz, august 2008.

The Romanian translation of the VARK questionnaire for adults - January 2007, Lect. univ. drd. Simona Elena Bernat, „Babeş-Bolyai" University, Department of Educational Sciences, Str. Sindicatelor, no. 7, Cluj-Napoca, E-mail: simonabernat@yahoo.com.

© The questionnaire reproduction or use without the written consent of the author, Prof. dr. Neil D. Fleming, is prohibited. The youth version Translation was made by the author of the thesis under direct supervision of the Scientific Coordinator.

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Vermunt Inventory of Learning Styles

The Learning Style Inventory developed by Vermunt and Vermetten (2004) consists of a list of sentences that have been designed primarily to obtain information about how students learn, in terms of learning process and motivation to learn, but also information about how students perceive the learning process.

The version used in this research consists of 120 arguments which take into consideration four components of learning: processing strategies at a cognitive level, metacognitive regulation strategies, learning concept and orientations in the learning process. Because the ILS scales items are composed of statements extracted from the interviews with students, for the pupils group those statements which referred to the university context were reformulated, adapting them to the preuniversity context.

The scales and subscales description:

- **Cognitive processing strategies:**
    - **relating-structuring** - making connections between the taught knowledge and the existing information, structuring parts into a whole;
    - **critical processing** - adopting a critical attitude toward the interpretations and conclusions of the text authors, comparisons with their own opinions and drawing some personal conclusions;
    - **memorizing and rehearsing** - rehearsing and learning by heart the facts, definitions, lists of features;
    - **analyzing** - sequential processing of the studied material, focusing on the details and the analysis of a theory components;
    - **concrete processing** – the use of the course content outside the educational environment and the focus on the taught information practical usefulness, connecting the studied issues with personal experience.
- **Metacognitive regulation strategies:**
    - **self-regulation** - individual regulation of the learning processes (which includes the materials to be studied) by planning, monitoring, evaluating and testing;
    - **external regulation** - regulation of learning processes is performed by an external source, through questions, course objectives, tests, supporting materials provided by teacher.

- **lack of regulation** - the observation of the difficulties that the individuals face with when their try to adjust the learning processes.

- **The learning motivation:**
  - **personally interested** - they study because they are interested in the taught subjects, to enrich himself and because they like to learn and study;
  - **certificate directed** - goals such as passing exams, accumulation of credits and high grades to exams;
  - **self-test directed** - wants to test own skills and discover own qualities (he wants to prove himself that he is good and to show this to the others);
  - **vocation directed** - the choice of subjects and courses, with the intention to acquire further qualifications (he desire to prepare for the vocation);
  - **ambivalent -** people who doubt over their current education path.
- **Mental models of learning**
  - **construction of knowledge** - a vision in which each person is responsible for what he learns through: elaborating his own questions and examples, looking for relationships, consulting other bibliographic sources;
  - **intake of knowledge** - learning is seen as a sequence of memorizing and rehearsing of facts (he prefers clear and precise instructions about the importance of content or about solving a task);
  - **use of knowledge** - a vision of learning as a process, through which he acquires the knowledge that may be useful in everyday life;
  - **stimulating education** – characterizes the students who expect the professors to encourage them to use strategies such as networking or self-testing;
  - **collaborative learning** / co-operation - people who prefer to study in groups.

The Felder and Solomon learning Style Index

Students' learning style is defined by answers to the following questions (Felder and Silverman, 1988 - updated with a preface in 2002):

- What type of information do the students mainly perceive?
- Which is the sensory channel the external information is most effectively perceived through?

- Which is the manner the information is processed in? -How does the progress in learning look like?

The four learning styles are:

- Active / reflective learning style
- -Sensory / intuitive learning style
- Visual / verbal learning style
- Sequential / global learning style

The Fleming and Mills learning Styles Inventory

Learning Styles Model (VARK) identifies five styles of learning, based on aspects related to the perception and processing of the learning material: visual, auditory, reading / writing, kinesthetic, and multimodal.

In the present research, we used the VARK questionnaire for young people and the VARK questionnaire for adults. The strategies used in the model as being used in the learning process are: visual learning strategies, auditory learning strategies, learning strategies through reading / writing, kinesthetic learning strategies and multimodal learning strategies.

Scale of the Assistive Technology Psychosocial Impact

The Scale of the Assistive Technology Psychosocial Impact (PIADS) has 26 items, aiming to evaluate the assistive technology effects regarding the functional independence, the welfare and the life quality. The PIADS three scales are based on a factor analysis of the combined responses of several studies (Day and Jutai, 1996).

The first one, the competence, measures the sense of competence and the efficacy. It is based on the perception degree of the technology impact on performance and productivity. Competence subscale (12 items) includes questions on topics such as competence, productivity, utility, performance and independence.

The second subscale, adaptability (6 positions), indicates a desire to try new things and to take risks. Adaptability subscale includes questions on topics such as: the ability to participate, willingness to take chances, willingness to try new things and to seize opportunities.

The third subscale, self-esteem (eight items), indicates feelings of emotional health and happiness. It is based on the impact the assistive technologies have on self-esteem and on

the emotional well-being. Self-esteem subscale includes questions on topics such as: self-esteem, security, sense of power and control and self-confidence.

The scores can range from -3 (maximum negative impact), zero (no perceived impact) to 3 (maximum positive impact). PIADS can also be used to assess participants' expectations related to the assistive technology (anticipated impact before use).

PIADS questionnaire can be used to assess the impact of any device in the assistive technology, prostheses and other medical devices field. It can be used to assess their impact over time and to create a common base between the equipment and the consumer.

Questionnaire to assess the preferences and strategies used in the learning process in a use of assistive technologies context.

Through the questionnaire we have developed, we wanted to investigate the opinion of the participants in the study, visual impaired pupils and students, examining both aspects of secondary education and issues regarding the future or present approaches on continuing the high level or professional studies. We also focused on the learning environment and preference for different materials types/ supports to the development of knowledge and skills. Regarding the learning process, either individual or in groups, at home or at school, we introduced statements which focused on the use or non-use of assistive technology and its contribution to the educational and personal development activities.

The areas we presented, concern the educational and vocational guidance, the relationship with the school / teachers, teaching style preference, orientation and mobility using the white cane, preferences and needs during the use of assistive technologies, methods used for accessing information, learning in the context of the assistive technologies, transposition preference for the learning materials, the structure of the materials, the preference for reading, time for learning, self-instruction, assessment of knowledge with / without using assistive technologies, the structuring of the learning materials on the computer, executive attention and learning strategies on the computer.

For each statement from the questionnaire, we used a Likert scale from 1 (strongly disagree) to 5 (totally agree). The questionnaire was divided into the following constructs: educational and vocational guidance, relationships with the school / teachers, teaching style preferences, orientation and mobility, preferences / needs in the use of assistive technologies, methods of accessing the information, learning in the context of the assistive technologies use, preference for learning materials, materials structure, the preference for reading, time for

learning, self-instruction, knowledge assessment with / without using assistive technologies, the structuring way of the learning materials on the computer, executive Attention and computer learning strategies.

Working Procedure

The pupils and students participation was done on a voluntary basis and we asked schools agreement to allow us the access for our assessment and the participants' verbal consent. They were assured of the confidentiality of the provided information, but also of the possibility to ask the personal results later.

In the pupils case, the questionnaires were applied individually, using paper and pencil, but in the students case, the application was made on an online platform, which was developed later according to the approaches objectives. In the case of pupils with total blindness, the application was done by reading the questions by an assistant, and they gave the answer verbally. For the visually impaired pupils the questionnaires were modified in terms of graphics and the text has been increased. The response time for all questionnaires (299 items) averaged 70 minutes for the students and 110 minutes for the pupils.

Statistical interpretation and analysis of the results

The validity and the psychometrics properties of the used scales

We present in table 4 and 5 the Alpha and Guttman Slipt-Half coefficient values for the instruments used within the framework of this research, for the entire group and for the group of participants with visual impairments.

Alpha Cronbach and Guttman values which are over 500 indicate an acceptable internal consistency admitted from a statistical point of view, but values above 700 enables us to conclude that we have a better model. It is known the fact that a large number of items in an assessment tool may have a positive effect on general fidelity coefficients; therefore it is recommended that investigations should continue at the constructs level.

Table 4. The validity and the psychometrics properties of the used scales

N=282	Items	Alpha	Split-Half
Vermunt Learning Styles Inventory	100	**,911**	**,360**
The Felder and Solomon learning Style Index	44	**,624**	**,585**

Table 5. The validity and the psychometrics properties of the used scales for the visual impairment group

N=141	Items	Alpha	Split-Half
Vermunt Learning Styles Inventory	100	**, 917**	**,410**
The Felder and Solomon learning Style Index	44	**,665**	**,609**
Scale of the Assistive Technology Psychosocial Impact	26	**,817**	**,762**
Questionnaire to assess the preferences and strategies used in the learning process in a use of assistive technologies context	140	**,929**	**,753**

Alpha Cronbach value for the entire group is 911 and Guttmann coefficient shows a low value of 360. Analysis of internal consistency at the level of constructs such as the absence of regulation and personal interests indicates the fact that values of those two indicators are below the admissible statistical level which is 500. A plausible explanation, at a global level, in terms of a low fidelity scale value can be explained by the cultural differences and the educational system, which do not offer to students the possibility of having a complex package of optional disciplines, this aspect being encountered also in a low degree of self-assessment of their personal learning process (with no adjustment).

The confirmatory factor analysis Vermunt Learning Styles Inventory

In order to test the learning styles model, on its four dimensions, we performed a confirmatory factorial analysis on the participants' lot represented by people with visual impairments. Taking into account the definition of the individual learning style, after the age of 18, we included in this analysis the entire group of 141 participants.

The psychometric indicators of the scales do not present any low values in order to question the construction and the distribution of the items. The Alpha and the Split-Half values are low, under the admissible statistical level, at the following scales: regulatory absence – level of Domain 2 – Strategy regulation and personal interests – level of Domain 3– Learning Orientation.

By comparing the values obtained in the limits offered by the statistical frame, we can admit that the Vermunt Learning Styles model is a good one and it can be applied also on the visually impaired population. The values of the statistical indicators are at the normal limits, except the "Learning Orientation" domain, which is weaker, both from the point of view of residual errors and indicators of the matching level.

Similar data has been obtained by Boyle and collaborators (2003), who preferred to adapt the ILS to British University students in the social sciences unit (No=273; M=75; F=198; Age=~25 years). Trif (2007) started the validation of the Vermunt model on the Romanian population on students from a technical university (No=303; M=117; F=286; Age=~20 years). Roman (2010) used also other instruments included in the research and has adapted ILS, having a students' lot from social sciences faculty (No=479; M=32; F=447; Age=19 years – 37 years). The mentioned studies have obtained similar results which are situated, at the limit, between the generally admissible standards. In the case of our evaluations, we can notice values slightly under or above these standards for the "Learning Orientation" domain.

In order to use this questionnaire for other exploratory or confirmatory research on the visually impaired population, it was developed the standard with 5 normalized classes (percentiles).

The Rating Scale of the Assistive Technology Psychosocial Impact

The PIADS model evaluation, following the confirmatory factorial analysis in the group of people with visual impairments, stressed out some very important information which converges to the highlight of a weak instrument of the psychosocial impact of assistive technologies' evaluation. Thus, the statistical indicators Alpha and Split-Half, already mentioned in the sub-chapter "The validity and the psychometric properties of the scales" present relatively normal values, except for the Split-Half value, for the "self - esteem" construct.

The factorial analysis provided us values which allow us to submit that the model is average, its matching being between 60%-65%. The adequacy indicator of the RMSEA model is of 0,092, which is over the recommended value of 0, 08, so we can admit that we have a valid and acceptable model. The synthetic values are presented in Table 42. The value of GFI is low - 0, 74, under the accepted level of 0, 90-0, 85. The NFI indicator has a low value of 0, 50, which is a lot under the interval of 0, 85-0, 90. The value of standard errors RMR is higher than the 0, 08 level.

The low values of the scale are various, if the fidelity and internal validity are acceptable. We can notice that the values of the factorial analysis partially confirm the used model. The probable causes of the low levels will be largely analyzed in the chapter of conclusions and limits of the research.

In order to use this questionnaire for other exploratory or confirmatory research on the visually impaired population, it was developed the standard with 5 normalized classes (percentiles).

The differences' analysis noticed at the researched construct levels

Following the distribution analysis, we analyzed the differences between the means recorded by the pupils and students (with or without visual impairments), using the parametrical test "t" for independent lots. Regarding the factor of school and professional orientation – measured by the fifth instrument we used – "The questionnaire for assessing the preferences and the strategies used to learn, in the assistive technologies use case", we chose to use the non-parametric Mann-Whitney U, because the distribution of this construct could not be normalized.

For the learning styles inventories (Vermunt, Felder and Solomon, Fleming and Miles) the following analyses were used, between:

a) Pupils with visual impairments / students with visual impairments;

b) Pupils without visual impairments / students without visual impairments;

c) Pupils with visual impairments / Pupils without visual impairments;

d) Students with visual impairments / students without visual impairments.

Also, for the learning styles inventories (Vermunt, Felder and Solomon, Fleming and Miles) means analyses have been conducted, depending on the study profile (science / humanistic) and gender (male / female), our attention being particularly focused on the lot of visually impaired subjects. For this lot, we sorted the participants also depending on the declared disability level: level 1 participants (people with visual impairments included in the level 1 of disability – severe) and level 2 participants (people with visual impairments included in the disability scales 2 – increased, 3 – medium, 4 – low, the latter presenting residual sight).

Depending on the disability level, established by the already mentioned means, we also conducted an analysis of the comparisons between pupils and students with visual impairments for:

- The inventories of learning styles (Vermunt, Felder and Solomon, Fleming and Miles)
- The PIADS Scale;
- The constructs of the questionnaire for assessing the preference and the strategies used to learn, in the assistive technologies use case.

Inter and intra-group differences between the constructs of Vermunt Inventory Learning Styles

Differences between the group of people with visual impairments and people without visual impairments

At a global level (table 6), it can be noticed significant differences in the mental models of learning, especially in the following dimensions: knowledge construction, stimulating teaching and learning through cooperation. On the "concrete processing" dimension, the mean is higher for the group of people with visual impairments, but also on the "learning content" construct from the "strategies regulation" domain. Regarding the "Learning orientation" domain, the means are higher for the visually impaired people,

significant differences being registered at the construct levels of "Orientation towards self-evaluation" and "Ambivalent".

Based on the presented data, we cannot submit that significant differences exist at a global level between the people with visual impairments and the participants without visual impairments, but we can comment upon the differences regarding certain attitudes, processes and behaviors.

Table 6. Differences between the group of people with visual impairments and people without visual impairments

Visual impairment persons (N=141)		Persons without visual impairment (N=141)
Domain 1 – Cognitive processing strategies		
Deep processing		
relating-structuring	←	relating-structuring
critical processing	←	critical processing
Stepwise processing		
memorizing and rehearsing	→	memorizing and rehearsing
analyzing	←	analyzing
concrete processing	←	concrete processing
Domain 2 – Metacognitive regulation strategies		
self-regulation		
learning processes and results	→	learning processes and results
learning content	←	learning content
external regulation		
learning processes	←	learning processes
learning results	←	learning results
lack of regulation	←	lack of regulation
Domain 3 – The learning motivation		
personally interested	←	personally interested
certificate directed	←	certificate directed
self-test directed	←	self-test directed
vocation directed	←	vocation directed
ambivalent	←	ambivalent
Domain 4 – Mental models of learning		
construction of knowledge	→	**construction of knowledge**
intake of knowledge	→	intake of knowledge
use of knowledge	←	use of knowledge
stimulating education	→	**stimulating education**
collaborative learning	←	collaborative learning

As we can notice, at a global level, powerful significant differences were registered between the group of people with visual impairments and the group of people without visual impairments, on the following dimensions: "concrete processing", "learning content self-regulation", "Orientation towards self - evaluation", "ambivalent", "knowledge construction"

and “stimulating teaching”. At the construct level of “learning through cooperation”, a significant difference was registered, at a significance level of p<0, 05.

People with visual impairments are focusing more on the practical utility of the information taught during study courses, with a special orientation towards the selection of the study material. The selection of the material from the Internet or from the Braille library, represents an aspect noticed in the comparison between the groups regarding the construct of external regulation of processes and learning results. They present, globally, a weak personal orientation towards the formulation of conclusions regarding the study materials. The orientation of their learning process is not of memorizing and rehearsing, but one of material analysis, selecting the relevant information.

If at a global level, people with visual impairments do not present a clear delimitation on the learning strategies domain (Domain 1) and their regulation (Domain 2), the means’ value is higher on the factors of the “orientation towards learning” domain, being especially oriented to the testing of their own abilities and the testing / defining qualities. Also, the significant differences show an increase in the level of definition and discontent towards their educational process, considering the fact that most high-schools have a philology profile.

We also noticed that at the level of external regulation processes and at the level of learning results, the means for the visually impaired participants are higher. This can also be influenced by the fact that they have direct access to the selected accessible materials, specific and relevant for their study objects and personal interests, and they are provided by the school, the teachers or other institutions.

The process of learning through collaboration for the visually impaired group is also sustained by the large number of pupils within our group. The educational institutions, offer them a boarding – school program, so homework is done during the collective training classes. On the other hand, the students with visual impairments, in order to have an easier access to information, ask help from their colleagues without visual impairments in order to access and understand the study materials.

The non-visually impaired participants within our study present learning features which are oriented towards knowledge construction, based on asking questions, search for materials related to the studied object and also on consulting other bibliographical references, other than the traditional and common ones. Furthermore, they would like to be encouraged and assisted by their teachers in the context of the use of a self-testing system of the gained knowledge.

Inter and intra-group differences between the constructs of The Felder and Solomon Index of Learning Styles

Differences between the visually impaired group and the visually non-impaired group

Analyzing the "t" values and the adjacent level of significance, we can notice the existence of two powerful significant differences (table 7) at the sensorial / intuitive learning style level and also at the visual / verbal learning style level, where the reported significance level is p<0, 01. From the analysis of the two samples' means, it is noticed a high level of means in the visually impaired participants at the level of the four models of Learning Styles Index.

Table 7. Differences between the visually impaired group and the visually non-impaired group

Visual impairment persons (N=141)		Persons without visual impairment (N=141)
active	→	active
reflective	←	reflective
sensing	→	**sensing**
intuitive	←	intuitive
visual	→	**visual**
verbal	←	verbal
sequential	→	sequential
global	←	global
active and reflective learning style	←	active and reflective learning style
sensing and intuitive learning style	←	sensing and intuitive learning style
visual and verbal learning style	←	visual and verbal learning style
sequential and global learning style	←	sequential and global learning style

The global analysis, as it can be noticed in the graphic form, brings into discussion the high level of means for the 4 learning styles, but especially for the sensorial / intuitive and the visual / verbal learning styles.

The learning style of visually impaired people, according to the results obtained from the used model; reflect the preference for the discovery of new possibilities and the realization of connections between the present information and information based on prior experiences, with a very good understanding of the transmitted information. They are oriented towards innovation and do not like complications, preferring a quicker learning style and being more receptive to mathematical and abstract formulations. People without visual impairments have a higher preference for problem solving through well-established methods, not accepting the

complex ones. They are attentive to details, retaining very well facts and being more practical in the problem solving process, describing a clear preference for the visual analysis of the study material.

Inter and intra-group differences between the constructs of The Fleming and Milles Learning Styles Inventory

Differences between the visually impaired group and the visually non-impaired group

The analysis of means, and also of the reported differences, shows that between the two groups there exist some powerful significant differences, at a significance level of p<0, 01 at the construct levels of "auditory learning strategies", "reading / writing" and "kinesthetic". At the level of visual learning strategies, it was reported a significant difference at p<0, 05. As it can be noticed in table 8, the means orientation for all the Inventory dimensions is higher for the group of people with visual disabilities.

Tabel 8. Differences between the visually impaired group and the visually non-impaired group

Visual impairment persons (N=141)		Persons without visual impairment (N=141)
visual strategies	←	visual strategies
auditory strategies	←	auditory strategies
read/write strategies	←	read/write strategies
kinesthetic strategies	←	kinesthetic strategies

The global differences present a significant increase of means at the level of visually impaired group for all the four dimensions of the questionnaire. The same orientation of means and significant differences are reflected on the pupils with visual disabilities. At the group of students, the significant differences are reported at the level of auditory and kinesthetic strategies. Within the visually impaired sample, for the variable pupil / student, it wasn't registered any significant difference, in comparison to the non-visually impaired sample, which presents significant differences at the level of auditory and reading / writing learning strategies, in the favor of the students without visual impairments.

The visually impaired participants are more attracted to those strategies involving a direct-experience oriented learning style and they use practical and intuitive methods. The same level of approach limits the visually impaired participants who follow a scientific study

profile versus those who follow a social study profile, observation valid also regarding the female participants.

Inter and intra-group differences between the constructs of The Rating Scale of the Assistive Technology Psychosocial Impact

Differences between the group of visually impaired pupils and the group of visually impaired students

The analysis of means at the visually impaired group, depending on the study level variable, indicates an increase of the means for the "competence" and "self-esteem" constructs, at the students' group level. There is no statistical significant difference registered. Table 9 describes synthetically the orientation of means.

The visually impaired participants, through their interaction with the accessible technological equipment, can feel better the effect of utility, performance and independence.

Table 9. Differences between the group of visually impaired pupils and students

pupils (N=103)		students (N=38)
competence	→	competence
adaptability	←	adaptability
self-esteem	→	self-esteem

Inter and intra-group differences between the constructs of the questionnaire for assessing the preferences and the strategies used to learn, in the assistive technologies use case

Differences between the group of visually impaired pupils and the group of visually impaired students

The analysis of difference at the visually impaired lot level, depending on the study level variable, indicates an increase of means especially for the group of pupils. The significant differences noticed are reported at the level of the following constructs – school and professional orientation ($p<0,01$) and learning in the context of using assistive technologies ($p<0,01$) – at the group of visually impaired pupils. In table 10, it is synthetically shown the orientation of means.

The pupils with visual impairments emphasize the importance of educational and also the family factors in the decision making process regarding the educational and professional

orientation. The support technologies represent for them an important factor in the learning process, both at the level of learning material selection and at the level of using in the act of learning as a support.

Table 10. Differences between the group of visually impaired pupils and students pupils students

Pupils (N=103)		Students (N=38)
educational and vocational guidance	←	educational and vocational guidance
teaching style preferences	←	teaching style preferences
orientation and mobility	←	orientation and mobility
preferences / needs in the use of assistive	←	preferences / needs in the use of assistive
technologies methods of accessing the information	←	technologies methods of accessing the information
learning in the context of the assistive technologies use	←	learning in the context of the assistive technologies use
preference for learning materials	←	preference for learning materials
materials structure	←	materials structure
time for learning	←	time for learning
self-instruction	←	self-instruction
the structuring way of the learning materials on the computer	→	the structuring way of the learning materials on the computer
executive attention	→	executive attention
computer learning strategies	→	computer learning strategies

A particular aspect regarding the educational and professional orientation is stressed out at the level of those participants who are visually impaired. They are interested in the diversity of the educational possibilities, at the academically level and also at the professional level, which they can follow. Besides, the blind participants focus their attention upon the ways the materials are structured and present a high level towards reading, having a preference for the assistive technologies, as a mediator for material reading. Regarding the profile variable, there were noticed only particular differences at a non-significant statistical level.

The male participants present a high level of using assistive technologies in the learning process, this reflecting itself upon a certain type of accessible material – the electronic format, digital audio, structured audio (e.g. Daisy), but also an increased level of executive attention.

Globally, the visually impaired students appreciate the way the information is structured on the computer, being very synthetic in the process of material analysis. Also, we can notice an increased level of the executive attention, but the data does not converge to a significant difference. Their learning strategies reflect upon the level of collaboration with the

other colleagues, the dissemination of their own resumed ideas but also upon the specific preferences for the structuring of learning materials.

The correlation analysis at the level of surveyed constructs

After analyzing the differences between the two samples at the level of the selected variables, we began to generate correlation tables between the constructs of the used instruments. Thus, we made an analysis between the constructs of each instrument, but also between the constructs of all the instruments. The following data is presented in dichotomy, for each group of participants, with or without visual disability.

Within the visually impaired group of participants (table 11) we found a strong negative correlation (p<0, 01; **-,222****) between the "structure - relation" construct and the "ambivalent" construct.

At the level of visually impaired group we can notice that regarding the educational stages, the more the dissatisfaction grows, the more the level of cognitive strategies of connection making between current learning information and anterior information diminishes. This fact has a direct effect upon the level of learning, by making it impossible to build a unitary whole of the learning process. The model offers a clear image from the cognitive processing strategies' point of view and their regulation in the act of learning, but also conclusive information regarding the motivation for learning and the models applied in the process of construction, absorption, usage and motivation in learning.

On the other hand, at the non-visually impaired group of participants, the more the motivational level towards the education increases, the more the interest for making connections between the prior and current learning experience – based information diminishes. It was also observed a low level of self-control upon the information regulation and the manner of gathering information; the interest for a future profession lowers, as well as the interest for the use of information in specific contexts.

Table 11. The correlation analysis for the visual impaired group

N=141	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1. relating-structuring	1																			
2. critical processing	,458**	1																		
3. memorizing and rehearsing			1																	
4. analyzing	,462**	,318**	,392**	1																
5. concrete processing	,512**	,411**	,282**	,420**	1															
6. learning processes and results	,567**	,382**	,318**	,499**	,549**	1														
7. learning content	,572**	,387**	,189*	,450**	,380**	,450**	1													
8. learning processes	,657**	,403**	,372**	,627**	,586**	,630**	,538**	1												
9. learning results	,392**	,312**	,528**	,382**	,440**	,432**	,304**	,580**	1											
10. lack of regulation			,385**	,206*		,229**		,249**	,335**	1										
11. personally interested			,246**					,199*	,302**	,194*	1									
12. certificate directed			,327**					,172*	,364**	,219**	,556**	1								
13. self-test directed			,220**			,179*		,280**	,297**		,470**	,486**	1							
14. vocation directed	,203*			,246**		,249**	,184*	,213*			,367**	,272**	,399**	1						
15. ambivalent	-,222**									,280**	,357**	,287**	,256**		1					
16. Construction of knowledge	,305**			,178*		,380**	,209*	,324**			,298**		,374**	,453**		1				
17. intake of knowledge			,327**			,207*		,210*	,325**	,246**	,416**	,420**	,502**	,355**	,201*	,474**	1			
18. use of knowledge	,324**			,192*	,274**	,330**		,291**			,174*		,332**	,421**		,627**	,445**	1		
19. stimulating education			,175*			,252**		,168*	,207*		,340**	,190*	,352**	,220**		,436**	,583**	,394**	1	
20. collaborative learning			,248**							,169*	,267**	,339**	,303**		,285**		,262**		,336**	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Also, the more the level of motivation only for passing the exams and obtaining the final diploma increases, the more observable are the negative correlations with the processes regarding the structure of information from prior and current materials and their placement in a unitary whole, with direct repercussions upon the processes regarding self-regulation of processes and learning content, the critical analysis of memorized information and also the decrease of the information usage level in specific contexts. A high level of critical analysis upon the study material has direct repercussions upon the decrease of knowledge absorption level.

The correlation analysis between the constructs of the questionnaire for assessing the preferences and the strategies used to learn, in the assistive technologies use case

Table 12 shows the significance level and the relationship between the constructs of the questionnaire for assessing the preferences and the strategies used to learn, in the assistive technologies use case. This scale was applied only on the lot of participants, pupils and students, with visual impairments.

The correlation analysis of the instrument's factors, considering only the participants with visual impairments, presents a high level of the relationships established among them, at a significance level of p<0, 01. Thus, we can determine the high level of support technologies usage which has as the main purpose not only the learning and educational and professional orientation, but also the personal development.

Table 12. The correlation analysis for the visual impaired group

N=141		1	2	3	4	5	6	7	8	9	10	11	12	13
1.	educational and vocational guidance	**1**												
2.	teaching style preferences	**,402****	**1**											
3.	orientation and mobility	**,512****	**,429****	**1**										
4.	preferences / needs in the use of assistive technologies	**,258****	**,267****	**,369****	**1**									
5.	methods of accessing the information	**,325****	**,317****	**,391****	**,504****	**1**								
6.	learning in the context of the assistive technologies use	**,317****	**,466****	**,304****	**,384****	**,525****	**1**							
7.	preference for learning materials	**,268****	**,283****	**,286****	**,476****	**,480****	**,503****	**1**						
8.	materials structure	**,184***		**,253****	**,418****	**,414****	**,447****	**,788****	**1**					
9.	time for learning	**,305****	**,395****	**,328****	**,198***	**,189***	**,479****	**,364****	**,338****	**1**				
10.	self-instruction	**,279****	**,302****	**,194***		**,450****	**,485****	**,556****	**,452****	**,286****	**1**			
11.	the structuring way of the learning materials on the computer		**,303****	**,215***	**,214***	**,371****	**,517****	**,436****	**,451****	**,403****	**,452****	**1**		
12.	executive attention		**,340****			**,369****	**,466****	**,310****		**,202***	**,403****	**,520****	**1**	
13.	computer learning strategies	**,234****	**,306****	**,226****	**,169***	**,459****	**,509****	**,271****	**,308****	**,387****	**,358****	**,515****	**,486****	**1**

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

The correlation analysis between the constructs of the Learning Styles Questionnaire and The Evaluation Scale of the Psychosocial Impact of Access Technologies

Table 13 shows the correlations resulted between the constructs of the Vermunt Learning Styles Inventory and the constructs of the Evaluation Scale of Psychosocial Impact of Access Technologies. The PIADS was applied only on the visually impaired participants; thus, there were reported the following positive and negative correlations:

- Competence
  - structuring – relating ($p<0,01$; **,266****)
  - analysis ($p<0,05$; **,188***)
  - concrete processing ($p<0,05$; **,173***)
  - self – regulation of processes and results ($p<0,05$; **,167***)
  - external regulation of processes ($p<0,05$; **,209***)

- ambivalent (p<0,05; **-,188***)
- gaining of knowledge (p<0,01; **,409****)

- Adaptability
  - structuring – relationship (p<0,01; **,227****)
  - external regulation of processes (p<0,01; **,241****)
  - ability testing (p<0,05; **,183***)
  - gaining of knowledge (p<0,01; ,275**)
  - knowledge absorption (p<0,01; **,223****)
- Self esteem
  - critical thinking (p<0,05; **,166***)
  - ambivalent (p<0,05; **-,171***)
- Use of knowledge
  - competence (p<0,01; **,232****)
  - adaptability (p<0,05; **,185***)
  - self-esteem (p<0,05; **,166***)

There weren't any significant correlations registered at the construct levels of: encryption, self-regulation of results, external regulation of results, the absence of regulation, personal interests, oriented to certificate, oriented to profession, stimulating teaching and learning through collaboration.

Table 13. The correlation analysis for the visual impaired group

N=141	competence	adaptability	self-esteem
relating-structuring	**,266****	**,227****	
critical processing			**,166***
analyzing	**,188***		
concrete processing	**,173***		
learning processes and results	**,167***		
learning processes	**,209***	**,241****	
self-test directed		**,183***	
ambivalent	**-,188***		**-,171***
construction of knowledge	**,409****	**,275****	
intake of knowledge		**,223****	
use of knowledge	**,232****	**,185***	**,166***

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

The persons, who present a high level of performance of using access technologies in their performed activities in the learning process, present also a high level of association and

analysis between the current information and information obtained in prior experiences in different domains, using a concrete, deep processing. What is more, the people with visual impairments are attentive to the information they select so that they can analyze it. That's why, the gaining and use of knowledge correlate with the feeling of independence and utility, offered through the support technologies.

A high level of adaptability correlates positively, at various levels, with the regulation strategies of the learning process, the motivation for learning and the methods used in learning. A high level of interests, manifested through the exploration of various opportunities offered by the access technologies, the access to information and a lot more, facilitates a growth in accumulation, analysis and use of knowledge in the educational and professional activities. Furthermore, a high level of self-esteem correlates positively not only with a critical analysis of the information source but also with the information, as well as with the openness of using access technologies in daily life.

The evaluation platform of learning styles for people with visual impairments

The evaluation platform of learning styles is designed exclusively for people with visual impairments. The platform which is in the form of a web site is fully accessible to people with no vision using a screen reader.

To meet the terms of use and distribution of the tests utilized in our study, the access is made upon an individual user and password, the user should first register within the system and the system's administrator will enable the account after checking the validity of the data. The data that the user will provide are strictly confidential and will not be disclosed to others, but will be used only for the research of this paper.

The administrator platform can create, activate and modify user accounts. In order to verify and support the user, the administrator can see the user's results. These data can be exported in order to allow the researcher to import the data collected in a statistic analysis program.

The platform is built so that the users cannot skip any question. In case the answer for the question is not given, the system automatically alerts the user. We considered that the opportunity to respond to each question is crucial, because it excludes the possibility of avoiding, voluntarily or involuntarily, the answer to a question.

Due to the number of the questions, the user can quit in any moment and can continue when he or she considers. This aspect is not encouraged by the system, but due to some possible errors in the user's hardware, and internet traffic, interruptions may occur spontaneously.

The user always has control over the degree of the questionnaires completion. Thus, if the user stops for a short period of time, when he or she will return, the system will warn about the number of answered questions and the unanswered ones. The administrator can see who answered and the total number of questions or the partial or final results by accessing the "REPORTS" field.

Users who have registered can view the results by accessing a link, which becomes active as soon as the last question was answered in the questionnaire. Thus, the user can read quantifiable information on its learning style for each scale separately on each dimension or construct scale.

Depending on the result, the user can see information about its overall learning style. The user can copy or list the report, which can then be given to the teacher. Depending on the features and applications, the platform can be adjusted in order to enable the provision of information regarding learning style of a well-defined group.

Conclusions

The present paper integrates our pursuits of defining learning styles and cognitive styles in relation to the necessity of using assistive technologies, as a useful support in order to ease learning approaches of visual impaired pupils and students. The theoretical framework of the present work elucidates pertinently the „learning style" and „cognitive style" concepts, referring to visual impaired pupils and students, corroborated with „assistive technologies" phrase. We consider that the use of assistive technology in learning can have a positive impact on learning results / outputs in pupils and students with visual impairments. The investigational approach took especially into account the prominence of measures / ways in the assistive technologies used by pupils and students with visual impairments can influence cognitive and learning style and adaptation to learning context, but also to physical and life context.

Trying to define and identify a certain learning style (depending on the visual disability type) valid for visual impaired people, we could identify the common and particular aspects that embodied the object of our study. From the quantitative and qualitative analyses , we can state that we detected indicative differences at intergroup level, between people with or without visual impairments, but also at intra-group level, between pupils/students with/without visual impairments.

The multifactorial design of our study allowed us to investigate the main characteristics of visual impaired pupils and students in relation to the independent and dependent variables presented during the statistical analyses.

The general and specific objectives marked and developed in the paper were totally achieved by qualitative and quantitative analyses. The 1.3 objective was not fully achieved due to objective reasons that will be further detailed, but also due to statistic errors that are presented at length in the research limits section.

The results of the data can form a starting point for the assessment of teaching-learning methods used in special schools as they elevate pupils' motivational level; they design an educational and professional profile consonant with personal interests and work place requests. We assist continuously to an educational system which may be sensitive and sometimes inflexible to changes. At global level, pupils are still directed toward an information reproduction style and less toward understanding it. Certainly, all this data

indulge changes in personal plan. We can notice different behaviors of the pupils and students with or without visual impairments and also inside the group of visually impaired people.

The confirmatory factor analysis for the instrument used was partially achieved. Psychometrical analysis for the constructs under study gave us the opportunity to scan and compare the resulting data, with statistic limits acceptable at scientific level, and finally we appealed to designing guiding gauges for visual impaired population for Vermunt Inventory of Learning Styles and Rating Scale of Assistive Technologies Psychosocial Impact.

The statistic data obtained allows us to state that first general hypothesis is confirmed and specific hypotheses 1.1 is partially confirmed. No data was detected to confirm differences on all four dimensions stated: active / reflective, sensory / intuitive, visual / verbal, sequential / global.

At the learning style level from the Felder and Solomon Index of Learning Styles, were detected low scores of internal consistency. For the group of visual impaired participants, there were registered very good psychometric rates for the visual / verbal learning style.

Constant differences at intra and intergroup level, allow us to submit the statement that people without visual impairments have a sensorial and visual approach of the learning style while the visual impaired people are directed toward an intuitive, verbal learning style. The same configuration regarding learning process analysis and interpretation style was also reported at the pupils with/without visual impairments group level. In opposition, the visual impaired students present a verbal learning style in comparison with the students without impairments that have a visual style. Visual impaired pupils are directed toward a mainly visual / intuitive learning style versus the students that are characterized by an active / sensorial / verbal learning style. No significant differences in terms of study profile or gender were detected.

In the case of visual impaired people, the more active the learning style is, sensory / visual orientation, the more intuitive, based on discovering practical things the learning becomes and the level of verbal understanding increases. The persons that have no visual impairment are directed toward a sequential / global style. The more the involvement degree in a global analysis increases, the easier is the use of a sequential approach of the information. In this research design, we aimed at identifying also the possible relations that can be noticed at the level of studied constructs. All the correlations were made for the entire group of participants with visual impairments.

At global level, the correlations detected between the constructs of the Vermunt and Felder and Solomon scale have as outputs counter relations between the propensity for a reflective learning and processing strategies, especially deep processing, memorizing and analyzing and also between the education directed toward a sensorial and personally interested constructs, ambivalent and stimulating teaching. The people that present the features of the intuitive approach obtain low ratings at the scales that assess personally interests, ambivalent and stimulating teaching. However, the intuitive learning style intensifies the relationship with personal interests, ambivalence and orientation toward a stimulating teaching.

In the case of people without disability, if the orientation is a reflective analysis, it has a counter effect on the mental patterns involved in learning such as: construction, absorption and use of knowledge.

At the constructs level regarding the use and strategies of assistive technologies in learning process, few significant data were registered in order to reflect a direct relationship between the constructs. A learning style directed to a sensorial analysis will register a high level of independency in orientation and mobility, and also a higher level of strategies in computer assisted learning context. People with a preponderant intuitive / verbal style are directed toward the preference and desire to use assistive technologies in learning context less than people directed towards a visual approach of learning.

As we cannot define, globally, a learning style for the visual impaired participants, the second general hypothesis is confirmed and the specific hypotheses 2.1 and 2.2 are partially confirmed. We will further detail the constant differences.

For the Vermunt Inventory of Learning Styles, the statistic rates obtained in relation to the participants' number determine us to conclude that we have a good model which can be used by the teachers notwithstanding the associated limits and suggestions. A value slightly under the acceptable level of fidelity for the personally interests level was registered. This aspect is due to cultural and educational differences that do not allow pupils and students to assist a diversified package of optional disciplines. A low degree of self-assessment learning process was reported as well. A low fidelity was registered at the critical thinking scale level due to the high number of pupils that compound the visual impaired group.

It has to be taken into consideration the fact that Vermunt does not study only the personal or processing style features, but he also highlights the learning context characteristics.

For the participants without visual impairments, low fidelity was registered at the skill testing scale and finding their own competences. The scales' fidelity encounters similar rates both for the group of students with and without visual impairments. In the case of students without visual impairments, there have been registered low rates for the scales that assess the degree of the external regulation processes and results of learning.

By comparing the rates obtained along with the limits imposed by the statistical framework, we can accept the Vermunt Learning Styles Model as a good one and it can be also applied to the population with visual impairments. The rates of the indicators mentioned are in normal limits, to a lesser extent for the orientation toward learning domain that is at a slightly level under the acceptable standard from residual errors and indicators of the fitting degree.

At global level, visual impaired people display the features of an education directed to a practical utility analysis of the information, expressing a special interest for a severe selection of it and oriented toward learning co-operation. They are directed to a self-assessment of personal skills and abilities in relation to the knowledge acquired presenting as well the traits of an ambivalent learning. In opposition, the people without visual impairments report the peculiarities of the learning directed toward knowledge construction based on the search of extra materials, being prone to ask teachers' help in learning.

The persons who have a partial sight exhibit a propensity toward a mechanical analysis of learning material and its reproduction, aiming only at passing the exams and not being interested in the educational path they follow.

In the case of visually impaired participants, the males have a learning style directed toward the identification and obtaining a qualification and aim at a collaboration with or assistance of a person in some stages of the learning process. In opposition, females are directed toward a type of learning based on analogies construction and that appeals to knowledge acquired during other learning tasks corroborating it with current data.

Visually impaired pupils are more motivated and directed to learning than pupils without visual impairments. They obtain high scores for motivation and orientation to learning is directed toward understanding and identifying their own qualities, but they consider that their educational path is not optimal for them. In opposition, pupils without visual impairments display a propensity for consulting extra materials and want to be more encouraged by the teachers during studies.

Students with visual disability are more prone toward cooperation with their colleagues during learning, by soliciting help and assistance, being very attentive to material

selection and being very interested in information from practical areas. Instead, students without visual impairments, due to their rapid access to information, have a propensity to consult extra materials, asking teachers for help for the utilization of certain strategies that can offer them the possibility to connect and/or self-assess their own knowledge and abilities.

The differences detected in the visual impaired group suggest a propensity of pupils toward a mechanical memorizing, preferring practical knowledge and being directed to the identification of the abilities and their own skills in order to graduate the high school. The students perceive the learning process as a memorizing mechanism and sequential rehearsing. The student participants without disability have an orientation toward an attentive analysis of the information and appeal to find connections between the information from various sources, even from previous learning experiences while the pupils present a mechanical learning style and reproduction of studied material. Students are directed to a deeper and more realistic analysis of information against pupils that are preoccupied with graduation and identification of their own qualities.

In the case of visual impaired people, if the level of dissatisfaction regarding the educational path rises than the level of cognitive strategies to open connections between the current learning information and previous information decreases. Regarding the people without visual disability, they have a low level of processing, self-regulation and intake process of the information because they are motivated only to pass the exams and graduate the educational cycle.

The positive and numerous rate of the relationships identified, represents a pro argument for using the scale for future researches, considering however the reserves and limits inherent in factors' organization and structure and in the visual impaired participants peculiarities. The pattern offers an accurate image from the point of view of cognitive processing strategies and their regulation and it also offers information related to motivation for learning and models applied to construction, intake, utilization and motivation in learning process.

The third hypothesis of our research is confirmed only at the level of the 3.1 specific hypothesis. The general hypothesis is partially confirmed and the 3.2 specific hypothesis is rejected. We detail herein after our argumentation with references in the research limits section.

Next, for the visual impaired people, it is shaped a pattern of multimodal strategies of assuming and processing information, especially considering the group of pupils who have a

high level of multimodal strategies. Blind people that have a realistic profile and girls are directed to practical strategies of learning, being characterized by a learning style based on kinesthetic strategies. Visual impaired students are oriented toward an information approach from the auditory and kinesthetic strategies perspective and students without impairments use auditory strategies in information assuming and processing based on reading / writing strategies.

Considering the visually impaired people, there can be identified a significant increase of reading and writing strategies in learning in a framework based on learning strategies that aim at assuming and processing information auditory perceived.

The identification of possible relations between the constructs of Vermunt Index of Learning Styles and VARK proves intense negative relations. In the case of the visual impaired people, the more the orientation is toward the utilization of visual strategies in learning, the more they negatively correlate with structuring-relating area, critical analysis and learning content self-regulation. The utilization of auditory and reading / writing learning strategies negatively correlates with co-operation learning. In the case of participants without impairments, significant relations between kinesthetic learning strategies and mental learning models can be identified. If they use learning strategies directed to reading and writing, it can be noticed a direct relation with the deep processing dimension, analysis, concrete processing, content self-regulation and external regulation of the results.

The features obtained between the Felder and Solomon and VARK styles, present counter relations between kinesthetic strategies and orientation to a visual approach, but reflect an increase toward a verbal and global learning approach. The utilization of learning strategies based on reading / writing techniques reflects a low level of visual orientation, but presents a high level of propensity toward learning based on a reflective and verbal analysis of situation.

The analysis of the results, further detailed, support the statement that the forth general hypothesis and specific hypotheses 4.1 and 4.2 are confirmed.

Psychometric results situated within the general acceptable statistic interval allowed us to appeal to a confirmatory factor analysis for the Rating Scale of Assistive Technologies Psychosocial Impact. Even though, it is a model with discreet statistic connections we can assume that it is a good and acceptable model following that the future undertakings of the researches to be performed will offer a more ample picture of the defined constructs.

Blind users interacting with assistive technologies present a high rate of appreciation of utility and inter-dependency that reflect upon their own personality. No significant rates were registered by referring to gender, pupil / student dichotomy and to study profile.

A self-appreciation of a high level of competence, adaptability and self-esteem in the interaction with assistive technologies reflects a high level of psychosocial impact upon the visually impaired person.

The relations between the three constructs of the PIADS scale and of the Vermunt Index of Learning Style present a counter relation on the ambivalence dimension at the competence and self-esteem level. An increased rate of adaptability at assistive technologies demonstrates a high level of learning processes external regulation. At the same time, highly significant relations regarding learning mental patterns were detected at knowledge construction, intake and use level in learning ambits. An increased rate of competences in assistive technologies utilization reflects a high level of knowledge construction and utilization.

The perception of the high level of performances and productivity in the use of assistive technologies reflects positively in the ways of accessing information, self-instruction and executive attention. A high level of PIADS constructs correlates positively with the majority of our questionnaire's dimensions. If the level of self-perceived adaptability rises, it is positively reflected in the analysis, structuring, utilization level of assistive technologies in learning process, in the information perception, selection and memorizing level and also at the personal self-instruction level.

The results obtained at the questionnaire for assessing the preferences and the strategies used to learn, in the assistive technologies use case, offered us plain information and permitted the development of new premises regarding learning process in the case of visually impaired people.

Psychometric analysis of the questionnaire dimensions and items reported a good internal fidelity and consistency but for reducing the errors from certain dimensions we appealed to a reorganization of the items that afterwards offered us a much more ample analysis spectrum.

In comparison to blind persons, people that have impaired vision are directed toward the definition of an educational and professional profile consonant with existing interests and possibilities. A high level of assistive technologies utilization and the need for multilevel structuring and existing learning formats offer to blind people a high rate of assistive technologies utilization in different learning moments. We identified a propensity of male

subjects toward technology, a preference for structured electronic and audio materials in learning process, and also a high level of executive attention.

Visual impaired pupils present a better educational and professional orientation, in terms of the fact that in the final years, the construction of the educational and professional profile is established. Learning process is justified in the computer and in the context of using assistive technologies.

Close relations identified between the questionnaire constructs allow us to state that the learning process is positively influenced by the use of assistive technologies and not only from the actual technical perspective (especially from a mediator instrument perspective). This mediator offers the possibility of having access to an ample informational framework that amplifies even more the perception of the adaptation of the visual impaired person to the educational and professional problems and requests.

Strategies, motivation and mental patterns involved in education reflect a matrix of correlations in close linkage with the dimensions and rate obtained. Educational and professional guidance, assistive technologies utilization in the teaching-learning process and their input in individual strategies of access to information present a high level of motivation for learning and of mental patterns involved in learning.

At global level, we can notice that aspects that are related to educational and professional guidance of visual impaired pupils are more the input of teachers and less the input of certain specific programs. As pupils think that they were disadvantaged by the fact that they attended the courses of a special school, the students affirm de opposite. Their opinion is formulated according to the viewpoint that there are no significant differences between the graduates of a special school and those of a normal high-school. Students consider that the work force market is not structurally and mentally ready to accept people with visual impairments, skepticism that is not adopted by pupils. In their opinion, the fact that assistive technologies represent an important element in pupils and students activity regarding the educational and professional development on short, medium and long term is unanimously acceptable. Assistive technologies acceptance and utilization as learning mediators do not belong expressly to person external factors but they take very much into account the person relation with her own experience, self-acceptance, self-impression and surpassing limits imposed by the impairment severity.

Regarding learning style, both students and pupils, prefer teachers that have an active and participative learning style, that use modern learning techniques, especially online technologies and supports. Students consider that teaching style of certain teachers is very

synthetic as they do not offer explanations and extra information in the description of the schema used. Under these conditions, visual impaired students consider that they make an extra effort in information access and selection process against their colleagues without visual impairments. The low degree of information accessibility from different areas guides the students towards the allocation of extra time for searching and accessing of required materials for educational and professional training activities.

The majority of information they have accessed is in an accessible format especially those from the compulsory courses structure. The students ask for a quite reduced number of compulsory bibliographies and especially of the extra one, consonant with the profile and study personal interests. The report regarding the accessible materials source is divided between library and organizations or institutions that have as main goal the facilitating the access to information. The main beneficiaries of the centers or organizations are students, pupils being satisfied with the supports from the school library or those offered by the teachers. Preferences for electronic text and structured audio digital format, in the detriment of Braille format, is delimitated very clearly in participants declared opinions. Libraries should be directed towards offering materials in audio digital, electronic and increased font format and less in Braille due to high costs of production and storage.

Preference for structuring manner of the learning material reflects an organized, simple, easy to control learning style that permits a more laborious and deep analysis of the text. Both pupils and especially students prefer electronic format, structured in more parts, and structured audio format that allows moving along the audio book.

In the interaction with assistive technologies, compared to learning style, students are directed especially towards reading, informing and documentation, listening audio materials, socialization and materials accessibility and less towards communication by email and phone. In opposition pupils are directed towards activities related to communication and socialization, relaxing, educational material reading and audio books audition. An important aspect to highlight is that pupils prefer activities related to personal development and less those to the educational side – aspect stressed as well by the percentage rate of the answers regarding the activities performed on computer, from the questionnaire. The students are more categorical in stating that computer is an essential support for acquiring professional abilities and represents a substantial, constant and indispensable support in learning process.

The use of assistive technologies in learning process guides toward a much more easy and agreeable process of analysis, synthesis and memorizing, an aspect unanimously demonstrated by the participants to the study. The decreased effort in computer utilization

during learning is in opposition with the printed texts and classic writing instruments utilization; at the same time, students' participation to the assessment stages (exams) should be performed assisted by the computer.

The limits of the research

One of the limits of our research has objective determinations because – as Serge Portalier states (2001) – it is difficult to gather homogenous groups of participants who are visually impaired or blind, taking into account the diversity of the visual deficiencies' etiology, as well as the different age when the visual deficiency may appear. Therefore, the data provided by our research which focus on people with visual impairments are difficult to be generalized. However, they are important because they represent a starting point for a different and individualized approach of teaching-learning activities, also considering the learning styles' specificity of visually impaired pupils or students.

The clear outline of a specific learning style for an entire lot of participants cannot be possible, due to both personal features and environment characteristics. These can differ from a pupil to another, from a student to another, from a person to another, even from a culture to another. The access to a specific measurement instrument to evaluate learning styles of pupils with visual impairments, led us to the use of some developmental scales in the academic field. Another limit of our study consists of the relatively small number of participants – pupils and students – visually impaired and blind – of different age. Reporting the results to the entire visually impaired population, for the same age range – we could hardly generalize the obtained data. A larger number of participants could have offered us the possibility to perform more clear analysis, statistically relevant, regarding the influence of access technologies on learning styles, but also the possibility to anticipate learning performances in correlation with the academic results.

The large number of questions may have represented a factor for the increase of tiredness, lack of interest and, thus, some part of the results could have been biased.

Some of the statistical indicators offered us the possibility to identify the errors, which in turn allowed us to continue our research or to readjust it by eliminating or re-ordering some of the items or constructs.

The modest internal consistency of The Rating Scale of the Assistive Technology Psychological Impact may be due to a low level of task understanding and also to the use of a single word or expression to identify a complex construct such as "self-esteem".

A part of the items included in the questionnaire evaluating the opinions regarding the preferences and strategies used in the learning process, in the context of using access technologies, was not correctly distributed on dimensions. So, they had to be removed or reorganized in the framework of other dimensions because of the low internal consistency at both the item and the construct level, as it was also mentioned in the statistical part of this paper.

We consider that the low statistical values for The Felder and Solomon Index of Learning Styles and also for The Fleming and Mills Learning Styles Inventory were caused by the defective manner of scoring and introduction of items, which put us in the difficulty to perform a confirmatory factorial analysis and also to establish a standard for future research.

Further investigations

For further investigative steps, we find it useful to identify some instruments, scientifically and methodologically valid, which can provide us with new data regarding the access to information of people with visual impairments and which can highlight the direct relation between the access technologies, the shaping of learning style and the personal development. One of these instruments is QUEST 2 - The Quebec User Evaluation of Satisfaction with Assistive Technology.

Also, we believe that we should perform a (re)analysis of the constructs and dimensions of the learning styles' models used in the present study, through an exploratory factorial analysis, which would allow us to eliminate or replace those items which do not measure the targeted factors or are irrelevant in the context of visual impairment.

We also intend, on the basis of the obtained data and the used instruments, to perform every two years a retest for the visually impaired pupils and to enlarge the age range of the participants with visual disabilities. Thus, we believe we could create a more complex data base, which would allow us to classify visually impaired people by age, level of disability and its debut and also by the personal interests.

We also want to realize a longitudinal study on a narrow group of participants, in order to observe the constancy or the evolution of factors concerning meta-cognitive processing and regulatory strategies, motivation and learning analysis models in high school and during university studies.

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Appendices list